# Stress Detection and Management in Corporate Employees

[1]Aditi Gujatti, [2]Darshana Kumbhakarna, [3]Isha Khutale, [4]Snehal Karnanjikar
[1,2,3,4]Academic Scholar
[1,4]Computer Department, [2,3]Information Technology Department
[1,2,3,4] Savitribai Phule Pune University, Pune, India

**Abstract:** Nowadays rather than physical pain people are suffering from mental stress especially cooperate employees due to factors such as long working hours, heavy workloads, tight deadlines, etc. Hence companies are trying to take measures to reduce stress. The application works by taking images/videos as input from in-built webcams in the system and extracts features like eyes, nose, and mouth to recognize emotion. It monitors the eye blinking rate of the employee. Also, the eye gaze movements of employees and emotion detection are taken into consideration. We are providing an optional questionnaire to the employees.
After analysis using the appropriate algorithm, if the employee is stressed, then he/she is provided with proper measures to relieve stress.

**Index Terms** – FER (Face Emotion Recognition), PSS (Perceived Stress Scale), CNN (Convolutional Neural Network), dlib, OpenCV.

.

## I. INTRODUCTION

Developing an application for Computers installed in companies that monitors the stress in employees using a webcam installed on the PC and detects stress based on factors like eye blinking rate, eye gaze, and emotion detection.

Employee status is detected as stressed and non-stressed according to the analysis of 15 days. The measures to relieve the stress will be suggested accordingly. We are using the following algorithms:

1. Emotion detection - Open CV
2. Eye Gaze – dlib
3. Eye Blinking Rate – dlib
4. Questionnaire - Multiple choice questions for the questionnaire with the consultation of experts to understand the user's condition in a better way.

## II. RELATED WORK

According to current research, most companies use computers. All computer users are confined to a single location for extended periods. Insufficient eye movement, and the distance between the system and the user's eye, all lead to weakening of the eye muscles and ultimately lead to dry eye and eye fatigue.

Long-term use of virtual machines affects the health of the user. It can affect the health of the user and can cause headaches, dry eye, fatigue, blurred vision, irritability of the eyes, and visual impairment. Decreased reflex rates may be the cause of these symptoms. The new employee training systems with an app-based learning program and online courses etc. are forcing employees to use electronic gadgets for a long time which leads to eye fatigue.

Suicide is one of the four leading causes of death among people between the ages of 10 and 44. One of the main causes of suicide is depression or mental illness. According to various studies, most employees reported that their performance was affected by stress. Employees will experience stress as a result of their workload, relationship problems, and changes in their lifestyle.

Stress is a major growing concern that can seriously affect the life of an individual and that can affect society.

### *A. Referred system.*

Eye Gaze as an Indicator for Stress Level Analysis in Students

The raw data is collected from students and extracted from the features: of gaze position, pupil diameter, and number of blinks, which is an indicator of mental and eye stress.

In this system, eye gaze is being tracked. From the eye blink rate and pupil diameter, the stress level is calculated. Here data of two participants is being compared and the participant showing signs of high stress is found. [3]

Pros: This system monitors various eye measures thoroughly.

Cons: Only one factor i.e., eye gaze is considered for stress level detection.

## III. METHODOLOGY

The idea is to develop a stress level detection system for corporate employees using webcams installed on the computers. Employees are to be monitored for a day based on factors like Emotion detection, Eye Gaze, Eye Blinking, and the Questionnaire provided by us. The results for the day are being calculated and if action is necessary then conveyed to the employee with the proper measures to handle the stress. If the results for the day or two are not very severe, we are checking the conditions for 10-15 days, and based on these, the stress level of the employee is detected as low, medium, and high. An employee having a highly Stressful condition will be advised to follow the proper measures provided by us or consult the appropriate expert. We are using Open CV for Emotion detection. For Eye Gaze monitoring, we are using Dlib. For eye blinking rate dlib is used. We are using appropriate algorithms and techniques to determine the factors and run our system in the best possible manner. We have consulted the expert person in the medical field to decide the appropriate range of medical factors like eye gaze, eye blinking rate, and other parameters to increase the success of the entire system. We are providing a multiple-choice questions-based questionnaire to have a better idea about the user's condition.

### A. *Emotion Detection*

Emotion detection is done using OpenCV. Input is taken in the form of a video stream, from which emotions are detected. Emotions such as depression, sadness, anger, etc. can indicate stress. In the initial step, we are extracting the person's face sitting in front of the camera using OpenCV. In the next step, we are predicting the person's emotion using CNN. In addition to that, the model is trained on the FER 2013 Inception dataset.[2]

*1) Algorithm:* The following are the steps

1. Read the FER Dataset and store it in a variable.
2. Start capturing the video.
3. Start timer till 3 minutes.
4. If an image is captured, then:
   - Read the image.
   - Crop required image part.
   - Find the max indexed array.
   - Store all 6 different emotions in an array.
   - Predict the emotions and store them in an array
   - Display the emotion in the frame.
5. If 3 minutes are passed, then:
   - Calculate the most frequently displayed emotion and store it in another array.
   - Reset the timer.
6. If a user wants to quit, then close the frame

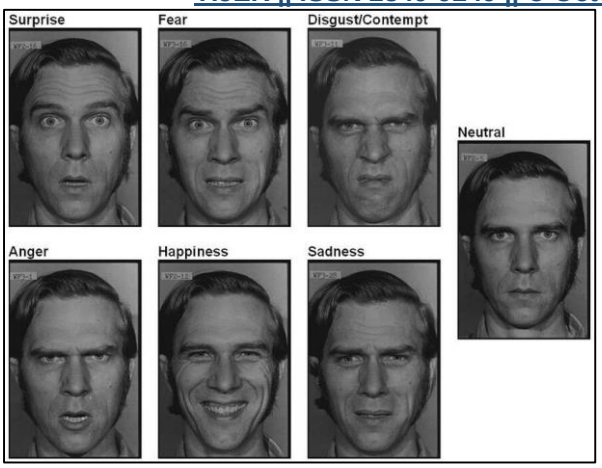



Fig.1 All emotions under consideration [2]

*2) Results:*

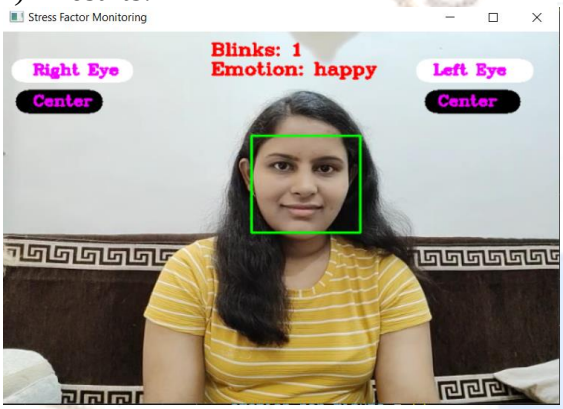



Fig. 2 Employee shows happy emotion

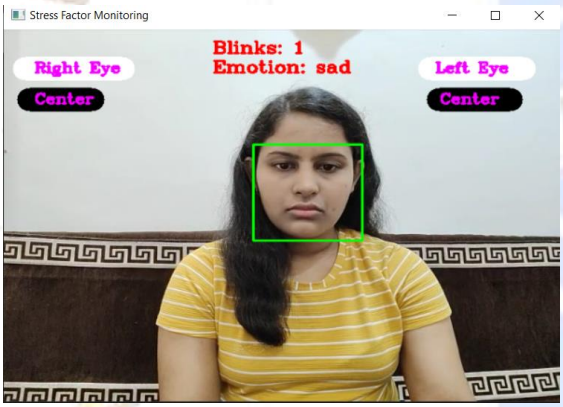



Fig. 3 Employee shows sad emotion

*B. Eye Gaze Monitoring*

Eye Gaze is determined by plotting 68 landmarks on the face using the dlib library. Eyes are divided into 3 parts left, right, and centre. The position of the eyes is determined by observing which part has more black pixels. If the eyes are to the left or right side then the eye gaze is recorded as 1 meaning the employee is distracted, if the eyes are to the centre for more time, then the value is taken as 0 meaning the employee is focused. If the employee is distracted, then we determine that the employee is stressed.[3]

1) *Algorithm:* Following are the steps

1. Load the shape predictor. Starts capturing the video.
2. Start timer till 3 minutes.
3. If a face is visible, then:
   - Get the 68 facial landmarks.
   - Locate the left and right eye.
   - Find left and right eye direction whether it is left right or centre.
   - Store the eye direction in the array.
4. If 3 minutes are passed, then:
   - Calculate the most frequent eye direction.
   - If it is either left or right, then store it as distracted.

It is centered then store as focused.

Reset the timer.

2) Results:

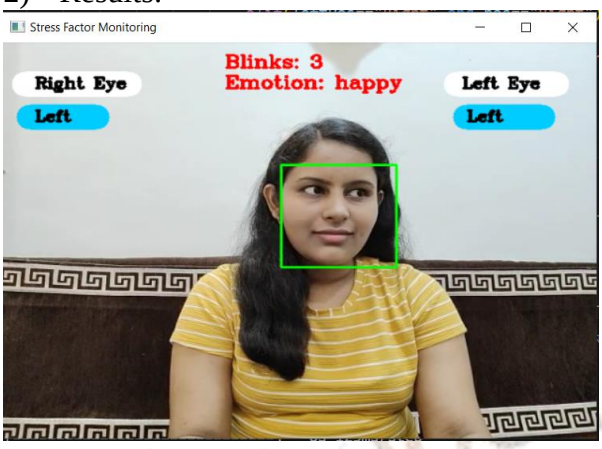



Fig. 4 Employee is distracted.

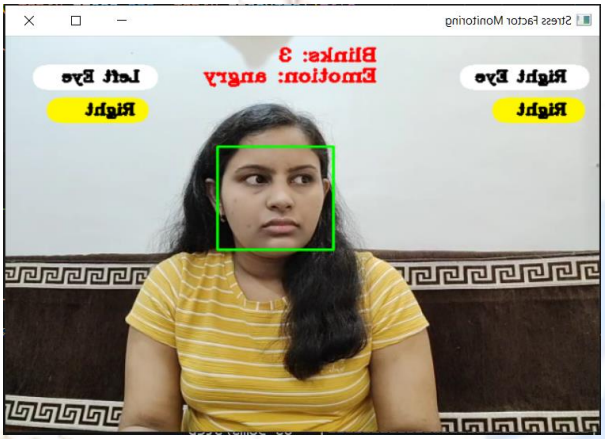


Fig. 5 Employee is distracted.

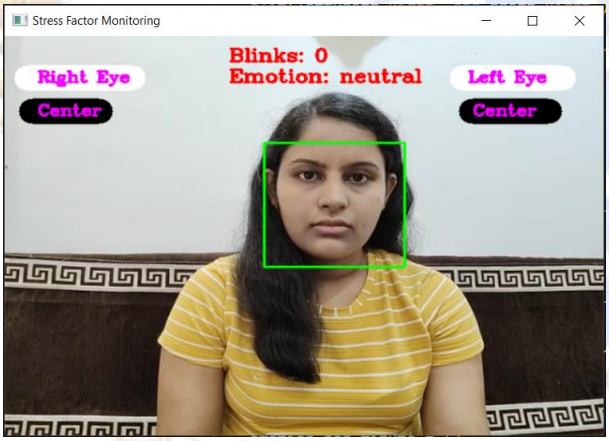



Fig. 6 Employee is focused.

*C. Eye Blink Detection*

Facial landmarks detector is implemented inside dlib to detect facial features like eyes, ears, nose, etc. After detecting the face, the eye region is detected with the help of facial landmark features. Using the face landmarks dataset, 68 landmarks on the face are pointed out. Each landmark is assigned an index. Using these indices, the desired region of the face is detected, Point index for two eyes:

left eye: - (37, 38, 39, 40, 41, 42)

right eye: - (43, 44, 45, 46, 47, 48)

Extracting blinks from continuous eye-tracking data in a mind-wandering paradigm. An initial note on proposed MSL measurements in the tropical Westpac Region. Two questions can help detect depression. One drawn horizontally and the other drawn vertically splitting the eyes. Temporary closure of the eyes along with the movement of eyelids is known as blinking. It is a rapid natural process. We have to find out what happens when the eye is blinked. We can conclude that the eye is closed/blinked when:

- Eyeball is not visible.
- Eyelid is closed.
- Upper and lower eyelids are connected If these actions occurred for a period of (approximately 0.3 seconds to 0.4 seconds) time, we could assume it is a blink if it is longer than that then it can be taken as closed eyes. For an opened eye, both vertical and horizontal lines are almost identical while for a closed eye, the vertical line becomes very smaller or almost vanishes. [1]

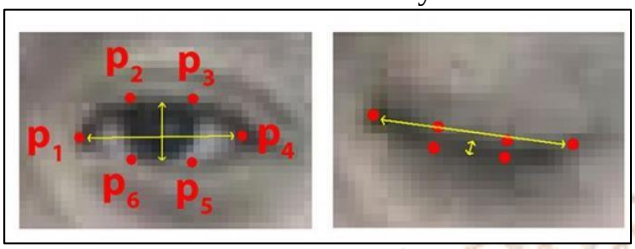



Fig. 7 Eye Landmarks and blink indication [1]

*1) Algorithm:* Following are the steps

1. Load the shape predictor.
2. Start capturing the video.
3. Start the time.
4. Locate the eyes and ears.
5. If the eye is found to be closed, then the blink count is increased.
6. If 3 minutes are passed, then:
   Store the blink count to an array.
   Reset the timer.
7. If a user wants to quit, then close the frame.

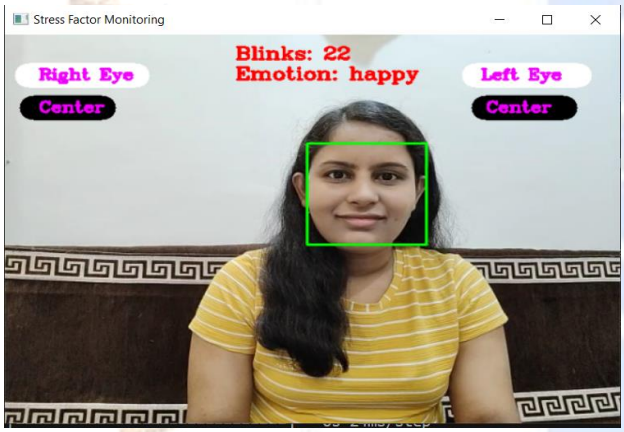



Fig. 8 Eye Blink Rate in 3 minutes

*D. Questionnaire*

Perceived Stress Scale is used for the Questionnaire. The employee is asked a few questions about their feelings and thoughts during the last month. There are five options given ranging from never to very often from which the employee has to select one option. Each option is assigned a score. The score for PSS ranges from 0 to 40. The total score is calculated and based on the score low, medium, or high stress is determined.

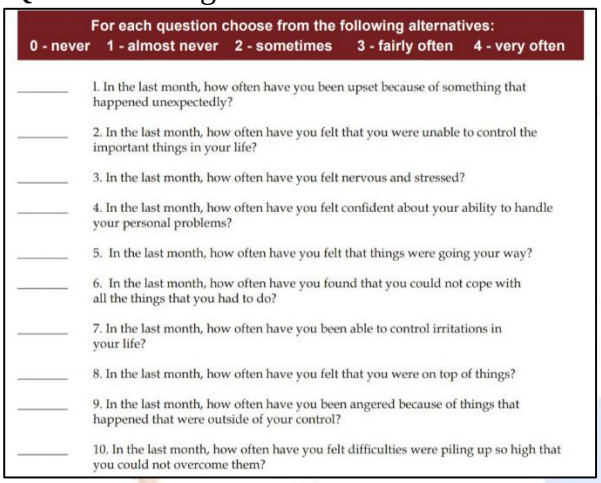
As per the options selected by the user, the Perceived Stress score is calculated,and stress is detected. Individual scores on PSS can range from 0 to 40 with scores indicating stress as follows:

- Score range from 0 to 13 - Low Stress
- Score range from 14 to 26 - Medium Stress
- Score range from 27 to 40 - High Stress

1) *Algorithm:*

1. Click on the start button in the questionnaire tab.
2. A question with 4 different options is displayed.
3. Choose one option and click on the next button.
4. Follow the same steps for 10 questions.
5. After attempting the 10 questions a thank you message appears.
6. If within the 7 days of giving the questionnaire the user tries to attempt the questionnaire:
   A message "You have already attempted the questionnaire for the week" is displayed.

Questions being asked:



For each question choose from the following alternatives:
0 - never 1 - almost never 2 - sometimes 3 - fairly often 4 - very often

_____ 1. In the last month, how often have you been upset because of something that happened unexpectedly?

_____ 2. In the last month, how often have you felt that you were unable to control the important things in your life?

_____ 3. In the last month, how often have you felt nervous and stressed?

_____ 4. In the last month, how often have you felt confident about your ability to handle your personal problems?

_____ 5. In the last month, how often have you felt that things were going your way?

_____ 6. In the last month, how often have you found that you could not cope with all the things that you had to do?

_____ 7. In the last month, how often have you been able to control irritations in your life?

_____ 8. In the last month, how often have you felt that you were on top of things?

_____ 9. In the last month, how often have you been angered because of things that happened that were outside of your control?

_____ 10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Fig. 9 Perceived Stress Scale Questionnaire [5]

## IV. DATASETS

- FER dataset - Emotion detection
- Shape Predictor 68 landmarks - Eye Blink Rate Detection

## V. RESULTS

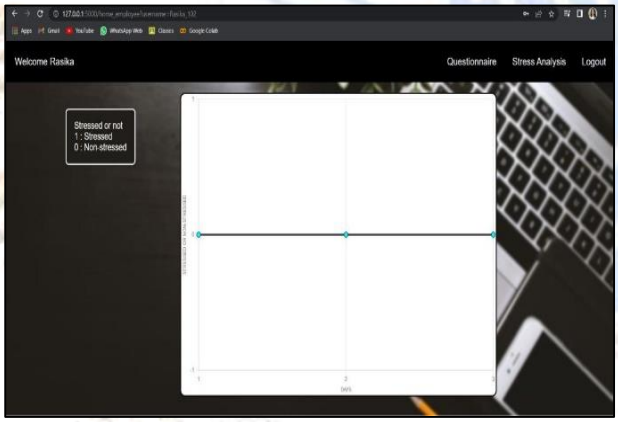



Fig. 10 Graph generated on employee side.

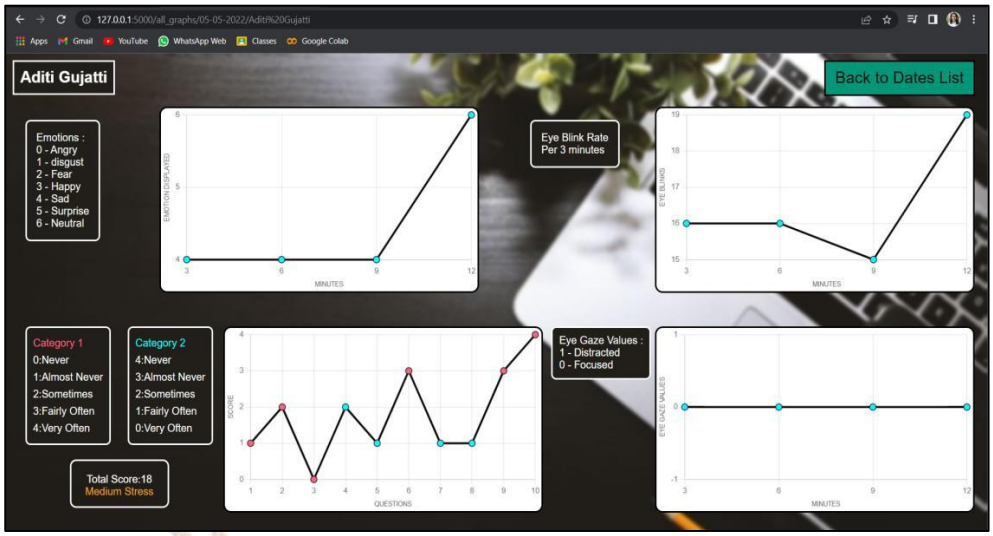



Fig. 11 Graph generated on the admin side.

## VI. CONCLUSION

Our system successfully monitors the stress conditions of employees based on the 4 different factors we have considered i.e., emotion detection, eye gaze, eye blink rate, and questionnaire.

This system works for detecting stress levels in employees which will further help the companies to take necessary measures to reduce stress and ensure the well-being of the employees.

Furthermore, an organization can use this data to increase the efficiency of the employee by tracking their mental conditions and taking the necessary steps to abate their stress. The future scope for this project is that we want to increase the efficiency of our system by considering more factors.

## VII. REFERENCES

[1] Vignesh C P Sriram R B. Chandra, Sharon Hajhan L U. Eye blink controlled virtual interface using OpenCV and dlib. European Journal of Molecular amp; Clinical Medicine, 7(8):2119–2126, 2020.

[2] Giorgos Giannakakis, Matthew Pediaditis, Dimitris Manousos, Eleni Kazantzaki, Franco Chiarugi, Panagiotis G Simos, Kostas Marias, and Manolis Tsiknakis. Stress and anxiety detection using facial cues from videos. Biomedical Signal Processing and Control, 31:89–101, 2017.

[3] C Jyotsna and J Amudha. Eye gaze as an indicator for stress level analysis in students. In 2018 International Conference on Advances in Computing, Communications and Informatics (ICACCI), pages 1588–1593. IEEE, 2018.

[4] Munif Faisal Abdul Rahman, Vito Christian Giovanni, Harco Leslie Hendric Spits Warnars, Gagah Dwiki Putra Aryono, Bayu Megantoro, et al. Facial recognition development to detect corporate employee's stress levels. In 2019 IEEE International Conference on Engineering, Technology and Education (TALE), pages 1–6. IEEE, 2019.

[5] https://das.nh.gov/wellness/docs/percieved%20stress%20scale.pdf