HUMAN COMPUTER INTERACTION-A BRIEF STUDY

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Abstract

The intention of this paper is to provide an overview on the subject of Human-Computer Interaction. The overview includes previous projects, current projects and technologies. This paper also covers definition, design, overview, future goals and advantages over human computer interface of HCI. Through this paper we are creating awareness among the people about this rising field of HCI. This paper also offers a comprehensive number of references for each method, concept and applications in HCI.

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1. Introduction

1.1. Human–computer Interaction

HCI involves the study, planning, and design of the interaction between people (users) and computers. It is often regarded as the intersection of computer science, behavioral sciences, design and several other fields of study.

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. Because HCI studies a human and a machine in conjunction, it draws from supporting knowledge on both the machine and the human side.

HCI is concerned with the joint performance of tasks by humans and machines.

The term was coined by Card, Moran, and Newell in their book, "The Psychology of Human-Computer Interaction". The term denotes that, unlike other tools with only limited uses, a computer has many affordances for use and this takes place in a sort of open-ended dialog between the user and the computer.

The Association for Computing Machinery defines human-computer interaction as "a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.

1.2. Since human–computer interaction studies a human and a machine in conjunction, it draws from supporting knowledge on both the machine and the human side

Machine side:

- Computer graphics
- Operating system
- Programming language
- Development environment

Human side:

- Communication theory
- Graphical and industrial design
- Linguistic
- Social sciences
- Cognitive psychology

It is the need of present to develop interactive interaction technologies for future.

2 Human-Computer Interaction: Definition, Terminology

Sometimes called as Man-Machine Interaction or Interfacing, concept of Human-Computer Interaction/Interfacing (HCI) was automatically represented with the emerging of computer, or more generally machine, itself. The reason, in fact, is clear: most sophisticated machines are worthless unless they can be used properly by men. This basic argument simply presents the main terms that should be considered in the design of HCI: functionality and usability.

Why a system is actually designed can ultimately be defined by what the system can do i.e. how the functions of a system can help towards the achievement of the purpose of the system. *Functionality* of a system is defined by the set of actions or services that it provides to its users. However, the value of functionality is visible only when it becomes possible to be efficiently utilized by the user . *Usability* of a system with a certain functionality is the range and degree by which the system can be used efficiently and adequately to accomplish certain goals for certain users. The actual effectiveness of a system is achieved when there is a proper balance between the functionality and usability of a system.

Having these concepts in mind and considering that the terms computer, machine and system are often used interchangeably in this context, HCI is a design that should produce a fit between the user, the machine and the required services in order to achieve a certain performance both in quality and optimality of the services. Determining what makes a certain HCI design good is mostly subjective and context dependant. For example, an aircraft part designing tool should provide high precisions in view and design of the parts while a graphics editing software may not need such a precision. The available technology could also affect how different types of HCI are designed for the same purpose. One example is using commands, menus, graphical user interfaces (GUI), or virtual reality to access functionalities of any given computer.

3 Design of HCI

In design of HCI, the degree of activity that involves a user with a machine should be thoroughly thought. The user activity has three different levels: physical, cognitive, and affective. The physical aspect determines the mechanics of interaction between human and computer while the cognitive aspect deals with ways that users can understand the system and interact with it. The

affective aspect is a more recent issue and it tries not only to make the interaction a pleasurable experience for the user but also to affect the user in a way that make user continue to use the machine by changing attitudes and emotions toward the user.

4 Overview on HCI

The advances made in last decade in HCI have almost made it impossible to realize which concept is fiction and which is and can be real. The thrust in research and the constant twists in marketing cause the new technology to become available to everyone in no time. However, not all existing technologies are accessible and/or affordable by public. In the first part of this section, an overview of the technology that more or less is available to and used by public is

4.1 Previous projects

- **Hand Gesture Recognition using Data-Glove**

  This thesis work, a real-time Human-Computer Interaction system based on the DG-Tech V Hand 2.0 data glove (Bluetooth version) has been designed. Recognition of hand gesture accurately and successfully using data glove has been done.

- **Human action recognition in video stream**

  This project focused upon recognizing human actions such as walking, running, jumping, bending etc. It uses interest point detection for achieving the same

  .

4.2 Current projects

- **Image Forgery Detection**

  In the current era of technology and multimedia we find ourselves surrounded by Digital Images. Considering the rapid advancement in Image Processing it has been very easy to manipulate any digital image using sophisticated tools like Photoshop, CorelDraw etc. This proposed shall provide some methods and algorithms that will attempt to restore authenticity and integrity in digital images.

- **Advance high level Content Based Image Retrieval system for Logo and Trademark Distinctivity**

Find out similar deceptive Trademarks from a database on the basis of their color, texture, shape, spatial features and text within them.

- **De-skewing, De-warping and De-noising of perspectively distorted documents: A comparisons between Geometrical Methods and Machine Learning Approach.**

  The main research directions in camera captured document analysis is to deal with the page curl and perspective distortions. Current document analysis and optical character recognition systems do not expect these types of artifacts and show poor performance, when applied directly to camera-captured documents. The goal of text de-skewing is to re-orient the skewed text lines and the goal of text de-warping is to flatten a camera-captured document such that it becomes readable by currently OCR systems. We will use Support Vector Machine and Neural Network for our Machine Learning Approach.

- **User state modeling using EEG signals**

  Interface is the most crucial part of any system. Traditionally the evaluation of interface is done by surveys or think-aloud method which don't give valuable insight into the user's changing experience throughout the task. The motive is to develop objective technique to measure user states such as workload, emotion and fatigue in real time using EEG signals of UI evaluation.

- **Facial expression recognition from Audio-Visual information using Wavelet and Curvelet transform**

  Facial expression recognition is an interesting topic of research. This project proposes the combined use of Wavelet Transform and Digital Curvelet Transform for recognition of facial expression from video.

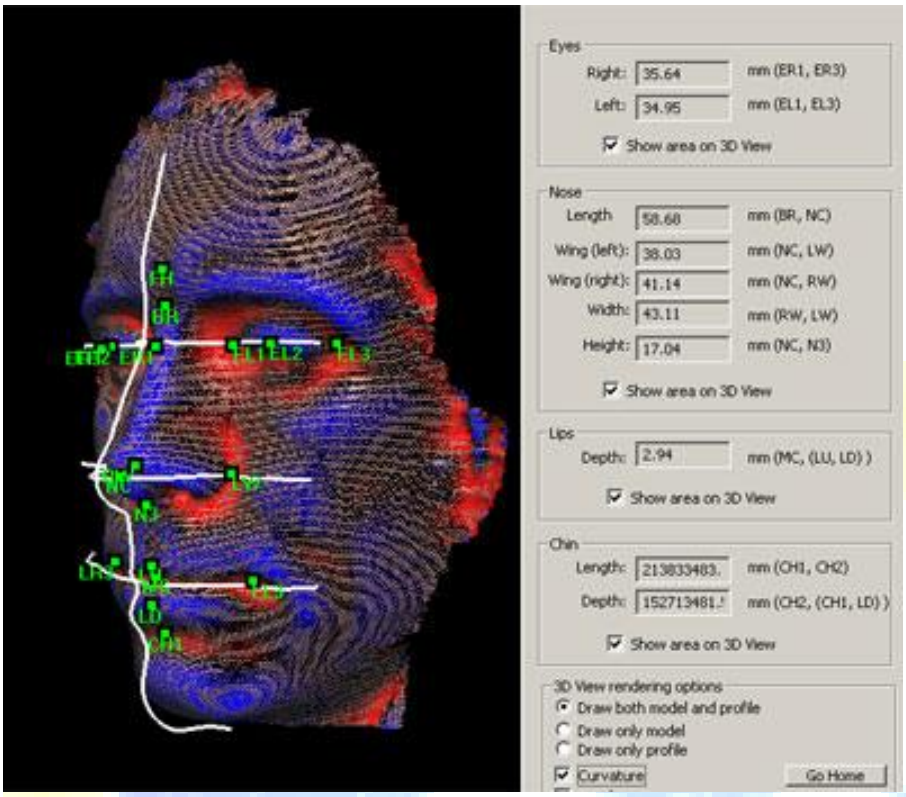

Fig.1

- **Computer Vision based Virtual keyboard (Projected or Generic)**

It is a projected visible virtual keyboard that can be touched on any surface and a video screen. The webcam watches finger movements using "Computer Vision" and translates them into keystrokes in the device. The proposed system will thus represent a ultra compact, portable computer.

Fig.2

- **Text Detection and Localization in Natural Scene Images**

  It means text detection and analysis from natural scene images using hybrid techniques of signal and image processing.

4.2.1 Existing HCI Technologies

The existing interfaces differ in the degree of complexity both because of degree of functionality/usability and the financial and economical aspect of the machine in market. For instance, an electrical kettle need not to be sophisticated in interface since its only functionality is to heat the water and it would not be cost-effective to have an interface more than a thermostatic on and off switch. On the other hand, a simple website that may be limited in functionality should be complex enough in usability to attract and keep customers.

The existing physical technologies for HCI basically can be categorized by the relative human sense that the device is designed for. These devices are basically relying on three human senses: vision, audition, and touch.

Input devices that rely on vision are the most used kind and are commonly either switch-based or pointing devices. The switch-based devices are any kind of interface that uses buttons and switches like a keyboard. The pointing devices examples are mice, joysticks, touch screen panels, graphic tablets, trackballs, and pen-based input. Joysticks are the ones that have both switches and pointing abilities. The output devices can be any kind of visual display or printing device.

The devices that rely on audition are more advance devices that usually need some kind of speech recognition. These devices aim to facilitate the interaction as much as possible and therefore, are much more difficult to build. Output auditory devices are however easier to create. Nowadays, all kind of non-speech and speech signals and messages are produced by machines as output signals. Beeps, alarms, and turn-by-turn navigation commands of a GPS device are simple examples.

The most difficult and costly devices to build are haptic device. “These kinds of interfaces generate sensations to the skin and muscles through touch, weight and relative rigidity.” Haptic devices are generally made for virtual reality or disability assistive applications.

The recent methods and technologies in HCI are now trying to combine former methods of interaction together and with other advancing technologies such as networking and animation. These new advances can be categorized in three sections: wearable devices, wireless devices,

and virtual devices. The technology is improving so fast that even the borders between these new technologies are fading away and they are getting mixed together. Few examples of these devices are: GPS navigation systems, military super-soldier enhancing devices (e.g. thermal vision, tracking other soldier movements using GPS, and environmental scanning), radio frequency identification (RFID) products, personal digital assistants (PDA), and virtual tour for real estate business. Some of these new devices upgraded and integrated previous methods of interaction. As an illustration in case, there is the solution to keyboarding that has been offered by Compaq's iPAQ which is called Canesta keyboard as shown in figure. This is a virtual keyboard that is made by projecting a QWERTY like pattern on a solid surface using a red light. Then device tries to track user's finger movement while typing on the surface with a motion sensor and send the keystrokes back to the device.

Fig.3

5 FUTURE GOALS OF HCI

The future for HCI, based on current promising research, is expected to include the following characteristics:

- **Communication all-around**. Computers are expected to communicate through high speed local networks, nationally over wide-area networks, and portably via infrared, ultrasonic,

cellular, and other technologies. Data and computational services will be portably accessible from many if not most locations to which a user travels.

- **High-functionality systems**. Systems can have large numbers of functions associated with them. There are so many systems that most users, technical or non-technical, do not have time to learn them in the traditional way (e.g., through thick manuals).
- **Mass availability of computer graphics**. Computer graphics capabilities such as image processing, graphics transformations, rendering, and interactive animation are becoming widespread as inexpensive chips become available for inclusion in general workstations and mobile devices.
- **Mixed media**. Commercial systems can handle images, voice, sounds, video, text, formatted data. These are exchangeable over communication links among users. The separate worlds of consumer electronics (e.g., stereo sets, VCRs, televisions) and computers are partially merging. Computer and print worlds are expected to cross-assimilate each other.
- **High-bandwidth interaction**. The rate at which humans and machines interact is expected to increase substantially due to the changes in speed, computer graphics, new media, and new input/output devices. This can lead to some qualitatively different interfaces, such as virtual reality or computational video.
- **Large and thin displays**. New display technologies are finally maturing, enabling very large displays and displays that are thin, lightweight, and low in power consumption. This is having large effects on portability and will likely enable the development of paper-like, pen-based computer interaction systems very different in feel from desktop workstations of the present.
- **Information utilities**. Public information utilities (such as home banking and shopping) and specialized industry services (e.g., weather for pilots) are expected to proliferate. The rate of proliferation can accelerate with the introduction of high-bandwidth interaction and the improvement in quality of interfaces.

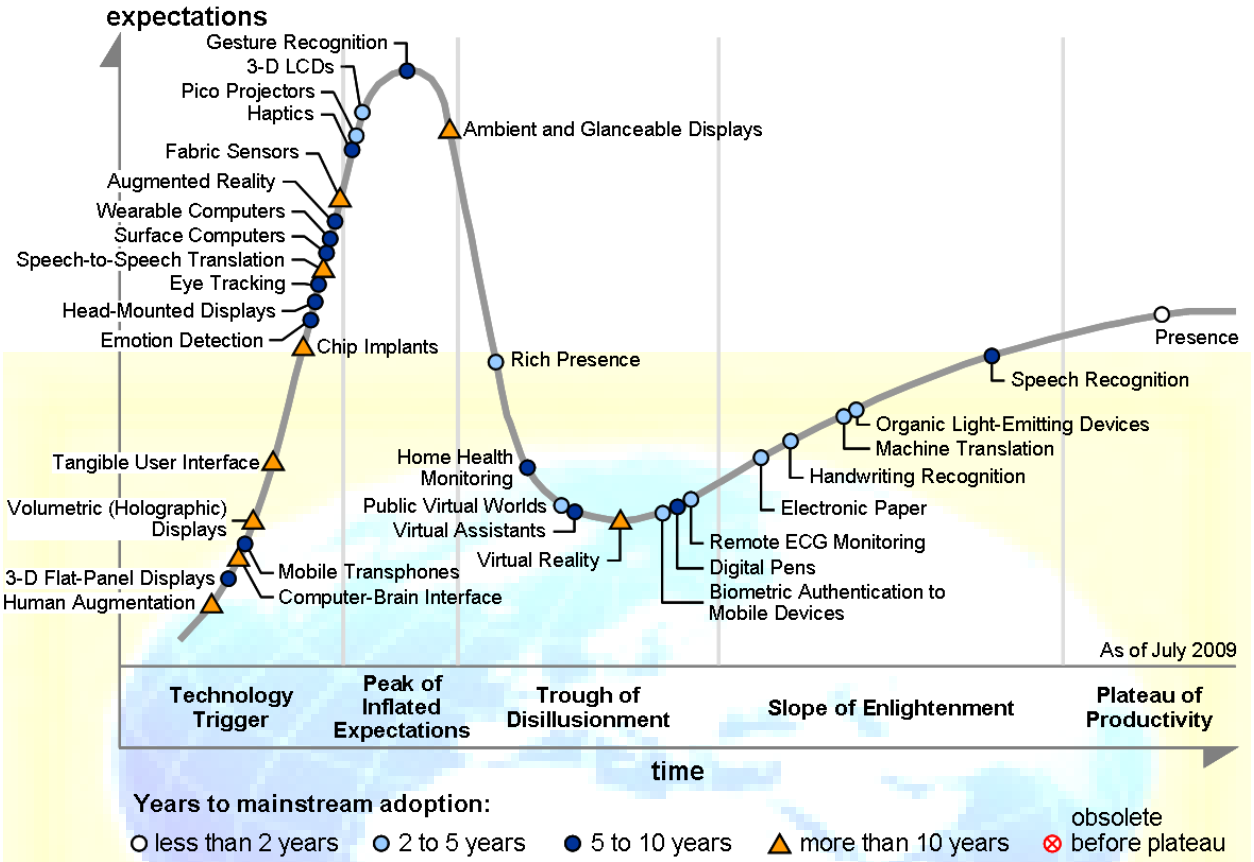

Fig.3

6 ADVANTAGES OVER HUMAN-MACHINE INTERFACE

Attention to human-machine interaction is important, because poorly designed human-machine interfaces can lead to many unexpected problems. A classic example of this is the Three Mile Island accident where investigations concluded that the design of the human–machine interface was at least partially responsible for the disaster. Similarly, accidents in aviation have resulted from manufacturers' decisions to use non-standard flight instrument and/or throttle quadrant layouts: even though the new designs were proposed to be superior in regards to basic human–machine interaction, pilots had already ingrained the "standard" layout and thus the conceptually good idea actually had undesirable results

7 FUTURE SCOPE

Human-Computer Interaction is an important part of systems design. Quality of system depends on how it is represented and used by users. Therefore, enormous amount of attention has been paid to better designs of HCI. The new direction of research is to replace common regular methods of interaction with intelligent, adaptive, multimodal, natural methods. Ambient

intelligence or ubiquitous computing which is called the Third Wave is trying to embed the technology into the environment so to make it more natural and invisible at the same time. Virtual reality is also an advancing field of HCI which can be the common interface of the future. This paper attempted to give an overview on these issues and provide a survey of existing research through a comprehensive reference list.

8 SUMMARY

Utilizing computers had always begged the question of interfacing. The methods by which human has been interacting with computers has travelled a long way. The journey still continues and new designs of technologies and systems appear more and more every day and the research in this area has been growing very fast in the last few decades.

We have found out various application and ongoing projects in the field HCI & have given basic knowledge about HCI.

It is concluded that while comparing both the technologies- HUMAN COMPUTER INTERACTION & HUMAN COMPUTER INTERFACE, HUMAN COMPUTER INTERACTION will have a prominent future in this effervescent world of technology.

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SIDE BAR

Scientometric: It is the science of measuring and analysing science. It is often done using bibliometrics which is a measurement of the impact of (scientific) publications.

DEFINITION

Multimodal: Characterized by several different modes of activity or occurrence.

Proliferation: Rapid increase in numbers.

Assimilate: Take in (information, ideas, or culture) and understand fully.

Haptic: of or relating to sense of touch.

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RELATED RESOURCES

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