RESEARCH ARTICLE

STUDY ON HUMAN COMPUTER INTERACTION

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ABSTRACT

Human computer interaction is one of the most emerging technology in computer science. Still it has not unite many researchers who recognize their focus as human computer interaction resides in other fields. This paper discusses about research which has been done in the field of Human Computer Interaction(HCI)concern to human psychology. A brief visit of HCI is given here. Specific examples of research in the fields of icons and menus are then reviewed. The actual result of such type of experiments and the divinations they make about general human psychology and certain human interactions with computers are discussed. Mental models of user interface interaction are discussed and compared to mental models of real world objects. Finally future directions for research are proposed.

Keywords-Human Computer Interaction, Multimodal HCI, Ubiquitous Computing and Innovative Ideas on HCI.

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I. INTRODUCTION

Computers have become more desirable or worse part of today's life. To make practical and effective use of computers had always concern the question of interfacing.

The technique via which human beings interacting from computers has a long journey. The journey still ongoing in new design of technologies and structure appear more and more in today's life and research in this area has been get bigger in the last few decades. The tremendous increase in *A. Human Computer Interaction (HCI)* field is not the part of quality of interaction only, but also experienced various branching in its history.

Instead of creating regular interfaces, the various research branches have had different view on the concepts of multimodality, intelligent adaptive interfaces and finally active rather than unimodality, command/action based ones and passive interfaces respectively. This paper intends to provide an overview on the state of the art of HCI systems and cover most of the important branches as cited above. In the next section, basic definitions and terminology of HCI are given. Then an outline of existing technologies and also recent advances and research in the field is provided. This is followed up by detailed description of the various architectures of HCI designs. The final sections include description on some of the applications of HCI and future expansion in the field.

Three major roles in early computing

ENIAC, probably the first general-purpose electronic computer in 1946, was 10 feet tall covered 1,000 square feet and ingest as much energy as a small town. Once program was written number of people needed for setting switches, cable connection and dials. In spite of a structure innovation that help vacuum tube reliability by enabling them to be operated at 25 percent basic power50 spent tubes had to be found and substitute

on an average day. In the previous days computer projects need to employed people for the three main roles: programming, management and operations. A tiny army of operators was required. Managers oversaw structure, expansion, and operation, including the specification of programs to be written and the dispensation of results. Each equipment play vital role especially became a focus of HCI research, and despite the continual changes of computers and the action around them we still find that these roles reflect aspects of this early division of labor.

B.   *Transistors open new era: 1958–1965*

In previous day's it's predicted that the world would need very few number of computer's to reflect the boundary of vacuum tube. In 1958 new arrival of commercial solid-state computers lead to dramatic changes. As number of computer has been deployed widely that increase attention to the operators and job. Low-cost computer operators set pushed button, switches and uses magnetic tapes and paper tape. The first versatile mode of direct interaction was Teletypes. That can read printed computer responses and status messages on that paper scrolled up one line at a time. The first display (i.e. VDUs or VDTs for visual display units or terminals or CRTs for cathode ray tubes) name glass teletypes because that have same capability to read message and scroll on the paper one line at a time.

On that time most displays were monochrome and have limit to alphanumeric character only. In Early day's terminals cost around $50,000 in today's dollars: expensive, on the other hand a small fraction of the cost of a computer. A large computer might have one console used only from the operator, refining the design of console buttons switches, and displays were a natural extension of human factors. Specialists in this ground authored the first human-computer interaction papers capturing the attention of some who were Developing, acquiring systems in industry and government

C.   *HCI during the period of time preceding personal computing: 1965–1980*

In the late 1964 Control Data Corporation has launched the 6000 series based transistor. After

that in 1965 IBM come with the IC i.e. integrated circuits system.

In 1964 Control Data Corp. launched the transistor-based 6000 series. In 1965 integrated circuits released by IBM i.e. System/360. These powerful computers, later christened mainframes to discriminate them from minicomputers conveyed computing into the business realm. At that point each of the three roles, operation management programming became a significant profession in computing, Operators interacted directly by computers for predictable maintenance loading and running programs, filing printouts, and so on. This hands-on division can be expanded to include data entry fetching and other repetitive tasks need to feed the computer. Managers variously oversaw hardware addition software development operation, and routing and using output. They were usually not hands-on users. Programmers were barely direct users until late in this period. Instead they flowcharted programs and wrote them on paper.

D.   *Elective use comes into picture in 1980–1985*

In 1980 Human Ergonomics, Factors (HF&E) & IS were picture more on increasing effectiveness than on augmenting human intellect. In contrast many programmers were attract and hold interest by this promise of computation. Increasing uses of minicomputers and microprocessor-based home computers creating a population of hands-on optional users. Twenty years far ahead the ideas early pioneers had of no of people selecting to use computers which helped them to effort thriving initiated to come true. And as a result the cognition of discretionary users became a matter of interest. In 1980 computer book by Harold Smith Human Interaction and Thomas Green perched on the cusp. One-third covered research on programming. The balance addressed "non-professional people," optional users who were not computer expert.

II.   Human-Computer Interaction: Definition and Terminology

Research is still ongoing on this topic and defining this is, sometimes called as interfacing concept of Human Computer Interaction (HCI) orMan Machine Interaction was automatically

represented with the emerging of computer or more simply machine itself. The reason in fact is clear most

The reason in fact is clear most involving machines are worthless unless they can be utilized in efficient way by men. This basic parameter simply shows the main terms that should be put in the structure of HCI: functionality and usability. Why a structure is actually designed can ultimately be defined by what the structure can do i.e. how the functions of a structure can help towards the getting off the purpose of the structure. *Functionality* of a structure is defined by the set of actions or services that it provides to its users. Though, the value of functionality is obvious only when it becomes possible to be efficiently utilized by the user.

III. Thumbnail on HCI

As technology getting bigger in last decade HCI have often made it's impossible to believe that which concept is real and which concept is virtual or factious. Tremendous increase in research and the stable twists in marketing cause the new technology to become easily available to everyone within time. Still there are number of technology but it's not publicly available because of the cost and security issues. People are using only the part of technology not full fledge.

A. Existing HCI Technologies

HCI structure must be consider number of aspects of human behaviors and needs to be uses. Difficulties while interacting human beings via computer from time to time fictional compare to the basic interaction method itself.

The existing interfaces not only differ in the degree of complexity but also degree of the functionality and the economical and financial aspect of the market.

In structure of HCI, the degree of action that involves a user with a machine should be thoroughly thought. The user action has three different levels: affective, physical and cognitive. The physical aspect discover the mechanics of interaction from human and computer while the cognitive aspect concern with ways that users can understand the structure and interact with it. The affective aspect is a more recent issue and it tries

not only to make the interaction a pleasurable experience 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

The main indentation of this paper is mainly on the advancement in technology in aspect of physical interaction means that how different method of interaction can be merged(Multi-Modal Interaction) and how each procedure can be improved in performance (Intelligent Interaction) to provide a better and easier crossing point to the user. The existing physical technologies for HCI basically can be categorized by the relative human sense that the machine is structured for. These devices are basically relying on three human senses: vision audition and touch, Input devices that depend on visualization are the most used kind and are commonly either switch-based or pointing devices. The switch-based devices are, kind of interface that uses switches and button like a keyboard. The including devices examples are joysticks mice, touch screen panels, graphic tablets, trackballs, and pen-based input. Joysticks are that have mutually switches and pointing abilities. The output devices can be any kind of visual display or printing device.

Fig. 1 Interaction with computer

B.   Modern Advances in HCI

In the following subdivisions, current directions and advances of research in HCI, namely intelligent, adaptive interfaces, ubiquitous computing. These interfaces involve different levels of user activity: physical, cognitive, and affection.

1)   Intelligent and Adaptive HCI: Although the devices used by majority of public are still some type

of basic command/action setups using not very classy physical apparatus, the flow of research is directed to structure of intelligent, adaptive interfaces. The exact theoretical definition of the concept of intelligence or being smart is not only known but at least not publicly agreeable. Now a day's anybody can define these concepts from the apparent increase and solidity in functionality, usability of new devices in market.

As mentioned before, it is economically and technologically It's important to make HCI structure in that way, so that it can provide pleasant and satisfying experience to the users. To understand this objective, the interfaces are feat more natural to use every day. Evolution of interfaces in note-taking tools is a good example. Till now first there were typewriter, keyboards and now touch screen tablet PCs that we can write on using your own handwriting and the recognize and they distinguish it change it to text and if not already prepared tools that transcript whatever you say automatically so you do not need to write at all.

One important aspect in new generation of edges is to differentiate between using intelligence in the making of the interface (Intelligent HCI) [or in the way that the interface interacts with users (Adaptive HCI). Intelligent HCI designs are interfaces that incorporate at minimum around type of intelligence in perception from and/or response to users. A few examples are speech enabled that use natural language to interact with user and devices that visually track user's movements or gaze, reply accordingly. Adaptive HCI structure, on the other hand, may not use intelligence in the creation of interface but, the way they continue to interact with users. An adaptive HCI might be a website using regular GUI for selling different kinds products, this website desired be adaptive -to some extent- if it has the ability to recognize the user keeps a memory of his explorations and acquisitions and intelligently search, find, and suggest products on sale that it reflects user might essential. Most of these kinds of adaptation are the ones that deal with cognitive and affective levels of user activity.

2) Ambient Intelligence, Ubiquitous Computing: The latest research in HCI field is unmistakably *ubiquitous computing*. The stint which often used substitution ably by *ambient intelligence* and *pervasive computing*, refers to the definitive methods of human-computer collaboration that is the deletion of a desktop and embedding of the computer in the scenario so that it becomes imperceptible to humans while surrounding them everywhere hence the term ambient. The first ubiquitous computing was announced by Mark Weiser in his tenure as chief technologist at Computer Science Lab in 1998 Xerox PARC. His idea was to embed computers everywhere in the environment and everyday objects so that no. of people can interact with many computers on the same time while they are invisible to them and wirelessly collaborating from one another.

Third Wave of computing is Ubicomp. The First Wave was the mainframe era, in which many people one computer. Then the Second Wave, one person one computer which was called PC era and now Ubicomp introduces many computers one person era.

IV. HCI Systems Architecture

Most essential influence of a HCI design is its arrangement. In fact, any given interface is generally defined by the number and diversity of inputs, outputs it delivers. Architecture of a HCI system shows what these inputs, outputs are and how they interact together. Following sections explain different configurations and designs upon which an interface is based.

A. Unimodal HCI Systems

As mentioned previously, an interface mainly relies on number, diversity of its inputs, outputs from which communication channels that enable users to cooperate with computer via this interface. For each of the dissimilar independent lone channels is called a modality. A system which is established on only individual modality is called *unimodal*. Depend on the nature of various modalities, they can be divided into three categories:

1. Based on visual
2. Based on audio
3. Based on sensor

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The subsequent sub-sections describe each class and provide examples and references to each modality.

1) HCI based on visual: On the basis of visual the human computer interaction is probably the most widespread area in HCI research. In view of the extent of applications and variability of open problems and approaches researchers tried to tackle various features of human responses which can be familiar as a visual signal. Some of the main research areas in this subdivision are as follow:

• Analysis on Facial Expression

• Body Movement Tracking (Large-scale)

• Gesture Recognition
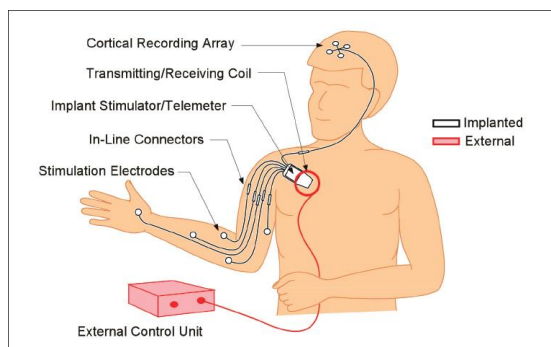
• Gaze Detection (Eyes Movement Tracking)

Fig. 2 Improving Brain-Computer Interfaces

Researchers are showing advances in restorative BCI systems that are giving paralyzed individuals more effective ways to communicate, move, and interact with their environment.

2) HCI Based on Audio: The essential part of HCI is that audio based communication in between a computer as well as human beings. Different audio signals capture the information of this range. While the nature of audio signals might not be as fluctuable as visual signals but the data gathered from audio signals can be more trustable, helpful, and sometimes it can be unique suppliers of material. Research ranges in this part can be divided to the following parts:

• Recognition of Speech

• Recognition of Speaker

• Analysis of Auditory Emotion

• Human-Made Noise/Sign Detections (Gasp, Sigh, Laugh, Cry, etc.)

• Musical Interaction

Historically, speech recognition and speaker recognition have been the main focus of researchers. Current happenings to incorporate human feelings in brainy human computer interaction initiated the efforts in analysis of emotions in audio signals. Other than the tone and pitch of speech data, typical human auditory signs such as sigh, assisted emotion examination for crafty more intelligent HCI system. Music generation and interaction is a precise fresh zone in HCI through solicitations in art industry which is studied in both audio- and visual-based HCI systems.

3) HCI Based on Sensor: This section is a combination of variety of areas with a wide range of applications. The commonality of these types of spaces is that at least individual carnal sensor is cast off in the middle of user and machine to provide the interaction. These sensors that are given below can be very basic or very sophisticated.

1. Pen-Based Interaction

2. Mouse & Keyboard

3. Joysticks

4. Pressure Sensors

5. Taste/Smell Sensors

Some sensor have been about for a while ,few of them are completely new technology. Pen-Based sensors remain precisely of attention in mobile devices and are associated to pen movement and handwriting recognition areas. Keyboards, mice and joysticks are already discussed in section 3.1. The state-of-the-art technology is Motion tracking sensors/digitizers are which revolutionized movie, art, video-game and animation industry. Industry comes in a form of wearable clothes or joint sensors and made computers ampleother able to communicate with actuality and human able to produce their world practically. Haptic and pressure sensors one of the extraordinaryattentiveness for applications in robotics and computer-generated reality. New humanoid robots include hundreds of haptic sensors which make the robots thoughtful and aware to touch. These types of sensors are also used in medical surgery application. A slight research workings are also done on space of taste

and smell sensors however they are not as popular as other areas.

Fig. 3 Eye-tracking replacing a task

Imagine this – you are playing a video game and want to communicate from the other character. On the other hand, in its place of expending the mouse, you simply rest your eyes on that special attractiveness and almost straightaway, you get an answer from it.

Multimodal HCI Systems

Multimodal is a combination of number of modalities. In MMHCI systems, these modalities mostly refer to the ways in which system returns to the inputs, i.e. announcement channels. The definition of these channels is inherited via human kinds of interaction which are mostly his senses like Sight, Hearing, Touch, Smell, and Taste. The possibilities for communication from a machine contain but i.e. not inadequate to these types. Therefore a multimodal interface acts as a implementer of human-computer interaction through two or more styles of input that go beyond the traditional keyboard, mouse. The number of inputs state and their way of working together might be different from one multimodal system to another multimodal system. Combination of different speech, gesture, gaze, facial expression and other non-traditional state of input for the multimodal interface. The most helpful input methods are that of gesture and speech. Though an idea multimodal HCI system should contain a combination of lone modalities which communicate correlatively, the real-world limitation and open problems in each modality oppose limitations on the combination of diverse modalities. In unkindness of

all advancement made in MMHCI, in maximum of current multimodal systems, the modalities are still treated separately, only at the conclusion effects of diverse modalities are combined together. An interesting aspect of multimodality is the communication of various modalities to help the appreciations. For example, tracking of lip movement (based on visual) can help speech acknowledgement methods (based on audio) and speech acknowledgment methods (based on audio) can support facility attainment in gesture recognition (visual-based).

V. Applications

Multimodal interfaces have no of advantages over traditional interfaces. For one thing, they can offer an additional as well as user-friendly understanding. For instance, in a real-estate system called Real Hunter one can point from a finger to a firm of concern and state to brand demands about that particular house. Multimodal interface provide natural type of experience using speech and pointing gesture to select an object. The main key point of multimodal interface is that ability to provide redundancy to put up various people and various scenario businesses to explore on a map.

A. Multimodal Systems for Disabled people

The main advantage of multimodal system is that have special type of application which helps disabled people to address and assist (as persons with hands disabilities), that need different types of interfaces than ordinary people. By using such special type of application disable user can do their task via interacting from the machine by using audio and head movements.

By calculating the position of cursor at the starting of speech recognitions synchronization within two modalities has been performed. Reason behind that the process of pronouncing the complete sentence, the cursor position must be captured by moving the head, after that cursor can point to the other graphical objects, however the order that must be completed is appeared in the head of a human in a less time before beginning of phrase input.

B. Multimodal Systems of Emotion Recognition

As we go ahead a world in that computers are additional ubiquitous, it will become more essential that technologies recognize and understand all clues, implicit and explicit, that we may provide them regarding our intentions. Naturally Human-computer collaboration cannot be based on individual on explicitly voice command. Computers will have to detect the different communicative signals founded on to infer one's emotional state. This is a significant piece of the puzzle that individual has to place together to forecast exactly one's intentions and future behavior. People are able to make expectation about one's expressive formal depend on their explanations about one's face, body, and voice. Studies show that if individual had entrance to only one of these modalities, the face modality would produce the best predictions. However, here accuracy is maintained 35% while human judiciaries are given access to both face and body modalities together.

This suggests that jiggle recognition, that has to the most part focused on facial expressions, can greatly benefit from multimodal fusion techniques. Results show that the emotion recognition system based on acoustic information only give an inclusive enactment of 70.9 percent, as compared to an inclusive performance of 85 percent for a recognition system based on facial expressions. It's fact due to which the cheek areas give important information for emotion classification. On the additional hand, for the bimodal system established on melding the facial recognition and acoustic information, the inclusive show of this classifier was 89.1 percent.

C. Multimodal Applications of Map-Based

To express different messages various types of input modalities are used. For instance, speech provides an easy and regular mechanism to express a demand about a particular object or requesting that the object initiate a given operation. However, speech might not be supreme for tasks, such as selection of a particular region on the screen or defining out a particular path. By using pen or hand gestures these types of task can be handling in

better way. However, making queries about a given region and choosing that area are all complex tasks that should be accommodate by a map-based interface. Thus, conclusion is that map-based interface provide better experience by assistant multiple modes of input particularly speech and gestures. The current multimodal map-based application is Real Hunter. It is a real-estate interface that believes users to choose objects or regions with touch input while making queries using speech. For instance, the user can ask "How much is this?" while pointing to a house on the map.

D. Multimodal Human-Robot Interface Applications

This is same as like map-based interface, robotics-human interfaces usually have to provide mechanisms for pointing to specific positions, for operation-initiating requests. As discussed earlier, the former type of interaction is thriving put up by gestures; however the latter is enhanced accommodated by speech.

E. Multi-Modal HCI in Medicine

Surgeons were beginning to reach their limit on the basis of Traditional method alone used in the early 1980s.

Smaller tool needed for the human hand was impractical for many tasks and better magnification. Higher precision was required to concentrate and control inlesser and sensitive parts of the human body.

Due to vast Improvements in engineering Digital robotic neuro-surgery becomes an important solution, computer technology as well as neuro-imaging techniques. In surgical area robotics surgery was familiarized.State University of Aerospace Instrumentation, Karlsruhe University of Germany and Medical School of Harvard(USA) has been working on developing man-machine interfaces, multi-agent as well as adaptive robots technologies proposed for neuro-surgery.

The neuro-surgical robot having main components like sensors for feedback vision,an arm andcontrollers, a localization system and a data processing epicenter. Sensors alsoprovide comments from the surgical place with real-time imaging, however the latter one updates to the

controller through new directives for the robot by using the computer interface and some joysticks.

When there is a brain surgery is involved then neuro-surgical robotics perform amazing task with much greater accuracy as well as precision.

F. Multi-Modal HCI in Crime

What is sixth sense? The Sixth Sense prototype is comprised of a pocket projector, a mirror and a camera. The hardware elements are coupled in a pendant like mobile wearable device. Both i.e. camera and projector should be connected from mobile devices. i.e. in the users pocket. The projector projects visual information enabling surfaces, walls and physical thingsnearby us has been used as interfaces, the camera recognizes and tracks user's hand gestures, physical objects expending computer-vision based techniques. The software program processes the video stream data captured via camera and trails the positions of the colored markers (visual tracking fiducials) at the tip of the user's fingers viabasic computer-vision techniques. The movements and preparations of the fiducials are construed mad about gestures that act as interaction instructions for the projected application interfaces. Number of traced fingers is merely constrained by the number of unique fiducials, this sixth sense technology also support multi-user interaction as well as multi-touch.

As we know about the above sixth sense technology we can use this technology to detect the crime investigation. We can use this technology to take pictures at any time we don't require any kind of camera we will not be dependent on camera .this will be helpful for all those who don't have knowledge of taking proper pictures at proper direction. This will also be available at low cost.

Fig. 4 HCI in Different branches

VI. An Innovative Ideas on HCI

This HCI can be useful for many situations such

A. HCI for Disabled Peoples

As we have discussed about sixth sense we can apply this idea for blind people by giving them proper training about this and they can be our spy. As normal people can go in crime spots so instead of that we can send these blind means physically disabled people in such places to take crime spots photos and videos. They can be our eye at crime spot. This will give them a new life to fight for nation as well as their life. Later if this get success we can create an army of such peoples and this will also be a revolution in the field of HCI. Many crimes can be detected easily and will be solved by these peoples.

B. HCI for Medical Emergency Technologies

We can implement a device will can be interactive with human beings in the field of medical. If a person lives in remote area and unable to reached to hospitals and no mobile network coverage are available there in such case this device can be helpful. That person has to pass his message and that will be delivered to nearesthospitalwithout any disturbance and any cost. We know that if mobile network is not coming than how this device will work in such remote area but as we know technology is growing so fast we can take help of Li-fi technology. What is Li-fi? Faster technology will be in future like Li-Fi technology, more reliable internet connections, even when the demand for data usage has outgrown the accessible supply withcurrent technologies like 4G, LTE and Wi-Fi. It will not replace these technologies, but will work seamlessly along with them. By using light to bring wireless internet will also allow connectivity in environments that do not support Wi-Fi currently, as like aircraft cabins, hospitals and hazardous environments. For data transmission light has been used in fiber optic cables and for point to point links, but Li-Fi is a special and novel combination of technologies which allow it to be universally adopted for mobile ultrahigh speed internet communications.

We can also use this device to avail medicines for those hospitals or medical camp that are not getting it at any time. They must be search it

on particular device and if those medicines are available at any place in the world they can ask for that and can get it easily without wasting much time.

VII. Conclusions

Human-Computer Interaction is one of the most emerging technology in computer science. Quality of system based on how it is exemplified and used via users. Therefore, enormous amount of attention has been paid to better designs of HCI. The new way of research is to substitute the common regular methods of interaction with intelligent, adaptive, multimodal, natural methods.

Ambient intelligence as well as ubiquitous computing which is called the Third Wave is trying to embed the technology into the scenario so to make it more natural and invisible at the same time.

Virtual reality is also an advancing field of HCI that can be the common edge of the future. This paper attempted to give an overview on these issues and provide a survey of remaining research through a comprehensive reference list. We can also have such sixth sense technology to improve crime detection and can help physically disabled people and we can create a device in medical emergencies.

Acknowledgement

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