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STRESS DETECTION IN IT PROFESSIONALS USING MACHINE LEARNING

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ABSTRACT

Computers have become a necessity in the lives of IT professionals. When an individual works on computer for longer hours his/her mental health gets disrupted causing breaks in individual's effective state. Nursing an IT professional's emotional health is very crucial for his/her safety. Stress is an unpleasant state of mind caused due to long hours of work or pressure on individuals. It was stated that an IT personal has more stress than any other industrial worker. This is due to excessive abuse of work and continuous exposure to computers. Here we make use of same computers to detect the stress levels in IT professionals with the help of Image processing and machine learning algorithms. We are going to capture the video of an IT professional to identify the stress levels of a person and also it identifies whether that person is stressed or not. Stress is the most common problem in the today's world and everyone suffers from it at some point in their lives. Stress can last for a short or long period of time, but it has a mental impact and can lead to a variety of health problems. The surprising result that approximately 86% of Chinese employees are stressed at workplace it is the world record. Individuals over the age of 72 have the lowest level of stress. These reports show how the country will be in the future, with nearly 25% of people experiencing stress during the holidays. So we have came up with a solution to detect the stress levels using various methods. We also display whether the person is stressed or not.

1. INTRODUCTION

Nowadays all IT industries are seeking a new peek in the market by bringing new technologies and products into market. Due to heavy work load the stress levels in employees are noticed to raise the bar high. According to few medical researchers, 50-80% of all physical diseases like ulcers, asthma, migraine headaches are caused by stress. In previous researches stress was identified through Q&A Surveys, Voice, Facial Gestures of an employee. Stress can be identified through Cortisol Levels in Blood. To make stress detection more favorable to the employee we use past data and through image processing we create a model which identifies stress by taking videos of employee and identify whether he/she is stressed or not.

Our project consists of 2 methods to identify stress levels. User can choose either one of them to detect stress.

- 1) Blink Detection
- 2) Eyebrow Detection

Blink Detection

Eye Blink Detection method, which generally counts the number of eye blinks of a user. Eye blink for a normal person is generally 15-20 times per minute, but in the case of a stressed person, eye blink is gradually greater than 20 times per minute. We also calculate the Eye Aspect Ratio (EAR), which is generally a numerical value when the eye is open and tends to zero when the eye closes

 (Enriching the Research)	Open Access Research Article
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	July, 2023

Actually, we grab the live input image from the user using open computer vision (OpenCV) library and predict eye shape of the taken live image using hyper parameters. after that we arrange node points around eye structure and calculate Eye Aspect Ratio using formulae mentioned below using NumPy, Eye aspect ratio generally useful to calculate count of eye blink if the eye aspect ratio raise from 0 to <1 then there is a eye blink detected and eye blink count will be increased(for closed eye the aspect ratio is zero for open eye the aspect ratio is >0) if the value raise from 0 to some value then eye blink will done definitely based upon designed algorithm.

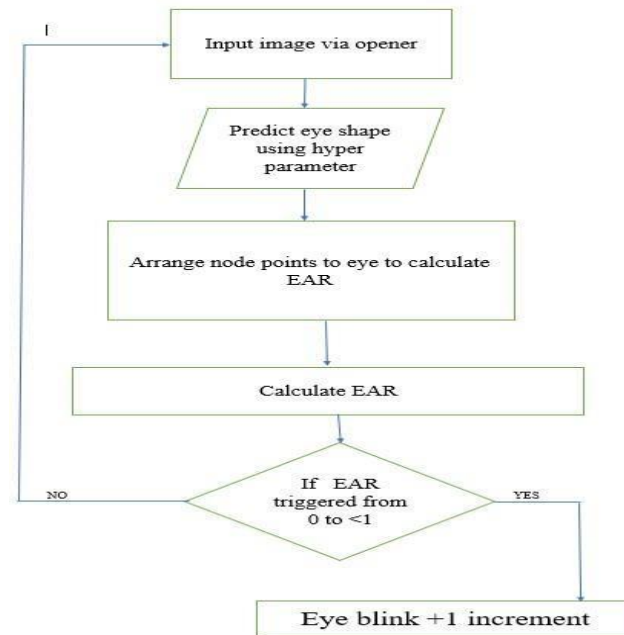
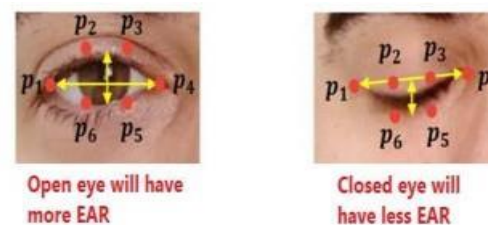


Fig.1 System Architecture for Blink Detection



$$EAR = \frac{|P2 - P6| + |P3 - P5|}{2|P1 + P4|}$$

Fig.2 EAR for closed and open eyes

After the successful counting of the number of eye blinks using the machine learning algorithm mentioned above, we take the number of eye blinks per minute and compare it with the normal human eye blinks per minute. Based on the comparison of the values with the threshold value, we determine whether the person is stressed or not.

Eyebrow Detection

Even though eyebrows are relatively more stable across changing facial expressions, they can aid in the detection of the remaining facial features. Existing brow detection algorithms in the literature require

 (Enriching the Research)	Open Access Research Article
	Volume: 23 Issue: 07
	July, 2023

complex computations and are therefore unsuitable for direct porting to embedded platforms. We detect a user's eyebrow by capturing a live input image with the OpenCV library and using hyper parameters in the NumPy library we detect the eyebrow's structure. Every person's eyebrow structure is different; stressed people exhibit different facial expressions and have different eyebrow structure. We identify the user's left and right eyebrows and compare them to the average position of the user's eyebrow in normal form. The average person has about 250 hairs per eyebrow. The thicker the brows, the easier the job to detect the eyebrow more efficiently and it leads to detect more accurate results, because the thickness of the eyebrows generally increases the detection rate efficiently.

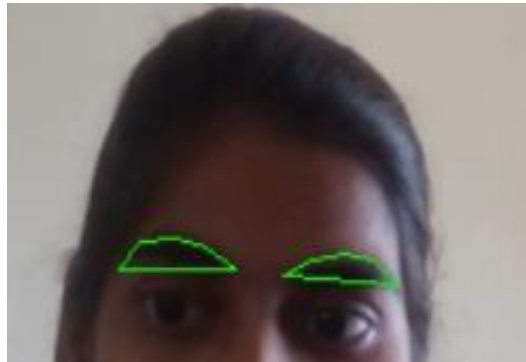


Fig.3 Eyebrow Detection

The above is the our eyebrow detection mechanism, we generally calculate stress level by measuring the contraction and displacement of the brows from their normal position. The distance between the left and right brow is calculated, and the stress level is normalized between 1 and 100 using an exponential function

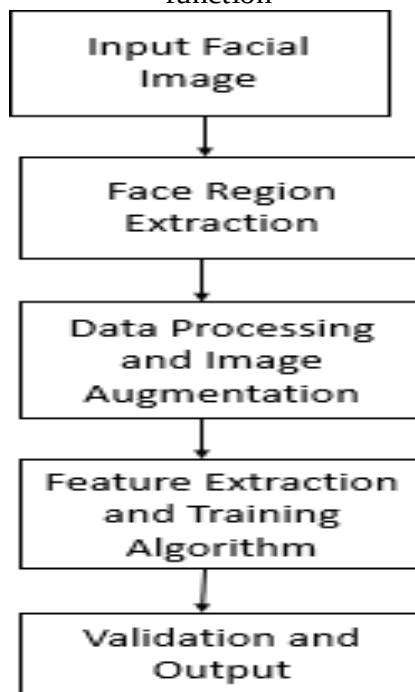


Fig.4 Eyebrow Detection System Architecture

	Open Access Research Article
	Volume: 23 Issue: 07
	July, 2023

2. LITERATURE SURVEY

- The existing systems work on stress detection is based on digital signal processing and takes into account factors including skin temperature, blood volume pupil dilation, and the galvanic skin response
- Additionally other research on this topic uses a variety of physiological signals and visual cues such as head movement and eye closure to track how stressed a person is while they are at work but in actual use these measurements are uncomfortable and obtrusive
- This system presents a non-invasive method for detecting stress in computer users by monitoring their physiological signals and visual cues. The authors aimed to develop a system that could identify the onset of stress in computer users in real-time, without the need for intrusive devices.
- The authors used a combination of physiological signals such as skin temperature, blood volume, pupil dilation, and galvanic skin response, as well as visual cues such as head movement and eye closure to detect stress in computer users. These signals were measured using a combination of sensors, including a thermal camera, a photoplethysmography sensor, and an electro-thermal activity sensor.
- The data collected from these sensors was then analyzed using machine learning algorithms to identify patterns associated with stress. The authors used a Support Vector Machine (SVM) classifier to analyze the data and to detect the onset of stress in real-time.
- The study demonstrated that stress detection in computer users could be achieved using non-invasive monitoring of physiological signals and visual cues. The authors suggested that such a system could be integrated into computer hardware and software, allowing for automatic stress detection and management in real-time.
- Each sensors data is compared to a stress index which serves as a threshold for determining the level of stress.

Disadvantages:

- Physiological signals that are used for analysis are frequently categorized by a non-stationary time performance.
- It can be difficult to identify a common pattern to describe the stress feeling because various persons may act or express under stress in different ways.
- The implementation of this system would require the use of various sensors, such as thermal cameras, photoplethysmography sensors, and electro dermal activity sensors. This could be costly, and may not be practical for widespread adoption.
- Every Sensor data is compared with the stress index which is a threshold value used for detecting the stress level.

The use of physiological signals to detect stress could raise privacy concerns, as these signals are sensitive and could be used to infer other information about the user, such as their emotional state or health status.

3. EXISTING SYSTEM

- In our project, we are following two methods in one structure. The user can use any of these two methods.
- The reason why we are implementing 2 methods is that each method shows highly accurate results, and the most perfect result can be chosen by the user based upon their keen interest.
- If one has a problem with the eyes, they go with the eyebrows and vice versa. If one fails, there is an alternative method for detecting stress in an efficient manner. The following three methods are

1. Eye blink Detection

 (Enriching the Research)	Open Access Research Article
	Volume: 23 Issue: 07
	July, 2023

2. Eyebrow Detection

- In case of Eye blink Detection we give the number of eye blinks and EAR value as an output if the number of eye blinks in a minute is less than 20 then the person is not stressed if not we consider the person as stressed.
- In case of eyebrow detection, we display both stress levels and also we display the output as stressed or not stressed based on emotion detection.

Advantages:

- In the Existing Projects we have taken skin temperature, blood volume, pupil dilation, galvanic skin response, head movement and eye closure. In proposed system we use blink and eyebrow detection to identify the stress levels.
- Here user can choose any of the methods (blink detection and eyebrow detection) to identify the stress.
- It is in expensive.

Eyebrow detection is a non-invasive method of stress detection that does not require the use of sensors or other devices on the user's body.

4. PROPOSED SYSTEM

A Huge number of research and developments are going on in the domain of machine learning and object detection. A large number of new kinds of tools also came into existence. Few of those developments are similar to our idea. But all those projects' implementation has distinctions and differences in object detection like using different algorithms and different libraries for the processing. Our dataset contains nearly 90 objectnames that are useful and observed by a common man in our day-to-day life, which is enough for real-time object detection. we use the YOLO algorithm for object detection and Text to Speech conversion technique for voice alerts.

ADVANTAGES:

- Using audio as the output, which is present in the application. No need for a different device.
- IoT devices may not be available to everyone, therefore we introduce an application for this purpose.
- Our project does not cost much in terms of the hardware used. Easy integration with mobile or web apps.
- Reduces time complexity.

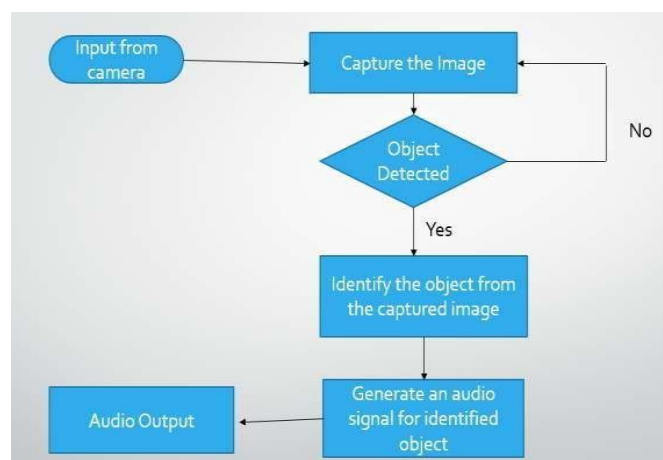


Fig 5. System Architecture

 (Enriching the Research)	Open Access Research Article
	Volume: 23 Issue: 07
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5. RESULTS

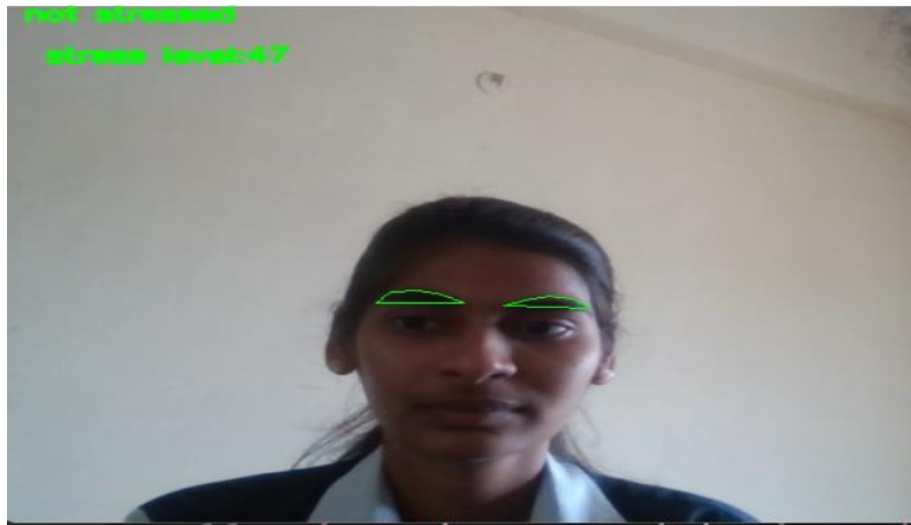


Fig.6 Detection of Stress



Fig.7 Blink detection

6. CONCLUSION

We implemented this project based on three modules are Open CV, NumPy and Tensor flow using machine learning techniques. As the stress is the most important factor in human and we detect the stress in three ways are eye blink method detects the blinks of an eye and calculated the eye aspect ratio, eyebrow detection detects the level of stress and indicate the weather the person is stressed or not stressed, face emotion recognition detects the different emotions of a person like sad, angry, surprised, disgust, happiness, neutral. Based on the emotions it classifies whether a person is Stressed or Not

	Open Access Research Article
	Volume: 23 Issue: 07
	July, 2023

Stressed. In future we will extend our model to detect stress levels of multiple persons at a time and we send a message or mail to the employee detecting their stress levels. In the near future we wish to update the current model to work in a smart phone so that our model will be accessible to everyone in the world.

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