CS401
Software Engineering

Human Computer Interaction

Outline

- Guidelines in HCI
- Interactive System Design
- HCI and Software Engineering
- Prototyping
- Interactive Devices
- HCI Design

Guidelines in HCI

Shneiderman's Eight Golden Rules

Ben Shneiderman, an American computer scientist consolidated some implicit facts about designing and came up with the following eight general guidelines –

1. Strive for Consistency.
2. Cater to Universal Usability.
3. Offer Informative feedback.
4. Design Dialogs to yield closure.
5. Prevent Errors.
6. Permit easy reversal of actions.
7. Support internal locus of control.
8. Reduce short term memory load.

Guidelines in HCI

Norman's Seven Principles

To assess the interaction between human and computers, Donald Norman in 1988 proposed seven principles. He proposed the seven stages that can be used to transform difficult tasks. Following are the seven principles of Norman –

1. Use both knowledge in world & knowledge in the head.
2. Simplify task structures.
3. Make things visible.
4. Get the mapping right (User mental model = Conceptual model = Designed model).
5. Convert constrains into advantages (Physical constraints, Cultural constraints, Technological constraints).
6. Design for Error.
7. When all else fails – Standardize.

Guidelines in HCI

Heuristic Evaluation

Heuristics evaluation is a methodical procedure to check user interface for usability problems.

Nielsen's Ten Heuristic Principles

1. Visibility of system status.

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8. Aesthetic and minimalist design.

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7. Flexibility and efficiency of use.
8. Aesthetic and minimalist design.
9. Help, diagnosis and recovery from errors.
10. Documentation and Help

Guidelines in HCI

Interface Design Guidelines

1. General interaction, information display, and data entry are three categories of HCI design guidelines that are explained below.

Guidelines in HCI

General Interaction

Guidelines for general interaction are comprehensive advices that focus on general instructions such as –

1. Be consistent.
2. Offer significant feedback.
3. Ask for authentication of any non-trivial critical action.
4. Authorize easy reversal of most actions.
5. Lessen the amount of information that must be remembered in between actions.
6. Seek competence in dialogue, motion and thought.
7. Excuse mistakes.
8. Classify activities by function and establish screen geography accordingly.
9. Deliver help services that are context sensitive.
10. Use simple action verbs or short verb phrases to name commands.

Guidelines in HCI

Information Display

Information provided by the HCI should not be incomplete or unclear or else the application will not meet the requirements of the user. To provide better display, the following guidelines are prepared –

1. Exhibit only that information that is applicable to the present context.
2. Don't burden the user with data, use a presentation layout that allows rapid integration of information.
3. Use standard labels, standard abbreviations and probable colors.
4. Permit the user to maintain visual context.
5. Generate meaningful error messages.
6. Use upper and lower case, indentation and text grouping to aid in understanding.
7. Use windows (if available) to classify different types of information.
8. Use analog displays to characterize information that is more easily integrated with this form of representation.
9. Consider the available geography of the display screen and use it efficiently.

Guidelines in HCI

Data Entry

The following guidelines focus on data entry that is another important aspect of HCI −

1. Reduce the number of input actions required of the user.
2. Let the user customize the input.
3. Interaction should be flexible but also tuned to the user's favored mode of input.
4. Disable commands that are unsuitable in the context of current actions.
5. Allow the user to control the interactive flow.
6. Offer help to assist with all input actions.
7. Remove "mickey mouse" input.

Interactive System Design

The design and usability of these systems leaves an effect on the quality of people's relationship to technology.

Concept of Usability Engineering

Usability Engineering is a method in the progress of software and systems, which includes user contribution from the inception of the process and assures the effectiveness of the product through the use of a usability requirement and metrics.

Concept of Usability Engineering

Goals of Usability Engineering

Effective to use – Functional

Efficient to use – Efficient

Error free in use – Safe

Easy to use – Friendly

Enjoyable in use – Delightful Experience

Concept of Usability Engineering

Usability

Usability has three components – effectiveness, efficiency and satisfaction, using which, users accomplish their goals in particular environments. Let us look in brief about these components.

Effectiveness – The completeness with which users achieve their goals.

Efficiency – The competence used in using the resources to effectively achieve the goals.

Satisfaction – The ease of the work system to its users.

Concept of Usability Engineering

Usability Study

The methodical study on the interaction between people, products, and environment based on experimental assessment. Example: Psychology, Behavioral Science, etc.

Concept of Usability Engineering

Usability Testing

The scientific evaluation of the stated usability parameters as per the user's requirements, competences, prospects, safety and satisfaction is known as usability testing.

Concept of Usability Engineering

Acceptance Testing

Acceptance testing also known as User Acceptance Testing (UAT), is a testing procedure that is performed by the users as a final checkpoint before signing off from a vendor. An example handheld barcode scanner.

Software Tools

- Specification Methods – The methods used to specify the GUI. Even though these are lengthy and ambiguous methods, they are easy to understand.

- Grammars – Written Instructions or Expressions that a program would understand. They provide confirmations for completeness and correctness.

- Transition Diagram – Set of nodes and links that can be displayed in text, link frequency, state diagram, etc. They are difficult in evaluating usability, visibility, modularity and synchronization.

Software Tools

- **Statecharts** − Chart methods developed for simultaneous user activities and external actions. They provide link-specification with interface building tools.
- **Interface Building Tools** − Design methods that help in designing command languages, data-entry structures, and widgets.
- **Interface Mockup Tools** − Tools to develop a quick sketch of GUI. E.g., Microsoft Visio, Visual Studio .Net, etc.
- **Software Engineering Tools** − Extensive programming tools to provide user interface management system.
- **Evaluation Tools** − Tools to evaluate the correctness and completeness of programs.
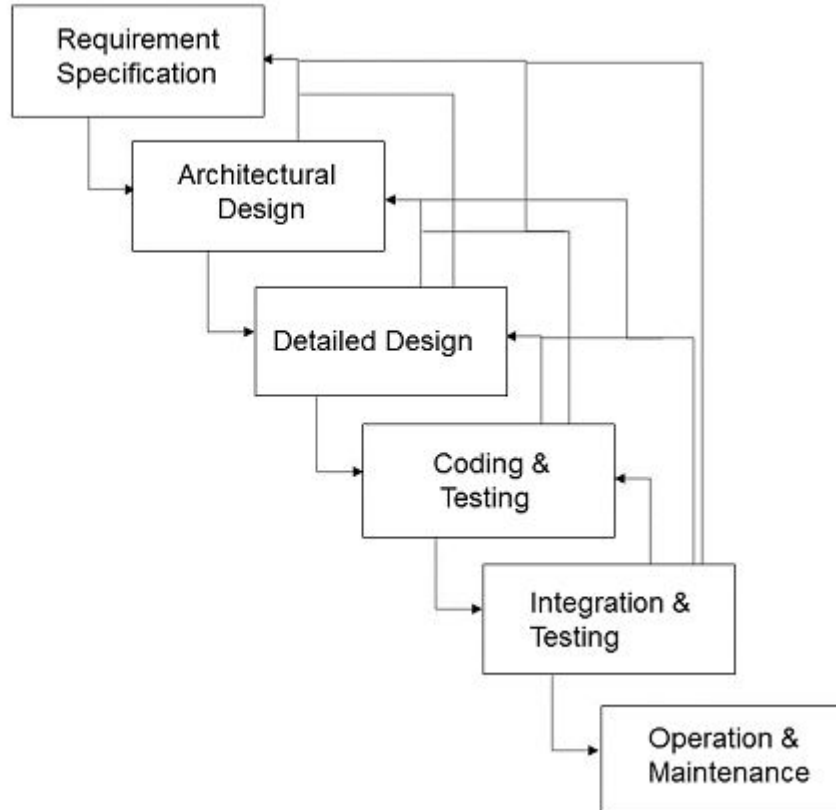
HCI and Software Engineering

- Software engineering is the study of designing, development and preservation of software. It comes in contact with HCI to make the man and machine interaction more vibrant and interactive.

HCI and Software Engineering

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Prototyping

- Prototyping is another type of software engineering models that can have a complete range of functionalities of the projected system.
- In HCI, prototyping is a trial and partial design that helps users in testing design ideas without executing a complete system.

- Example of a prototype can be Sketches. Sketches of interactive design can later be produced into graphical interface. See the following diagram.

Prototyping

Interface of a proposed system

A sketch of the interface

Interactive Devices

Touch Screen

Gesture Recognition

Speech Recognition

Keyboard

HCI Design

HCI design is considered as a problem solving process that has components like planned usage, target area, resources, cost, and viability.

HCI Design

The following points are the four basic activities of interaction design –

- Identifying requirements
- Building alternative designs
- Developing interactive versions of the designs
- Evaluating designs

Three principles for user-centered approach are –

- Early focus on users and tasks
- Empirical Measurement
- Iterative Design

Design Methodologies

- Activity Theory – This is an HCI method that describes the framework where the human-computer interactions take place. Activity theory provides reasoning, analytical tools and interaction designs.

- User-Centered Design – It provides users the center-stage in designing where they get the opportunity to work with designers and technical practitioners.

Design Methodologies

- Principles of User Interface Design – Tolerance, simplicity, visibility, affordance, consistency, structure and feedback are the seven principles used in interface designing.

- Value Sensitive Design – This method is used for developing technology and includes three types of studies – conceptual, empirical and technical.
  - Conceptual investigations works towards understanding the values of the investors who use technology.
  - Empirical investigations are qualitative or quantitative design research studies that shows the designer's understanding of the users' values.
  - Technical investigations contain the use of technologies and designs in the conceptual and empirical investigations.

Participatory Design

- Participatory design process involves all stakeholders in the design process, so that the end result meets the needs they are desiring.

THANK YOU