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Overview of human-computer interaction and study towards the computer and geriatric use

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ABSTRACT

The goal of this paper is to provide an overview and nimble on the concept and subject of Human-Computer Interaction (HCI). The outline includes the basic definition and terminology, various applications and survey of existing technologies and recent advances in the field like how to do visualization of data for knowledge discovery, brain computer interface, etc and what will be the scenario after 20 years from date and to show how Information and communication technologies have proven to be an effective way of helping geriatric persons improve independence outcomes, but such technologies are yet not widely used by this segment of the population due to many reasons the main aim behind to write this paper is to put a light on use of mobile phones among geriatric people and to bridge the gap between interaction with device by doing some survey on existing interface.

The geriatric person show some resistance in adopting technology, making them deprived from the benefits it has to offer. This problem is gaining more importance, since due to our healthy lifestyles we live longer, and are likely to be physically, socially and cognitively active until older ages.

Keywords: *Computer, HCI, Human, Interface, Geriatric use.*

1. INTRODUCTION

According to Albert Einstein "Computers are incredibly fast, accurate, and stupid. Human beings are incredibly slow, inaccurate, and brilliant. Together they are powerful beyond imagination." So for getting brilliant and fast result human and computer need to come together. For that it is must to have an interface between user and computer, and that is promising with the HCI. Theoretically HCI is defined as "A discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of the major phenomena surrounding them."

Make use of 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.

The progression in Human-Computer Interaction (HCI) field has not only been in quality of interaction, it has also experienced different branching in its history. Instead of designing regular interfaces, the different research branches have had different importance on the concepts of multimodality rather than uni-modality, intelligent adaptive interfaces rather than command/action based ones, and finally active rather than passive interfaces.

2. 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.

2.1 HCI Systems Architecture

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

2.1.1 Unimodal HCI Systems

As mentioned earlier, an interface mainly relies on number and diversity of its inputs and outputs which are communication channels that enable users to interact with computer via this interface. Each of the different independent single channels is called a modality a system that is based on only one modality is called *unimodal*.

They can be divided into three categories:

- Visual-Based
- Audio-Based
- Sensor-Based

2.1.2 Multimodal HCI Systems

The term multimodal refers to combination of multiple modalities. In MMHCI systems, these modalities mostly refer to the ways that the system responds to the inputs, i.e. communication channels.

Multimodal interfaces can offer a number of advantages over traditional interfaces. For one thing, they can offer a more natural and user-friendly experience. For instance, in a real-estate system called Real Hunter [24], one can point with a finger to a house of interest and speak to make queries about that particular house. Using a pointing gesture to select an object and using speech to make queries about it illustrates the type of natural experience multimodal interfaces offer to their users. Another key strength of multimodal interfaces is their ability to provide redundancy to accommodate different people and different circumstances. [3]

3. NEW TRENDS AND OPPORTUNITIES

For many years, humans have sent commands to "machines" primarily via the keyboard-mouse paradigm — also known as WIMP (windows, icons, menus, point-and-click devices). Here, the term *machine* is used in a very broad sense: in addition to the point-and-click devices that are usually associated with computers,

3.1: We use a keyboard of kinds to dial numbers on a telephone, to interact with a TV, to select a wide range of functions on a car dashboard, and many other activities that employ key-based interaction modalities. In most cases, the machine's output to the user is then based on a display device such as a monitor.

3.2: Several affordable sensors have begun to shake up the way people interact with devices. Touch and multi touch screens have driven the change from cellular phones to smartphones, and gestures are now the main interaction modality to activate functions on personal devices. At the same time, speech recognition technologies and CPUs' increased computational power let users efficiently provide inputs when they can't perform gestures.

3.3: Personal devices are the most evident example of how new forms of HCI can reduce the gap between humans' mental models and technology. One market that has led this deep innovation in HCI is entertainment. With users asking game and device makers for new ways to control characters, game console developers proposed controllers to release players from the constraints of using a keyboard and mouse? The new interface becomes a means for providing tactile feedback as well as acting as a sort of tangible interface (the controller becomes a steering wheel, a gun, or a tennis racket, for instance).

3.4: Sensors such as the Microsoft Kinect are a further step toward the implementation of fully natural interfaces in which the human body becomes the controller. The device lets users provide commands to the machine via gestures and body poses as embedded hardware performs real-time processing of raw data from a depth camera, thus obtaining a schematic of a human skeleton comprising a set of bones and joints. Recognizing the position and orientation of bones lets the hardware identify poses and gestures, which can be mapped to commands for the machine.

3.5: Researchers have also proposed sensors that can track a user's hands. For instance, the Leap Motion can interactively track both hands of a user by identifying the positions of finger tips and the palm center, and later computing finger joints using an inverse kinematics solver. Some car makers are already proposing a hand-tracking based alternative interaction modality in lieu of traditional touch screens devoted to managing infotainment functions. Similarly, some smart TVs let users control their choices with a set of gestures, thus replacing the traditional remote control.

3.6: Found only in science fiction movies just a few years ago, the above-mentioned scenarios are now the present reality of HCI. On the other hand, new and more intriguing scenarios appear to be imminent, as brain interfaces seem poised to invert the relationship between humans and machines, for instance. This new interaction paradigm's success will rely on future technological advances, which aim to transform interface devices into wearable and embeddable objects. Interfaces based on augmented reality (AR) technologies are clear examples of this transformation. Many applications for tourism, entertainment, maintenance, shopping, and social networks are already available for personal devices, but new wearable sensors might soon change our habits. Google Glass will be

(massively) marketed in the near future, and new application fields are proposed daily. Human-machine interaction and human-machine "integration" are doomed to become very similar concepts, and indeed, Google Glass-like solutions could soon be replaced by contact lenses that implement natural eyewear-based interfaces. [1]

3.7: Persons with disabilities are often unable to use computers. This is because they are either unable to find a suitable means of interaction or they simply cannot afford commercial solutions. In study also found that available solutions do not promote the individual's sense of independence, It allows persons, who may have disabilities ranging from not being able to use their hands to severe cases where the person is only able to move their head, to navigate and
Manipulate the graphical user interface using head movements and speech. This System is used for user with
Motor impairments people who cannot use their hands to operate a computer mouse also they are unable to use the shortcuts of keyboard to operate the system because of disability, but wish to operate a computer. [2]

New forms of HCI will significantly change our lives. New interaction paradigms offer the chance to improve quality of life for people who can't take advantage of current interfaces — due to physical disabilities, for example. On the other hand, new issues will arise — particularly related to privacy, security, and ethics — thus potentially slowing the diffusion of new hardware and software products based on wearable (and "invisible") devices. Although some researchers have already investigated relationships between interface design and legal and privacy issues, national legislations are heterogeneous and not yet ready to cope with present and future advances in HCI.

Now will try to elaborate that we have proven advance technology in existence, it is highly in use and accepted by young youth but it is not completely accepted by geriatric (elder) people due to many reasons of interface designing.

4. APPROACH AND INTEREST OF GERIATRIC PEOPLE TOWARDS COMPUTER

By enchanting the interest of senior users in technology, we can fight loneliness and omission and allow the old person to be more productive, independent and to have a more social and fulfilling life. This can be done by improving the accessibility to existing devices and services. All this should be made possible at people's homes, geriatric hospitals since elderly people have sometimes some level of impairments caused by age, which reduces their mobility. In this study we will survey several HCI methods and control interfaces, evaluating the feasibility of different solutions, considering both physical and situational impairments of elder users which is caused by age.

In our daily life, we find ourselves surrounded by technology, which enables the creation of new opportunities and forms of social interaction, instant information access, constant availability and higher control of the surrounding environment. New solutions of Human-Computer Interaction (HCI) are making our relationship with computers and technology in general, more natural and easier to learn. However, the benefits of technology do not reach all social groups. The elderly show some resistance in adopting technology, making them deprived from the benefits it has to offer. This problem is gaining more importance, since due to our healthy lifestyles we live longer, and are likely to be physically, socially and cognitively active until older ages.

4.1 Existing Work

4.1.1 Traditional Interfaces

In this type of interface input with the help of basic keyboard in case of mobile devices and mouse are the most common setup to operate a desktop computer. Which is mostly accepted kind of interface for all aged people.

4.1.2 Multi-touch Interfaces

Multi-touch interfaces use a touch sensing surface to recognize the presence of one or more points of contact. This kind of technology gained popularity on mobile devices, such as tablets and smartphones. Since touch screens allow users to directly interact by touching with the information displayed on the screen, this technology is considered to be one of the most accepted of all technologies.

However, considering the aged deteriorated capabilities (degraded vision and tactile sense), this kind of interfaces should have some specific features like multiple sizes for fonts, buttons and icons, as pointed out by Stone5. The author verified that one of the main problems of mobile touch devices among elderly, is that buttons are too small. But since the button size and arrangement is under software control, it is possible to easily circumvent that problem. [9]

Pros:

i. **Flexibility:** A major advantage of multi-touch systems is the ability to adapt them to almost any imaginable problem that it should solve. As the screen content can be modified to the developer's needs, he can simulate input devices such as keyboards or tasks like technical drawing by creating an adequate virtual reproduction. This makes touch screens a very flexible user interface system and enables extremely intuitive applications, if designed correctly.

ii. **Fast:** Another specific positive aspect of multi-touch lies within the use of simultaneously handled input devices. As users can employ both their hands (and many fingers) or also different devices in combination with their hands at the same time, they are able to make significant improvements regarding the time a task takes to be completed. Users need to be somewhat acquainted with the handling, but on simple and intuitive systems, this seems to be no problem, as Wu and Balakrishnan found out on assessing their Room Planner application [11].

iii. **Simultaneous Usage:** Apart from simultaneous usage of hands or devices, you can also extract a lot of information out of a single means of input. Finger touches can be varied in pressure sensitivity and angle (on several axes) and hands can be used to express a variety of gestures by tilting, flicking and catching or forming any conceivable kind of sign [11] (see figure below).

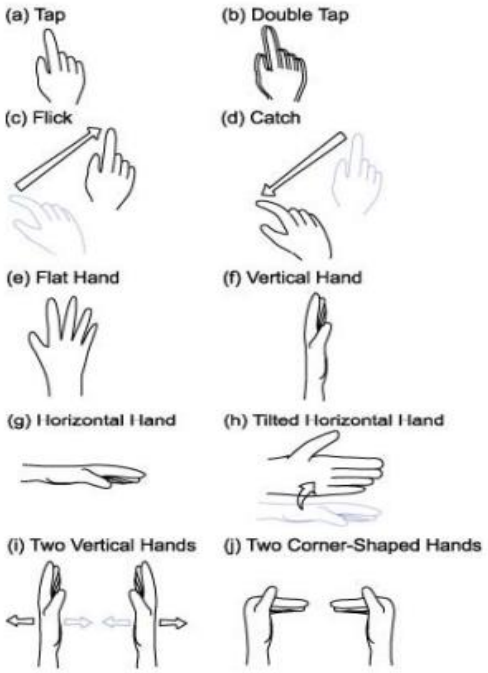

Figure 3: The set of hand gestures supported in Wu and Balakrishnan's *Room Planner* [10]

iv. **Collaborative Touch Systems:** Furthermore, multi-touch opens a whole new set of possibilities for applications since multi-touch implies not only multiple hands or devices but also multiple persons. This enables the creation of reasonable collaborative touch systems, in which several users can interact with the screen as well as with each other simultaneously.

Cons:

Occlusion: On the downbeat side, multi-touch systems complicate the occlusion problem, as several fingers, hands or devices are clouding even more parts of the touch screen than on single-touch devices. This can, however, be eased by using clever interface design approaches, as Wu and Balakrishnan con- firmed [11]. One more basic issue is the fat finger difficulty which requires designers to use interaction elements of a certain minimum size, in order to be precisely touchable by human fingers. As multi-touch systems mostly rely on touch screens rather than touch tablets without display, you always need to be able to look at the surface and get discernable display information [10]. However, this is on some occasions hardly possible, like driving a car or operating a device within a pocket. It also restricts simple touch screens from being a beneficial device for visually impaired users. In some fields, a touch screen is mostly exposed to sunlight as with notebooks or mobile phones and visibility can be heavily affected as well.

Lack Clear Distinction: What is more, some actions like scribbling notes or making finer drawings cannot be reasonably performed with fingers and on small screens [10]. You need a device of a certain size that explicitly can handle appropriate input tools such as a stylus as well to the usual hand and finger recognition. Also, even though touch screens can adapt very closely to a vast number of application purposes, they will only ever be a effective representation of the original situation and lack certain features such as a plastic shape. This can make a significant difference in the managing of the interface, as can be seen when demanding to rapidly handle a virtual keyboard in contrast to the real thing.

4.1.3 Gesture Interfaces

Gesture recognition is able to seen as a means for computers to understand human body language, interpreting those gestures via mathematical algorithms. There are mainly two ways of achieving gesture recognition: with devices that have motion sensing capability (e.g. accelerometer, gyroscope, magnetometer) or video capturing and processing - also called computer vision - to detect

users movements. Gesture recognition is one of the most natural and intuitive ways of interacting, since it closely mimics how humans interact with each new. Gesture recognition interfaces emerged recently and gained popularity in the video game industry.

Pros:

- It uses general Gestures (like tap, double-tap, drag, flick, pinch, spread, press, press and tap, press and drag, rotate) which are very easy to adapt.
- Gestures Are Easy To Learn
- User Delight
- Room to Explore

Cons:

- Motor impaired person is unable to use gestures easily.
- Thoughtless Gesticulation
- Unfamiliarity Breeds Discontent
- Difficult navigation

5. CONCLUSION

This is the basic study to review the existence and use of Uni-model interfaces with its pros and cons to brief how technology is accepted and used by geriatric people in next part will try to show the result with statistic which will be based on the questionnaires for elder people.

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