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Situation Reaction Detection Using Eye Gaze And Pulse Analysis

[1]M. Indumathy, [2]Dipankar Dey, [2]S Sambath Kumar, [2]A P Pranav
[1]Assistant Professor, [2]UG Scholars
Dept. Of Computer science and Engineering SRM Institute of Science and Technology,
Chennai, Tamil Nadu, India
Corresponding Author: sambathk4@gmail.com

Abstract — It is said that the eyes are the mirror to the human soul whatever a human being do think or try to think is reflected in his or her eyes. The paper describes the concept of knowing more about a human being by reading their eyes. The human eyes or specifically the pupil in the eye will go to different directions based on various different situations it faces. Those different positions of the eyes are known as eye cues. This concept tried to capture these eye cues based on a situation which is given to a person and at the same time monitoring their electronics signals from the body. The results can give a person's reactions to various situations that they are into. This reaction based analysis can also help us in detecting various psychological disorders and defects in a human being.

Index Terms— Eye, Pupil, Electronics Signals, Capture, detection, Psychological disorders

1. INTRODUCTION

This idea is very much inspired and regulated by the concept of Neuro Linguistic Programming, which says that there is a connection between neurological process and behavior as a person's behavior to various situations which he or she has learnt over time is controlled by various neurological factors and are reflected on the human body as well [1]. The best part to know about reactions is to read the sensor in the body which first detects the images, that is the eyes. The eyes reads the images that we see and transfer them to the brain for processing now the eyes not only reacts to situations which we see but also to various situations we hear and we listen. So basically if someone asks us something our brain will process the question being asked and for the same it will react to the situation which will be through our eyes[2]. The reaction to these situations are known as eye cues and these eye cues can be captured and read by a computer and further by using image processing techniques we can define about a person's mindset to various situations. The paper describes about how the eye cues are captured and analyzed for a person who is shown or asked about various situations. The technology used here is very simple and the analysis is also very simplified but the ideology behind this concept can be a very good cause for various reasons that we are facing today.

II. EYE CUES DETECTION

A. What are eye cues

The eye cues are the unconscious human eye movement which happens when we think or see something and there is some kind of processing in our brain. The eye cues are indicators of special cognitive process that happens in our body. These are simple reaction of the eye based on the thinking process of

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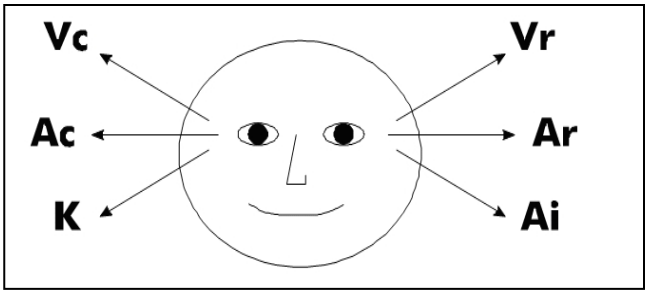
our brain, so whenever our brain thinks of something the reaction can be seen on the movement of eyes[3].

B. Types of eye cues

There are many eye movements that occur when we think of something or we try to think of something. But from all of these psychologists have traced only six which are known as the eye cues these six eye cues helps us in determining various factors a person is undergoing. These six eye cues are also dependent on various factors like images and sounds and if they are constructed or they are already in the memory and they are described based on remembrance sometime. One of the cues also describe about someone talking to themselves. The brief descriptions of the cues are given below.

i. Up and to the left is known as the visually constructed images or when people are asked to imagine something that does not logically exist or has never been seen by the person then the persons eye will go to that direction. This can include something which is not stored in a person's memory.
ii. Up and to the right indicates visually remembered images that is if something which exist in your memory and you just have to use your brain to find it out in that case your eye cues will be in this position. This position is also for the detection of general thinking and remembering a situation which happened.
iii. To the left indicates that the person is trying to create something auditory. That is the person is trying to create some audio in their mind. This position of the eye depicts that the person is trying to construct something in audios which he has been asked or he has seen. This position is also attained when the person is trying to imagine something that he has not done before like a high pitch sound or something like that.
iv. To the right indicates that the person is trying to remember some sound or audios that he has previously listened to or is familiar with previously. This position is also attained by the person when they have the sound in their memory. This position of the eye depicts something which has a connection with the person's lifestyle.
v. Down and to the left indicates that the person is trying to remember some feeling or kinesthetic. This position of the eyes only depicts that the person is trying to recall something which has a connection with senses like smell, feeling or kind of taste. This eye position is again one of the important position when reading cues as this gives a person's perception towards physical things.
vi. Down and to the right indicates the person id trying to talk to himself that is internal dialogues. If a person has to speak himself about something his eyes will go to this direction. When people talk to themselves that means they have some confusion or they are in meaning of something they want to.



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C. Detecting the cues

In this implementation of the system to detect the eye cues python programming language is used. The reason behind using python is that it is very easy to implement and there are lot of supporting libraries which can be added to process what we want. In this program python is used with OpenCv library which is a vision library in python [4]. The OpenCv has a contrib module which can be added to it. This library with python makes it easy to implement the Haar cascade analysis which is further used to detect the eye movement and by capturing the eye movement we can easily derive the eye cue and if we can derive the eye cues then further processing becomes easier. The Haar cascade in OpenCv contrib module has a already trained module to detect faces that have been used in order to detect faces. Then after detecting faces the reference line is taken as the frame borders so with reference to the frame borders the movements of the eye balls are captured [5]. The reason of taking the frame as reference is because the frame will always remain constant with reference to the image that is being captured by the camera. There is no need to have a separate camera as with python we can use the webcam of our P.C. to capture the images. This program runs locally on the computer in which the analysis is to be taken place. Then the further processing of the image can be either done on the local machine or can be uploaded to a cloud system where a analysis algorithm will run and process the images.

III. PULSE SIGNAL ANALYSIS

I. What are pulse signals

The body generates continuous pulse signals due to the heart. With each heart beat there is a flow of pulse signals throughout our body. These signals are generated due to the flow of blood in the arteries. These signals can be detected at various places in the body like the arms chest or near the joints. The arteries in our body almost go to everywhere from the heart to the various corners of the body and wherever they go they can be used to detect the pulse of the body. The pulse is actually the count of the heart beat or how many times our heart beats in a minute and is measured in Bpm that is beats per minute. This measurement is very vital and important for the medical purposes as it can tell a lot about a human body.

II. Use of pulse signals.

The pulse signals can be used to determine about a person's status physically and mentally. The major use of pulse analysis in technology field is to conduct the polygraph test which is used to detect if a person is telling truth or they are lying to the authorities. The polygraph test detects the beats per minute of a person and if that is more than the normal then by using various sensors and actuators the truth rate can be detected. The use of this analysis in the proposed system is important as this system can be deployed at various places and maybe sometimes the persons eyes cannot generate the cues or the system gets confused with the cues then the system can check for the pulse rate and based on that the system can accurately detect the persons reaction to a situation. The reaction detection can become more relevant and also the system can have more than one parameter to detect the reaction. The pulse analysis also helps the tester to get vital signs of the body the subject are undergoing any test. The pulse signals can be replaced by ECG that is electro cardio graph in many cases when the test may require to capture the electronics signals that are flowing through the body. The overall feasibility of the result will increase with this pulse analysis and also the percentage of successful detection will also increase by this.

III. Method to capture the pulse

The pulse signals can be detected by using various sensors and using an interface in between to send the signals to the computer system. The sensors that the proposed system will used is based

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on IR sensing of the pulse. The similar sensors which are used in smart watches now a days. The sensor will contain a IR blaster and a receiver which will be send through the skin and will get reflected by the arteries. The IR blaster send green light through the skin and as green light is absorbed the red light gets reflected which is further detected by the light receiver or the sensor that is placed next to it. The sensor then counts this reflection and then it detect the pulse. The motive behind using this sensor is that it is cheaper in cost and it becomes very easy to detect the pulse. The pulse value is detected accurate to 90% most of the time by this sensor. The sensor then send the value to the system using an interface, this interface in the proposed system is a Aurdino Zero as it is the best platform to do so and is extremely cheaper. The interface changes the analog signal that is sent by the sensor and converts it to digital. These digital values then flows through the computer and are either ported to the local system or uploaded to a cloud to analyze.

IV. DETECTION OF THE REACTION

A.Backend program to analyze the data captured

The data that will be captured by the sensors and the program will be either stored or analyzed later or it will be sent live to a system which can do the analysis together with it. The proposed idea will use IBM Watson platform as a base to upload all the data and do the processing. The reason behind using the Watson system is because it's a very powerful computing and the mapping of data from the sensors to the Watson platform is also very easy. The data will be processed based on the basis of sets that is all the data will be divided into sets based on the questions that will be asked to the subjects who will be using the system. The processing of data needs to be done by a system which can process the data at a higher rate so that if the results are to be generated live then it can be done very easily and the system can also give viable output and can predict the value up to the highest possible level of correct results.

B. Algorithm to analyze the data and predict the reaction

The algorithm that will be implemented on the system is very simple and is self-designed. The system will be receiving values from two different types of sensors that are the pulse and the eye cue detection program. Now the analysis of the situation reaction will be based on a rating that will be done by the system, first the system will present the subject with a situation that can be in the form of a image, a question or a audio and as soon as that is projected on the screen the system will start the eye tracking program which will capture the eye movement and store them as a data set. At the same time the system will also receive the values of the pulse and will also store them the pulse value will be compared to the regular pulse and by the polygraph concept will be checked for any difference and if found will then be rated with a value the same thing will happen with the eye cue when the proper eye cue can be detected then the eye cue will also be rated and then both of these numeric values will be compared to a already set value which will give the difference. On the basis of this difference the system will judge about the situation reaction analysis and other such things that the tester wants to know about the subject. The algorithm is very simple to know and can be implemented very easily as well. This algorithm will fit for all the ideal cases that the system needs to analyze.

V. FUTURE SCOPE AND USE OF THE SYSTEM

A. Use of the system

The proposed system can be used for various different purpose and at various different places and on various different subjects as well. The major use of the system includes using the system in places where a person needs to undergo a situation reaction test like in the selection processes

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of various departments like the army and police these systems can be placed which can detect a candidates exposure to the situation that he will face and how he reacts to them, previously this was purely done by psychologist now with this they can have a decision support system which can help them decide better based on the digital values it gives. The system can also be used in the treatment and diagnostics of various mental and psychological disorders. Like severe shocks to a person, in those cases it very difficult for the doctors to find the reason behind the shock with this system the patient can be exposed to various situation and the reaction captured by the system can be used to detect as which things the patient is phobia tic to. The system is also very useful for the testers and reviewers as it can be implemented on to a person how is giving reviews for a system or who is testing a system based on the values gathered by this system the reviewers and testers can get a better psychological feedback as how a person reacts to the systems operations at various levels which can help them making the system better and remove things that may disappoint the user.

B. Use of the system

In the near future these types of system can be implemented on various robotics features and sensor to detect mood and capture the person's neuro linguistic signature which can be further used to develop the person's personality and for self-analysis. These system will also change the way we review things or we comment and react on things the future of this technology can be self-reviewing systems which will give true reviews based on the person's reaction to the situation he is entitled to.

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