

# HUMAN COMPUTER INTERFACE

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**ABSTRACT--** The intention of this paper is to provide an overview on the subject of Human-Computer Interaction. The basic overview includes the definitions, scope, design process and a survey of existing and recent technologies, finally the applications of HCI. Human Computer Interaction (HCI) is the study of how people design, develop, implement and use interactive computer systems and the effect computers have on individuals, organizations and the society. Continued use of the processes, techniques and tools developed by HCI can drastically reduce costs and increase productivity and profitability in organizations. Effective design of HCI is indispensable to complex applications but it helps people operate these systems with more ease and safety. It is aimed to ease completion of tasks in a computer. It encompasses things such as use of shortcuts, offering information feedback, designing dialogs for interaction with the user and also offers error prevention and error handling. Its purpose is to accept input from the user, process that input, and generate output hence making human interaction with the computer efficient.

**Keywords:** Human-Computer Interaction, common architectures used in the design of HCI systems, emerging technologies

## I. What is HCI?

Human: Individual user, a group of users working together, a sequence of users in an organization

Computer: Desktop computer, large-scale computer system, Pocket PC, embedded system (e.g., photocopier, microwave oven), software (e.g., search engine, word processor)

User interface: Parts of the computer that the user contacts with

Interaction: Usually involve a dialog with feedback & control throughout performing a task

HCI (human-computer interaction) is the study of how people interact with computers and to what extent computers are or are not developed for successful interaction with human beings. One important HCI factor is that different users form different conceptions or mental models about their interactions and have different ways of learning and keeping knowledge and skills. In addition, cultural and national differences play an important part.

Another consideration in studying or designing HCI is that user interface technology changes rapidly, offering new interaction dimensions to which previous research findings may not apply. Finally, user preferences change as they gradually use new interfaces.

HCI is also sometimes referred to as Man Machine Interaction (MMI) or Computer Human Interaction (CHI). Basic goal of HCI is to improve the

interactions between users and computers by making computers more usable and receptive to the user's needs. HCI is concerned with the joint performance of tasks by humans and machines. It boost up Human capabilities to use machines, algorithms and programming of the interface itself.

Engineering concerns that arise in designing and building interfaces are the process of specification, design, and implementation of interfaces and design trade-offs. Human-computer interaction thus has science, engineering, and design aspects. It is the need of present to develop interactive interaction technologies for future.

## II. HCI Scope

Use & Context: Find application areas for computers

Human: Study psychological & physiological aspects e.g., study how a user learns to use a new product, study human typing speed

Computer: Hardware & software offered e.g., input & output devices, speed, interaction styles, computer graphics

Development: Design, implementation & evaluation

The main orientation is toward the users, especially the non-computer-professional users, and how to improve the human-computer usage for them.

Areas of studies include:

- the problems people having with computers
- the impact of computers upon people in both individual and organizational contexts
- the determinants of utility, usability and acceptability
- the appropriate allocation of tasks between computers and people
- modeling the user as an aid to better system design

- Harmonizing the computer to the characteristics and needs of the user

## III. HCI Design Process

It is a goal directed, creative activity; a plan for development. It also includes decision making activity to balance tradeoffs between requirements of product compatibility and ease of use [1]. Four basic levels of interaction design in HCI include:

1. Identifying the user's need and developing requirements

In this we are going to see who will be our end users and kind of support an interactive product can provide.

2. Developing the prototype for designs

In this firstly we will collect the ideas for fulfilling the requirements specified initially. Then on the basis of that we will develop

i) Conceptual Design: produce the basic model of the product which gives the vague idea about what product is going to do, about its functionality and its interface.

ii) Physical design: in this consideration of the physical technicalities of product is done like icons to use, menu format, colors, sounds etc

3. Building interactive models

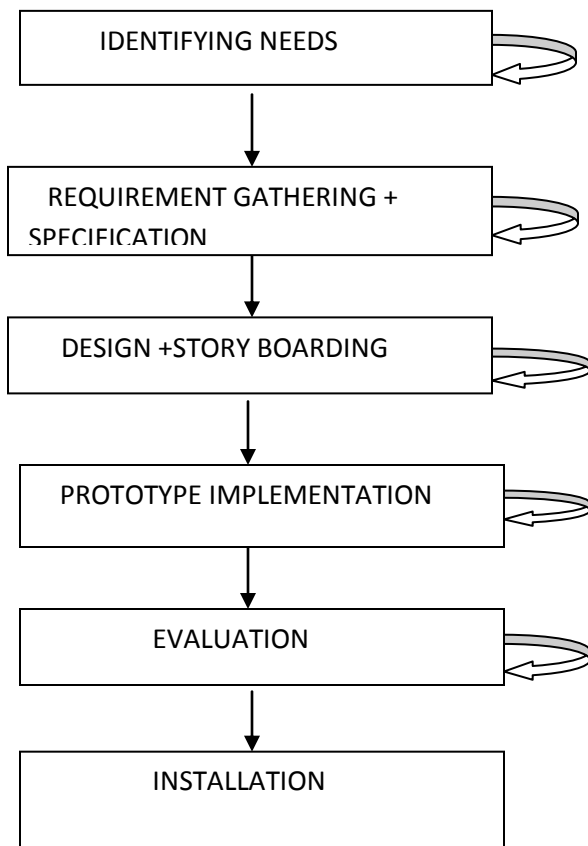
In this build a simple prototype of the designs including paper based story boards etc.

4. Evaluating Designs

In this evaluation of design is being done from user point of view i.e. design & products usability, reliability and acceptability. This means user involvement is must throughout the development.

Three principles for user centered approach are:

1. Focus on users and tasks in the initial stage  
Understand the potential users by studying their behavior, attitude & cognitive characteristics. Observe users in their daily routine tasks, understanding the nature of these tasks and then participating these users in designing the product. User's task and the way of doing them are the driving force behind the development and all decisions are made within the context of the users, their work and their environment.
2. Empirical measurement  
Users reaction to various prototypes and performance to manuals is seriously taken into account, recorded & analysed.it further helps designers to choose between different alternative designs. Proper check has to be kept on the progress as the product is developed.
3. Iterative Design  
Testing is performed to see if there are any errors or problem in the design. If found, fix them and carry out more tests.



**Fig 1. HUMAN COMPUTER INTERACTION  
DESIGN PROCESS**

#### **IV. LIFECYCLE MODEL FOR HCI**

Many life cycle models exist in general. They show how different activities are related to each other. For HCI we have Star Lifecycle model & ISO 13407.

##### **A. STAR LIFECYCLE MODEL**

This model is suggested by Hartson & Hix (1989).The important features of this model are evaluation is at the center of activities [2].IN this no particular ordering of activities is done. Development may start in any one of the activities. It is hard to manage time and track progress in this model but it has the great benefit of being able to utilize user

evaluation throughout the whole design process, adapting to the needs of the users as they are discovered and as they change.

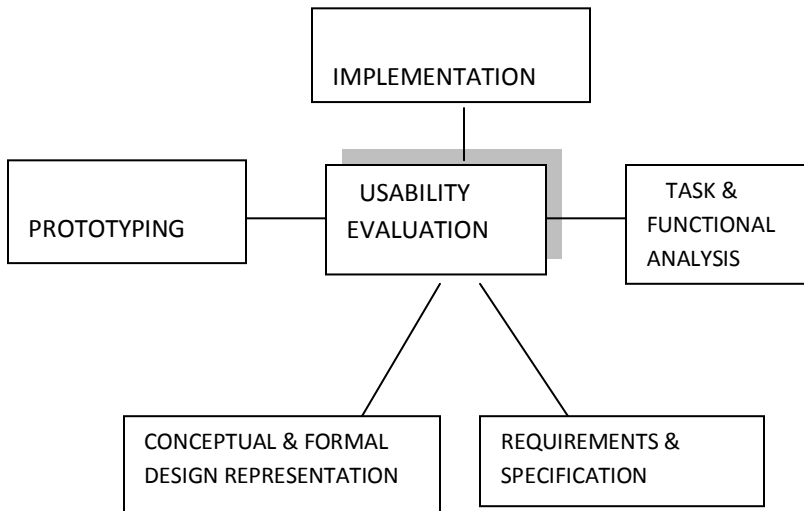


Fig 2. The Star Life Cycle

**B. ISO 13407 Human-Centered Design process model**

This model provides guidance on design activities that take place throughout the life cycle of interactive systems [3]. It gives or specifies four human centered design activities which are important for the development of system i.e.

- i) Understanding & specifying the context of use
- ii) Specifying the users & organizational requirements
- iii) Producing the design prototypes
- iv) Doing evaluations of designs against the requirements

The goal of the standard is to ensure that the development and use of interactive systems take

account of the needs of the user as well as the needs of the developer and owner

Four Principles of Human-Centered Design:

- active involvement of users
- appropriate allocation of function to system and to user
- iteration of design solutions
- Multi-disciplinary design

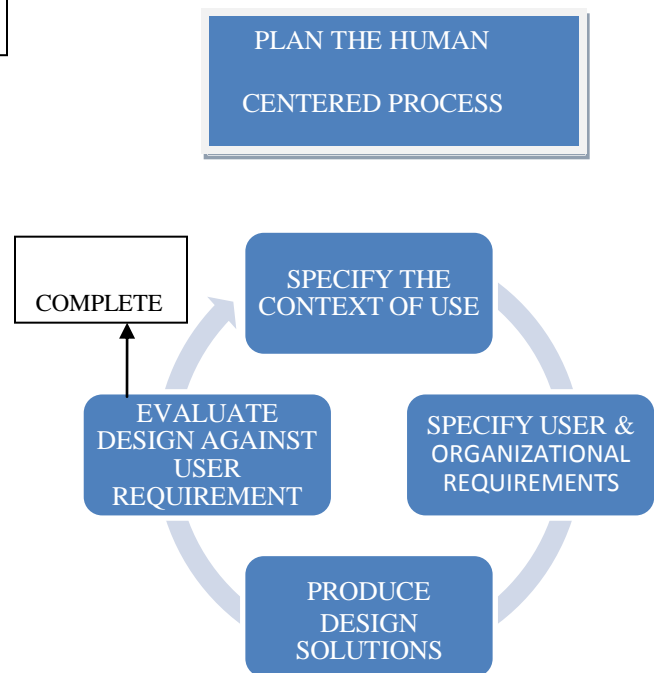


Fig 3. USER CENTERED DESIGN ISO13407

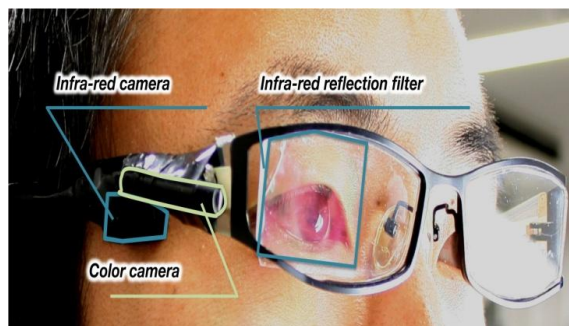
**V. Emerging Computer/Human Interface Technologies**

The Idea of eliminating the difference between human thought and computer responsiveness leads

number of companies to work hard on number of promising technologies [4]. One of the technologies include Voice Recognition Software which makes computer to type as we speak, or it allows users to control the applications by issuing voice commands.

Another recent technology that represents a wonderful approach to computer/human interfaces is iGesture Pad, in which user places their fingers on a touch sensitive pad & then move them in certain patterns that are interpreted as commands. This technology offers a new dimension in computer/human interface but it's still a somewhat clumsy translation through physical limbs.

Another latest technology for physically disabled persons is tracking the head movement of a person's head and translating that into mouse movements device developed for this technology named HeadMouse. While tracking head movement is better in many ways than tracking mouse movement, a more intuitive approach would be to track actual eye movements. This technology is quickly emerging technology with high potential for widespread adoption by computing public. The two most promising companies which offer eye tracking technology with potential for human/computer interface applications appear to be Tobii Technology & EyeTech Digital Systems.



**Fig 4. Eye Tracking Technology**

The next level of human computer interface technology is ability to control your computer with your thoughts alone. This technology is called Brain Computer Interface Technology. Imagine the number of applications of direct brain control.



**Fig 5. Brain Computer Interface**

People could easily manipulate cursors on the screen, direct various software applications, enter text on virtual keyboards etc. Another promising area of computer/human interface technology which offers tactile feedback hardware that allows users to “feel” their computer interfaces [5]. In this, computer can track & translate detailed hand and finger movements. These technologies give users the ability to manipulate virtual objects using their hands. This technology has potential for making human/computer interfaces more intuitive and efficient.

## VI. Future of HCI

One of the possible future developments of HCI is the MAKEY technology which makes everything in the world a possible piece of technology. In this technology instead of simply connecting random items to use as a keyboard or mouse using it to help make using a computer easier [6]. This would be incredibly helpful mainly in developing countries

where they may not be able to afford to buy all the hardware necessary to interact with a computer. However it also helps people to use computers who perhaps can't access because of the disability or some injury [7]. By allowing such sort of things a reality new ways to use objects to perform tasks on a computer would be discovered. Not only this at the recent industry advisory board meeting HCI was unanimously pointed as the important topic for future research and teaching by our industry experts. Ease of use remains a barrier to growth and success in IT even in today's world. And this is surely the major challenge for emerging markets such as smart phones, medical devices, home media appliances & automotive interfaces.

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