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Emotion Sensory World: A Review on Blue Eyes Technology

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Abstract

Emotions are so valuable that it is an inevitable part and without emotions the world becomes numb. So, by giving some emotional values to devices we can make them more effective. This paper aims at the objective to provide computer or any other machines with the human powers. A computer that understands our emotions and abilities and responds accordingly will be the best partner for us. Both, together as partners can bring new innovations in the present world. A technology that had been aroused which sense human emotions and a feeling through gadgets is named as blue eyes technology. Blue eyes system had intended to be a solution that monitors and records the user's conscious brain and their physiological condition. Implementation of this technique which identifies human emotions and respond necessarily is been dealt with.

Keywords: *DAU, CSU, emotion mouse, MAGIC pointing, SUITOR*

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INTRODUCTION

A world where humans interact with computers having emotion in it is not far away. The blue eyes technology is a non-obtrusive method employing highly accurate video cameras and microphones to identify user's action [1]. The computer has the ability to interact with you by understanding your facial expressions, speech etc. Three elements helping the computer to sense the emotion level of humans is through eyes, fingers, and speech. With the help of the video cameras and microphones, the machine can understand what the user needs and his emotional states.

Thus computer is made to see and feel the emotions. Real time face tracking is possible to recognize the face gestures. Gestures like, yes/no, can thus be recognized easily [2]. Computationally, our computers are deaf, dumb and blind. They do not bother about what you think or feel. It just does what we assign them. They do not have the ability to modify our comments. On the other hand, in case of a computer with emotional intelligence can recognize the feelings of the user. Such computers are able to slow down or replay a tutorial if the user seems to be confused. The emotion technology does not restrict its applications inside the desktop, but it is more than that. In a car that has an effective computing system, has the ability to recognize whether the driver is drowsy, and advice the driver to stop the car and take rest. The computer to be genuinely intelligent and interact with us must be given the ability to recognize, understand even to behave and express emotions. The technology used here itself gives information about this technology. Researchers attempts to add even more capabilities to the computers that allow the computers to interact like humans, recognize their presence, talks, and listen, and even guess the feelings of the user [1]. The detection of the human expressions is becoming very challenging in machine learning [3]. Blue stands for bluetooth and eyes stands for the eye movements through which emotional information is obtained. Bluetooth indicates the wireless communication [1].

SYSTEM OVERVIEW

Blue eyes technology uses two main components. They are:

- Mobile measuring system or data acquisition unit (DAU) and
- Central system unit (CSU).

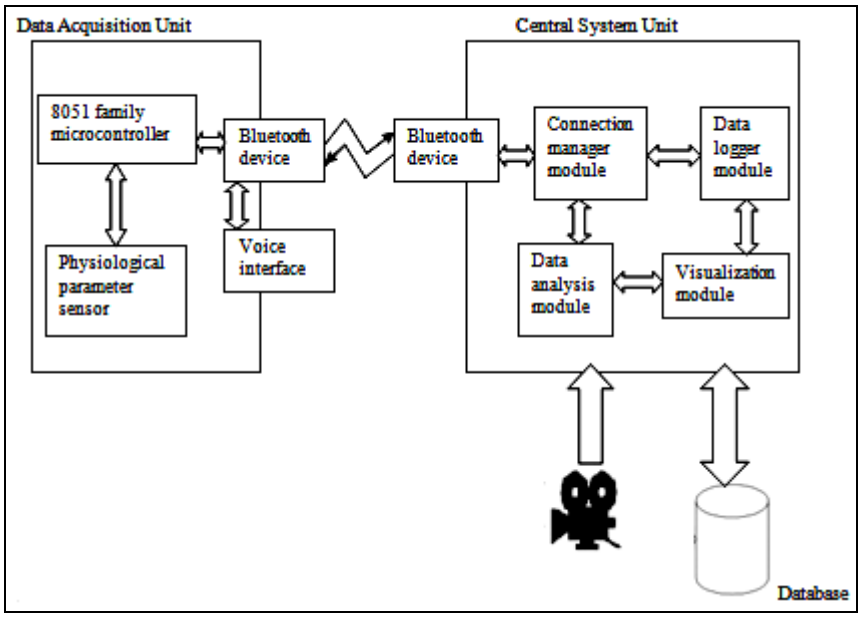

Fig. 1: *System Overview.*

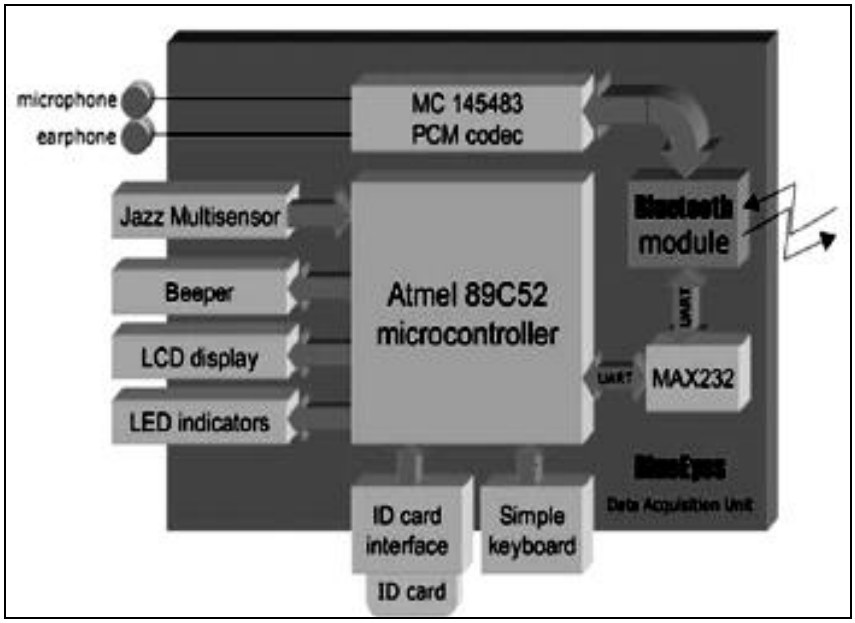

Fig. 2: *DAU Components.*

A wireless interface is established between sensors worn by the operator and CSU with the help of bluetooth. The connection between DAU and CSU is established using wireless bluetooth (Figure 1).

Data Acquisition Unit

DAU is a mobile part of this system. The physiological data from the sensors is collected and is given to the central system for processing. Wireless bluetooth communication is accomplished for the connection establishment, authentication and termination. Data personalization is provided by assigning unique ID cards to each and every user. 5-key keyboard, LCD display and a beeper are used to communicate with the user, when an exceptional situation arises. Alarm messages can be sent to the user from the central system. Standard mini-jack plugs are used to transfer the voice data to DAU that is interfaced to a headset (Figure 2) [4].

Central System Unit

CSU maintains the other end of bluetooth connection. For voice data transmission, CSU contains a bluetooth module, a PCM codec. They are used to buffer the incoming data,

perform on-line data analysis, and record the results for further processing and to provide visualization interface. A simple programming device is used to program operator's personal ID cards. An 89C2051 microcontroller is present inside the CSU that is used to handle both UART transmission and I2C EEPROM programming.

Each component in the central unit is having its own purpose. Connection manager is used to maintain the wireless communication with the data acquisition unit. It establishes the authentication, buffering of data and the alertness among the operators. Data analysis module is used to perform the analysis of the physiological data from the users to that of the data stored in the database.

The saccade detector, pulse rate analyzer, custom analyzers are three different analyzers used in the data analysis module. Visualization module is a direct interface between the user and system. The operator's physiological condition can be viewed through it. Data logger is the place where all the analyzed data are stored for further processing (Figure 3).

EMOTION COMPUTING

An effective computing is realized by, first giving the ability to detect emotions by a computer and second, the ability of computer to express the emotions. For an adaptive computer system it is important to detect emotions [5].

A person's physiological measurement and their emotional states are closely related. Paul Ekman in one of his experiments recorded some measurements such as GSR, temperature, somatic movement and blood pressure. Ekman then asked the participants to mimic different facial expressions and he recorded the measurements accordingly. Six emotions were analyzed by Ekman. They were joy, surprise, fear, disgust, anger and sadness [6].

Techniques Used

Emotion Mouse

A non-invasive method to collect information about a person is by touch. For the development of a smart computer, the computer needed to take initiative to collect the information itself. The input device, mouse thus helps to gain the information about the user (Figure 4). An emotion mouse is designed to measure heartbeat, temperature, pressure and GSR and is matched with emotional states: joy, surprise, anger, fear, disgust and sadness. From the obtained physiological data the emotional states are determined.

These data are then related to the task that the user is currently using. After a period of time, a model representation of the personality of the user is gained. Thus this technology helps the computer to adapt itself to create a better working environment to the user and making the user more productive [7].

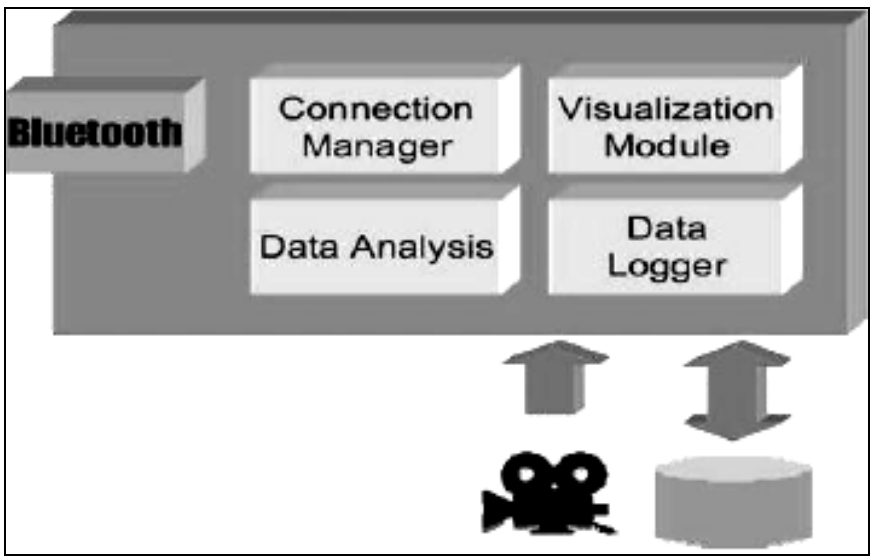

Fig. 3: *CSU Components.*

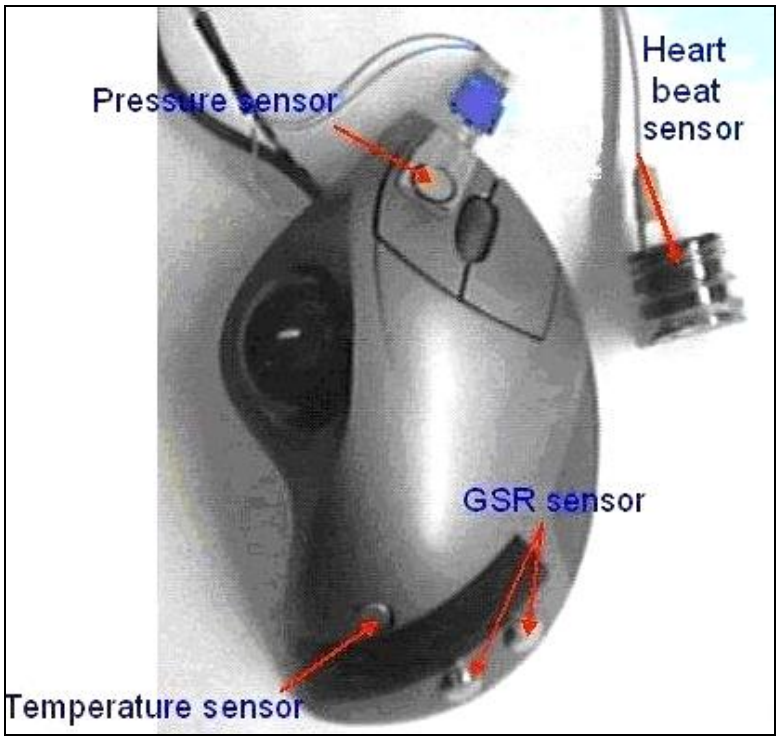

Fig. 4: *Emotion Mouse.*

Sentic Mouse

Sentic mouse is sensing equipment resulted from an experiment conducted by Lang *et al*. Sentic mouse is used to measure a user's emotional valence response. Emotional valence is a user's emotional assessment of the stimuli. It varies from positive (pleasure, attraction, and liking) to negative (displeasure, avoidance, disliking). Lang *et al.* asked the subjects to self-rate their emotional response by providing them a series of pictures [8]. The data such as sentic data, heart rate, and self-assessment were then measured and were compared to each other and with theoretical values predicted. An ordinary mouse, which was augmented with a pressure sensor, was used to collect the sentic data (Figure 5). This process is thus used to assess the emotional valence response of a user.

Fig. 5: *Sentic Mouse.*

MAGIC Pointing

Gaze tracking is used as an alternate method to the computer input. It is a vast technology in which researches are going on and have become accessible in different areas of research [9]. In this method the eye gaze is explored in a new direction. In traditional gaze pointing method, there are many limitations. The inefficient recording of the gaze point can be misunderstood as an emotion which the user would never have intended [10]. MAGIC pointing is a better solution for this. Fine manipulation and selection are its advantages.

Random movements of the cursor are eliminated by altering the cursor to the eye gaze area. The head pose and the gaze direction are related to each other and can be measured simultaneously [11]. Conservative and liberal are the two techniques used in MAGIC pointing. Liberal technique is used to warp the cursor to the objects the user is looking at (Figure 6). Since it is very overactive the MAGIC pointing can be suppressed while the user's eye appears to read a text pattern [1].

In case of conservative approach, as the manual input device gets activated the cursor is moved to the boundary tracked by the eye.

95% accuracy can be brought in the selection of the target as well as the target boundary. The MAGIC pointing to take place the minimum distance between the present cursor position and the tracked cursor position should be 120 pixels. The manual pointing time of a cursor is logarithmically proportional to A/W ratio according to Fit's Law. A is the distance to be moved and W is the size of the target. That is targets with small size require longer time to be acquired. The pupil can also be detected with the help of low cost cameras under different illuminations (Figure 7). The pupil of the people who are in long distances from the computer or wearing the glasses can also be detected [12]. The unwanted variations such as additive or multiplicative noise that occurs while tracking the eye can be avoided by using different algorithm [13].

Artificial Intelligent Speech Recognition

Artificial intelligence involves the studying of thoughts from a human mind and deals with the presentation of these ideas using machines [8]. Using this artificial intelligence method, a machine becomes more smart, useful and less expensive.

The users give their voice input to the computer with the help of a microphone and the corresponding speech is filtered mainly using three filters. The voice inputs are then stored in RAM [14]. The number of filters used in a system determines the probability of accuracy. As the number of filters increase, the accuracy increase. These stored words are matched against the internally stored words. While a user speaks, the key word is identified and some actions are taken. No special computer language or any software is needed for this purpose. Switched capacitor digital filters are commonly used since they can be custom-built in integrated circuit form and are then fed into ADC.

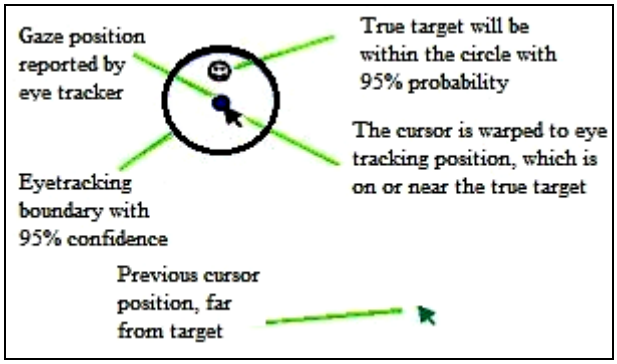

Fig. 6: *The Liberal MAGIC Pointing Technique.*

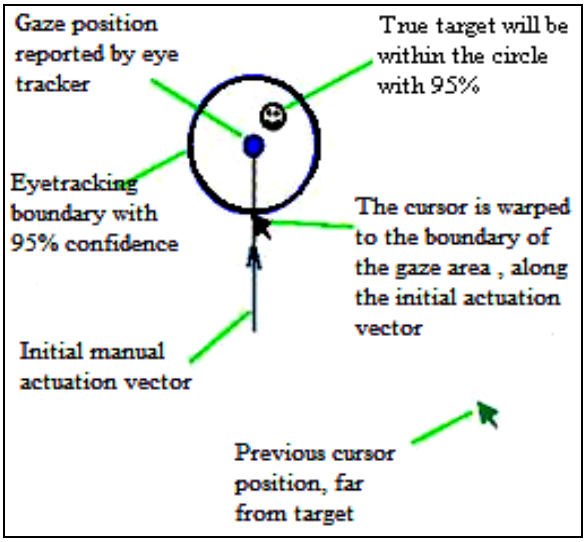

Fig. 7: *The Conservative MAGIC Pointing Technique.*

The ADC is used to sample the output of the filter many times a second. Each sample is represented by signals with different amplitudes. These values are then converted into binary values according to the amplitude of the vertical signals. The input circuits fed by the ADCs are controlled by a central processor unit (CPU). RAM is the memory where all the digital data is saved. The spoken words in digital form are accessed into the CPU. The future words are then compared to the stored words both in their digital form.

Since there is a chance that even if the same speaker speaks the same text, the amplitude, loudness, pitch, frequency difference, time gap gets varied, there will never be any perfect match between the data [8]. Therefore statistical techniques are used for pattern matching and the best among them are selected. The perfect match is found by subtracting the values of binary words given as input from the stored templates. The result is a zero, when there is a match or else an error is occurred. Better matches are obtained when the error gets smaller.

SUITOR

SUITOR (Simple User Interest Tracker) tries to make the relationship between the user and computer much deeper. The SUITOR helps in fetching more information about what the user is searching by noticing the focus point of the user's eyes on the computer thus by determining their interests. IBM has created some new techniques for tracking the eyes of a user. One is named as SUITOR that helps in filling the scrolling ticker on a computer screen consisting of the information that the user currently uses [1]. SUITOR is a technique that knows the direction the user looks at, the applications they run, and the web pages they browse. For e.g. if the user reads the headline of a paper, SUITOR pops up the story in a browser window [15]. The related stories then pop up accordingly.

EMOTION SENSORY WORLD

Large numbers of techniques are used to identify the emotional status of the user. According to Ekman, emotional states of a person can be represented through various techniques. A facial affect program is used, which specifies the relation between the facial muscle movements and the emotions. Ekman had used six different emotions for his experiment. Happiness, anger, sorrow, sadness, surprise, fear, are the emotions used [16]. These emotions can also be recognized from the motion of head and the facial features. According to his findings, he identified that different emotions result in different facial muscle patterns.

The emotion happiness had the eyes relaxed or neutral. Anger brought the eyebrows pulled down and inward. The eyebrows were drawn together with the inner corners raised and the outer corners lowered during sadness. The eyes were also glazed during sadness. Surprise brought the eyebrows raised and curved. It is said that eyes are the window to the soul. Information about a person's internal state can be determined by just looking at their eyes.

The image of the user is captured by a camera and the eye area is focused using texture filtering algorithm. These images are then compared with the image that is already stored in the database. The best image that matches the user's emotion is identified and the computer acts accordingly to make the mood of person better. There is a chance that when the face is illuminated with the light from many directions the same emotions can be felt as different even if it is seen in the same person [17]. Robots are designed such that it understands the human and interact with them perfectly [18].

APPLICATIONS

1. The blue eyes technology can be used in automobile industries. The emotional state of the driver can be determined through the computer input device. So the critical decisions as: I know you need to move faster, but I cannot do that, are initiated when the driver is seemed to be worried [19].
2. The voice recognition system can be used in making airline and hotel reservations. Reservation and cancellation of tickets, enquiries about the schedule can be simply stated.
3. Physiological condition monitoring.
4. Used in military purposes. The machineries can be controlled by voice input commands.

5. Pilots instead of using their hands can give commands to the computer through microphones.
6. Household devices like televisions, refrigerators, ovens can do their jobs while we speak to them.

CONCLUSION

The blue eyes technology paves the way for a simplified life through a more delicate computer device. It is a very advanced system which avoids potential threats resulting from human errors varying from weariness, oversight, tiredness, etc. thus bluetooth provides wireless communication and the movements of the eye enables us to collect a lot of information about the user.

The identification of facial expressions has a lot of applications such as; medical applications as pain detection, monitoring the depression and further more [20]. The day when this technology would be used at home is not far away. Even though this makes the people lazy, it is going to be a technological forecast.

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