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Natural User Interface a Tool in Physics Learning

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ABSTRACT
In this paper, the natural user interface technology is understood as that which allows people to use their senses in applications control, thus elucidating how technology works more naturally with the human From the use of touch screens and voice command technology, the current innovations taking place in the natural user interface, that which makes the human to computer interaction more possible, to the voice/speech platform which initiates an automated process or service, the gesture interaction, where gestures originating from the body usually the hand or face are described. Many approaches were made using cameras and computer vision algorithms to interpret signs and languages. New inventions are bringing the possibilities of utilizing technology without the necessity of direct physical interference, elimination of any action that involves one's touch of a media or interface, making it possible to relate, have visuals, and even information advancements in people, with the computers in the forefront of advancement in technology of the present day world. Thus, this papertakes into consideration the study of the Natural User Interface (NUI) technology, hoping that in the near future, a well-designed natural user interface will be availed with computer systems becoming tremendously complicated day by day, and more autonomous.
Keywords: *Computer Interaction, algorithm, visualization, Virtual Interaction, Natural User Interface*

INTRODUCTION

Computers are now taken the roles of most aspects of life. People's ways of life are changing. These changes are sometimes caused by innovations and technology, but in other times, it works to spur technological invention. Global changes are currently taking place as a result of technological development. There were many computer-based revolutions in the past, starting with the unraveling of the desktop computer, the introduction of internet surfing, the wifi and up to the recent ongoing research in the Li-Fi technology [(12)]. An immense overhaul of data flow will take place when there is a shift from the Natural User Interface, the graphical user interface, to a more viable voice/speech gesture recognition interface. A computer with the Natural User Interface technology supports the use of real and virtual objects. To bring about a tremendous improvement in the computer data flow, a change has to take place from the everyday graphical user interface, the normal inputting methods such as in the keyboard to computer kind of input, to a more viable speech and gesture identification or recognition interface. Thus, the Natural User Interface works towards achieving the smooth side by side running of the real object with the virtual object.

THE NATURAL USER INTERFACE (NUI)

This is a system for human-computer interaction that enables a user operates through intuitive actions related to natural everyday human behavior. The

natural user interface technology allows people to use their senses in applications control, thus making technology works more naturally with human, and helps a lot in the dissemination of the physics knowledge, and also in medicine. As Human Beings, we are enthusiastic in a new and more efficient method of communication and interaction with the global world. Hence, there is the need to interact with data objects in the same way we interact with the physical objects. The natural user interfaces are extremely important, because their emulation of the everyday human gestures perfectly match our belief on how technology should work. For example, with multi-touch interfaces, we are allowed to treat our data collections as a workspace. In this sense, a computer evolves beyond what computers were known to be. Major trends in interactions between human and computer had reduced the gap between real and virtual objects. We will need new conceptual models on how best to support and control these new forms of more natural but less obvious forms of interaction. Research is needed to determine what will be the most natural, efficient and socially acceptable means of controlling such interactions.

MULTI-TOUCH TYPE OF INTERACTION

This type of interaction is a special case of multimodal interaction which involves input means at the same time. It enables the computer system recognizes more than one point of contact or multi-touch with its surface at the same time [13] This input means are normally the user's fingers. This type of interaction has been studied decades ago, but only of recent, the algorithm's further development is achieved, for instance, the chording operation, and the bimanual operation.

The multi-touch interaction is a technology that enables the Natural User Interface. It can be subdivided into: hardware and software. The hardware is responsible for information gathering, while the responsibility of analyzing the message or the information gathered lies within the working of the software, which is then converted to a given command for the user. This has great significance on how to accurately track and locate contacts in order to achieve the freedom of gesture interaction. These and more can be some of the significance of this kind of interaction.

Fig1: Multi-touch interaction

VOICE USER INTERFACE

The voice user interface works on a language pattern, and consists of spoken languages. There is a significant demand in order to develop this kind of interface. In an attempt to develop a conversational interface like this, some things have to be taken into consideration. The first is the need of the interface of the underlying structure, and the second is the recognition and response to verbal and non-verbal inputs, and to be able to give out verbal and non-verbal outputs. These requirements can be divided into two groups: the requirements on the interface of the conversational system, and the requirements on the underlying structure. Observing the way of human conversation, it must be able to respond and identify verbal/nonverbal input and output respectively. This ensures the use of graphical display of the nonverbal method so also to represent the point of reference for many conversation or interaction. However, with the present day technological advancement, the voice user interface have become more eminent, giving people the advantage of an interface that doesn't necessitates the use of the eyes or hands in many circumstances. Thus, this type of interface works in order to make the interaction between human and computers more viable through the voice/speech platform so as to initiate an automated service or process.

Designing a good voice user interface requires interdisciplinary talents of computer, linguistics and human factors, human psychology, in-depth

understanding of the functions carried out, as well as taking into consideration the category of people the voice user interface is meant for. The success of this design depends on how closely is the design's match with the model set in place, how efficient it works with little supervision or training, how satisfactory it is to the audience concerned. These measures and more must be taking into consideration by the designer. In example, speech applications have to be carefully crafted for the specific business process that is being automated. A speech application designed for business must be only used in the business environment and that meant for teaching, must be utilized in the schools only. Though, for more complex businesses and organizational demands, the use of the voice user interface may be difficult to operate, as such the human has to work in place of the machine [7].

Fig2: Voice Interaction

GESTURE INTERACTION

The human gesture interpretation through the process of defined mathematical algorithm is known as the gesture interaction. The gesture interaction can occur via any bodily motion; especially the hands, legs or nodding of the head. Many of the approaches to this kind of interaction were made possible through a well-designed program to achieve specific tasks modelled for the identification and interpretation of the particular gesture. In addition, the ability to know and recognize human posture, behavior, is also an example of gesture interaction-recognition method. Thus it should be understood that the ability of computers to identify and recognize the body movement or posture of individuals portrays the globalization and interrelationships between the machines and humans. With this innovation system, it is believed that the normal text user, the graphical user interfaces and even the touch screens may sooner or later phase-out, limiting the conventional keyboard and mouse to computer inputs. This type of interaction using the human gestures enables someone to directly communicate with the computer without the need of any other media or device. That is to say, with this kind of recognition system, it is possible a person points at the monitor, and the cursor just like the mouse, moves on the particular gesture.

There are ongoing works on other areas of gesture such as the generic eye model, the hand detection and recognition systems via the CAMSHIFT Algorithm, the Naïve Bayes' Classifier Method of static gesture recognition etc[10]. Hence, this gesture interaction can be done with the image processing and computer gesture recognition devices.

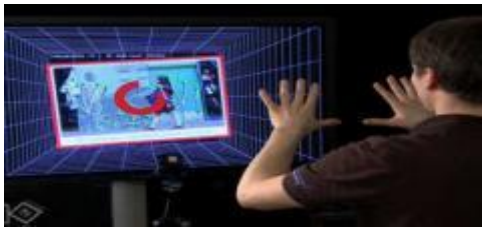

FIG 3a: An adult being sensed by a simple gesture recognition algorithm detecting hand location and movement

FIG 3b: A child being sensed by a simple gesture recognition Algorithm detecting hand location and movement

Moreover, the interfaces can be able to identify poses, dynamic hand motion, or even a combination of the two. The importance or advantages of the gesture type of interaction design can be elucidated as follows:-

People are able to have a new experience away from the normal way of interaction.

It naturalizes the human-computer kind of interaction, as this is depicted in many science fiction movies e.g 24hours movie.

It builds a better relationship between humans and machines better than the conventional user interfaces e.g the texts and graphical user interfaces, which limits a greater part of inputs to computer systems.

It can be utilized and applied in many fields and professions such the business, governments, robotics, medicine, and in the teaching and learning of the subject physics. Because users in these areas experience a new beginning in human to computer relations and interactions.

CONCLUSION

In this paper, the trends in Natural User Interface are studied, with the computer systems becoming more advanced and sophisticated. The basic fundamentals to the Natural User Interface systems are all geared towards a computer technology that can hear, listen and execute certain tasks allotted to it. Thus in this paper, those fundamentals were explicitly elucidated. With the civilization pushing towards the world as a global village, latest technologies are making it possible to use pen on board kind of interaction and learning, gestures, and visualizations. Computers are beginning to make choices and decisions on our behalf, and becoming more autonomous. Physics lecturers and researchers find this as a greater aid, in their job and the students even more enthusiastic and eager to learn. The latest trends in computer interaction are seen, hoping in the near future, a well-designed natural user interface would be developed. Researchers are strongly recommended to exploit the richer trend in technological advancement in this area.

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