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COMPREHENSIVE STUDY & REAL TIME APPLICATIONS OF BLUE EYE TECHNOLOGY

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ABSTRACT

Blue Eye Technology is the name given Human Recognition Venture to allow people to interact with computers in a more natural manner. The technology aims to enable devices to recognize and use natural input, such as facial expressions. The initial developments of this project include scroll mice and other input devices that sense the user's pulse, monitor his or her facial expressions, and the movement of his or her eyelids. The BLUEEYES technology aims at creating computational machines that have perceptual and sensory ability like those of human beings. It uses non-obtrusive sensing method, employing most modern video cameras and microphones to identify the user's actions through the use of imparted sensory abilities. The machine can understand what a user wants, where he is looking at, and even realize his physical or emotional states.

Keywords: BLUEEYES,Blue Eye

I. INTRODUCTION

Imagine yourself in a world where humans interact with computers. You are sitting in front of your personal computer that can listen, talk, or even scream aloud. It has the ability to gather information about you and interact with you through special techniques like facial recognition, speech recognition, etc. It can even understand your emotions at the touch of the mouse. It verifies your identity, feels your presence, and starts interacting with you. You ask the computer to dial to your friend at his office. It realizes the urgency of the situation through the mouse, dials your friend at his office, and establishes a connection. Human cognition depends primarily on the ability to perceive, interpret, and integrate audio-visuals and sensoring information. Adding extraordinary perceptual abilities to computers would enable computers to work together with human beings as intimate partners. Researchers are attempting to add more capabilities to computers that will allow them to interact like humans, recognize human presence, talk, listen, or even guess their feelings.

II. HOW TO COMPUTE?

One goal of Human Computer Interaction (HCI) [5] is to make an adaptive, smart computer system. This type of project could possibly include gesture recognition, facial recognition, eye tracking, speech recognition, etc. Another non-invasive way to obtain information about a person is through touch. People use their computers to obtain, store and manipulate data using their computer. In order to start creating smart computers, the computer must start gaining information about the user. Our proposed method for gaining user information through touch is via a computer input device, the mouse. From the physiological data obtained from the user, an emotional state may be determined which would then be related to the task the user is currently doing on the computer. Over a period of time, a user model will be built in order to gain a sense of the user's personality. The scope of the project is to have the computer adapt to the user in order to create a better working environment where the user is more productive.

III. TECHNOLOGY

A. PAUL EKMAN'S FACIAL EXPRESSION

Based on Paul Ekman's facial expression work, we see a correlation between a person's emotional state and a person's physiological measurements. Selected works from Ekman and others on measuring facial behaviors describe Ekman's Facial Action Coding System (Ekman and Rosenberg, 1997). One of his experiments involved participants attached to devices to record certain measurements including pulse, Galvanic Skin Response (GSR) [7], temperature, somatic movement and blood pressure. He then recorded the measurements as the participants were instructed to mimic facial expressions which corresponded to the six basic emotions. He defined the six basic emotions as anger, fear, sadness, disgust, joy and surprise. From this work, Dryer (1993) determined how physiological measures could be used to distinguish various emotional states. Six participants were trained to exhibit the facial expressions of the six basic emotions. While each participant exhibited these expressions, the physiological changes associated with affect were assessed. The measures taken were GSR, heart rate, skin temperature and General Somatic Activity (GSA) [7]. These data were then subject to two analyses. For the first analysis, a Multidimensional Scaling (MDS) procedure was used to determine the dimensionality of the data. This analysis suggested that the physiological similarities and dissimilarities of the six emotional states fit within a four dimensional model. For the second analysis, a discriminate function analysis was used to determine the mathematic functions that would distinguish the six emotional states. This analysis suggested that all four physiological variables made significant, non-redundant contributions to the functions that distinguish the six states. Moreover, these analyses indicate that these four physiological measures are sufficient to determine reliably a person's specific emotional state. Because of our need to incorporate these measurements into a small, non-intrusive form; we will explore taking these measurements from the hand. The amount of conductivity of the skin is best taken from the fingers

B. MANUAL AND GAZE INPUT CASCADED (MAGIC) POINTING

This work explores a new direction in utilizing eye gaze for computer input. Gaze tracking has long been considered as an alternative or potentially superior pointing method for computer input. We believe that many fundamental limitations exist with traditional gaze pointing. In particular, it is unnatural to overload a perceptual channel such as vision with a motor control task. We therefore propose an alternative approach, dubbed MAGIC (Manual and Gaze Input Cascaded) pointing[8]. With such an approach, pointing appears to the user to be a manual task,

used for fine manipulation and selection. However, a large portion of the cursor movement is eliminated by warping the cursor to the eye gaze area, which encompasses the target. Two specific MAGIC pointing techniques, one conservative and one liberal, were designed, analyzed, and implemented with an eye tracker we developed. They were then tested in a pilot study. This early stage exploration showed that the MAGIC pointing techniques might offer many advantages..

C. IMPLIMENTATION

The MAGIC pointing program takes data from both the manual input device (of any type, such as a mouse) and the eye tracking system running either on the same machine or on another machine connected via serial port. Raw data from an eye tracker cannot be directly used for gaze-based interaction, due to noise from image processing, eye movement jitters, and samples taken during saccade (ballistic eye movement) periods. We experimented with various filtering techniques and found the most effective filter in our case is similar to that described. The goal of filter design in general is to make the best compromise between preserving signal bandwidth and eliminating unwanted noise. In the case of eye tracking, as Jacob argued, eye information relevant to interaction lies in the fixations. The key is to select fixation points with minimal delay. Samples collected during a saccade are unwanted and should be avoided. In designing our algorithm for picking points of fixation, we considered our tracking system speed (30 Hz), and that the MAGIC pointing techniques utilize gaze information only once for each new target, probably immediately after a saccade. Our filtering algorithm was designed to pick a fixation with minimum delay by means of selecting two adjacent points over two samples.

D. ARTIFICIAL INTELLIGENT SPEECH RECOGNITION

It is important to consider the environment in which the speech recognition system has to work. The grammar used by the speaker and accepted by the system, noise level, noise type, position of the microphone, and speed and manner of the user's speech are some factors that may affect the quality of speech recognition .When you dial the telephone number of a big company, you are likely to hearth sonorous voice of a cultured lady who responds to your call with great courtesy saying "Welcome to company X. Please give me the extension number you want". You pronounce the extension number, your name, and the name of person you want to contact. If the called person accepts the call, the connection is given quickly.

E. THE TECHNOLOGY

Artificial intelligence (AI) involves two basic ideas. First, it involves studying the thought processes of human beings. Second, it deals with representing those processes via machines (like computers, robots, etc). AI is behavior of a machine, which, if performed by a human being, would be called intelligent. It makes machines smarter and more useful, and is less expensive than natural intelligence. Natural Language Processing (NLP) refers to artificial intelligence methods of communicating with a computer in a natural language like English. The main objective of a NLP program is to understand input and initiate action. The input words are scanned and matched against internally stored known words. Identification of a key word causes some action to be taken. In this way, one can communicate with the computer in one's language. No special commands or computer languages are required. There is no need to enter programs in a special language for creating software.

F. SPEECH RECOGNITION

The user speaks to the computer through a microphone, which, in used; a simple system may contain a minimum of three filters. The more the number of filters used, the higher the probability of accurate recognition. Presently, switched capacitor digital filters are used

because these can be custom-built in integrated circuit form. These are smaller and cheaper than active filters using operational amplifiers. The filter output is then fed to the ADC to translate the analogue signal into digital word. The ADC samples the filter outputs many times a second. Each sample represents different amplitude of the signal. Evenly spaced vertical lines represent the amplitude of the audio filter output at the instant of sampling. Each value is then converted to a binary number proportional to the amplitude of the sample. A central processor unit (CPU) controls the input circuits that are fed by the ADC's. A large RAM (random access memory) stores all the digital values in a buffer area. This digital information, representing the spoken word, is now accessed by the CPU to process it further. The normal speech has a frequency range of 200 Hz to 7 kHz. Processed by the filters and ADCs. The binary representation of each of these words becomes a template or standard, against which the future words are compared. These templates are stored in the memory. Once the storing process is completed, the system can go into its active mode and is capable of identifying spoken words. As each word is spoken, it is converted into binary equivalent and stored in RAM

G. THE SIMPLE USER INTEREST TRACKER (SUITOR)

Computers would have been much more powerful, had they gained perceptual and sensory abilities of the living beings on the earth. What needs to be developed is an intimate relationship between the computer and the humans. And the Simple User Interest Tracker (SUITOR) is a revolutionary approach in this direction. By observing the Webpage at netizen is browsing, the SUITOR can help by fetching more information at his desktop. By simply noticing where the user's eyes focus on the computer screen, the SUITOR can be more precise in determining his topic of interest. It can even deliver relevant information to a handheld device. The success lies in how much the suitor can be intimate to the user. IBM's Blue Eyes research project began with a simple question, according to Myron Flickner, a manager in Almaden's USER group: Can we exploit nonverbal cues to create more effective user interfaces? One such cue is gaze the direction in which a person is looking. Flickner and his colleagues have created some new techniques for tracking a person's eyes and have incorporated this gaze-tracking technology into two prototypes.

H. SYSTEM OVERVIEW

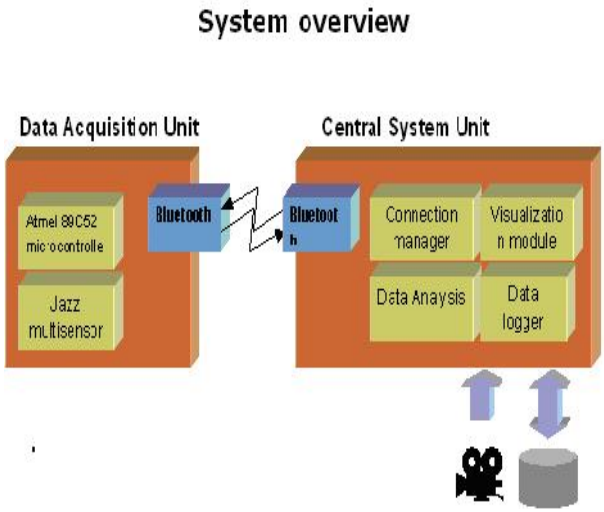

Fig. 1 System Overview

BLUEEYES system provides technical means for monitoring and recording the operator's basic physiological parameters. The most important parameter is saccadic activity1, which

enables the system to monitor the status of the operator's visual attention along with head acceleration, which accompanies large displacement of the visual axis (saccades larger than 15 degrees). Complex industrial environment can create a danger of exposing the operator to toxic substances, which can affect his cardiac, circulatory and pulmonary systems. Thus, on the grounds of lethysmographic signal taken from the forehead skin surface, the system computes heart beat rate and blood oxygenation. The BLUEEYES system Checks above parameters against abnormal (e.g. a low level of blood oxygenation or a high pulse rate) or undesirable (e.g. a longer period of lowered visual attention) values and triggers user-defined alarms when necessary. Quite often in an emergency situation operators speak to themselves expressing their surprise or stating verbally the problem. Therefore, the operator's voice, physiological parameters and an overall view of the operating room is recorded. This helps to reconstruct the course of operators' work and provides data for long-term analysis. This system consists of a mobile measuring device and a central analytical system. The mobile device is integrated with Bluetooth module providing wireless interface between sensors worn by the operator and the central unit. ID cards assigned to each of the operators and adequate user profiles on the central unit side provide necessary data personalization so different people can use a single mobile device.

I. TOOLS DEVELOPED

In creating the hardware part of the DAU we built a development board, which enabled us to mount, connect and test various peripheral devices cooperating with the microcontroller. During the implementation of the DAU we needed a piece of software to establish and test Bluetooth connections. We therefore created a tool called Blue Dentist. The tool provides support for controlling the currently connected Bluetooth device. Its functions are: local device management (resetting, reading local BD_ADDR, putting in Inquiry/Page and Inquiry/Page scan modes, reading the list of locally supported features and setting UART speed) and connection management (receiving and displaying Inquiry scan results, establishing ACL links, adding SCO connections, performing link authorization procedure, sending test data packets and disconnecting).To test the possibilities and performance of the remaining parts of the Project Kit (computer, camera and database software) we created Blue Capture The tool supports capturing video data from various sources (USB web-cam, industrial camera) and storing the data in the MS SQL Server database. Additionally, the application performs sound recording. After filtering and removing insignificant fragments (i.e. silence) the audio data is stored in the database. Finally, the program plays the recorded audiovisual stream. We used the software to measure database system performance and to optimize some of the SQL queries (e.g. we replaced correlated SQL queries with cursor operations). Since all the components of the application have been tested thoroughly they were reused in the final software, which additionally reduced testing time. We also created a simple tool for recording Jazz Multisensory measurements. The program reads the data using a parallel port and writes it to a file. To program the operator's personal ID card we use a standard parallel port, as the EPROMs and the port are both TTL-compliant. A simple dialog-based application helps to accomplish the task.

IV. APPLICATIONS

1. Blue Eyes can be applied in the automobile industry.
2. We could see its use in video games where, it could give individual challenges to customers playing video games. Typically targeting commercial business.
3. Blue Eyes system can be applied in every working environment requiring permanent operator's attention.

4. At power plant control rooms. At captain bridges.
5. At flight control centers.
6. Professional drivers.

V. CONCLUSION

The nineties witnessed quantum leaps interface designing for improved man machine interactions. The BLUE EYES technology ensures a convenient way of simplifying the life by providing more delicate and user friendly facilities in computing devices. Now that we have proven the method, the next step is to improve the hardware. Instead of using cumbersome modules to gather information about the user, it will be better to use smaller and less intrusive units. The day is not far when this technology will push its way into your house hold, making you more lazy. It may even reach your hand held mobile device. Any way this is only a technological forecast.

VI. REFFERENCES

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