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REAL-TIME STRESS DETECTION BASED ON FACIAL EMOTION AND SPEECH RECOGNITION IN THE WORKSPACE

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Abstract- The *goal of our project is to detect stress in workspaces using deep learning and image processing techniques. Stress is a psychological disorder that causes health issues in human beings. In this project, we detect stress through facial emotion detection and speech recognition. We upgrade the old stress detection system by live detection and combining facial emotion and speech recognition. We detect stress by CNN algorithm using FER2013 and RAVDESS.The system detects facial emotion and speech emotions and takes the average to detect stress.The system automatically detects frontalfaces in the video stream and codes each frame with respect to 7 dimensions: Neutral, anger, disgust, fear,joy, sadness, and surpriseOur system mainly focuses on managing stress and getting the best out of them in their work.*

Keywords: Deep Learning, CNN, Feature Extraction, Facial Emotion, Speech Recognition.

I. INTRODUCTION

Stress is a common experience in modern life and can negatively affect physical and mental health. One way to address this issue is through stress detection using facial emotion and speech recognition technology. Facial emotion recognition uses deep learning algorithms to detect emotional expressions in human faces. By analyzing the movements and patterns of facial muscles, the algorithm can identify different emotions such as happiness, sadness, anger, fear, disgust, surprise, and neutrality. Speech recognition technology uses deep learning algorithms to analyze a person's speech patterns, such as tone, pitch, speed, and volume.Combining these two technologies can help in identifying stress levels in individuals. When a person is stressed, it can be reflected in their facialexpressions and speech patterns. For instance, stress can cause facial muscles to tense up, resulting in wrinkles, furrowed brows, and a tightened jawline. Similarly, when people are under stress their speech patterns may change, such as speaking faster, louder, or with a higher pitch. By analyzing these changes in facial expressions and speech patterns, a stress detection system can identify if an individual is under stress. This can be useful in various settings such as workspaces, schools, and hospitals where early stress detection can help prevent its negative effects. However, it is essential to note that stress detection using facial emotion and speech recognition technology is still a developing field. Nevertheless, stress detection using facial emotion and speech recognition technology holds great potential in improving mental health and well-being in the future.The Deep Learning algorithm like the CNN algorithm is applied to classify stress. Image Processing is used for detection, the employees' facial images are captured by the live camera, and those captured images are given as input. Speech Pre-processing is used to remove unwanted noise from the input speech signal.

II. RELATED WORK

This paper "STRESS DETECTION USING FACIAL EXPRESSION" (2023) detects stress to the user by using the facial emotions of the person who cannot communicate verbally using the CNN algorithm. they use the FER2013 dataset for training. When the user uploads the images, the images get divided into patterns for feature extraction. Then the extracted features will be compared to the dataset. Then the emotions are detected and the stress level is detected. This system provides an accuracy of 92%[19]

This paper "Facial Expression Recognition System for Stress Detection with Deep Learning José Almeida1 and Fátima Rodrigues2 a 1Polytechnic of Porto, School of Engineering, Rua Dr. António Bernardino de Almeida, Porto, Portugal 2Interdisciplinary Studies Research Centre (ISRC), Polytechnic of Porto, School of Engineering, Porto, Portugal (2021). This project uses the Ck+ dataset for the training and testing of the system.It uses the CNN algorithm for stress detection using facial emotions. This system uses a convolutional neural network for classification. This system provides an accuracy of 92.1%. Another proposal for future work is the improvement of the classification models, training them with more data collected from our users. The migration of the classification

module to a server where it could take advantage of centralized processing with graphics cards (reducing the impact on users' devices) will also be considered. [18].

This paper "Stress and Anxiety Detection through Speech Recognition Using Deep Neural Network Divyashree P1 ,Ghanavi Yadav A2, Namratha Jayadev3, Prajwal B4, Sharmila Chidaravalli5 1,2,3,4 Students, Global Academy of Technology, Bangalore 5Assistant Professor, Global Academy of Technology, Bangalore(2022).they used Ravdess dataset for training and testing of system. This paper detects stress through speech analysis using MFCC. It uses a deep neural network. It gives an accuracy of 76.08%. This work presents a deduced model that takes audio as input and identifies whether the user is under Stress or Anxiety[17].

The paper "Predictive Analysis of Student Stress Level Using Naive Bayesian Classification Algorithm proposed by Monisha S, Meera R, and Vijay Swaminath.R, Dr. Arun Raj L, and this paper describes the overall academic performance and social compulsion that has created a pressurized psychological state for students. Earlier, the competition level used to be less. As science evolves, the knowledge and workload of the faculty and the school students have conjointly been evolving to view society. Students find it tough at times after they had completed their standards in SSLC (Secondary School Leaving Certificate) and HSC (Higher Secondary School Certificate). Associating with the NEET exam, the result influences a crucial endin countless students' life. The naive Bayes technique is an emerging discipline, used to analyze the accurate facts and helps in organizing the most stress-causing factors based on the probabilistic parameters. Object characteristics and correlation are the two main attributes based on which the stress accuracy level is predicted. Information gathered from the survey is analyzed using the Bayes classifier and the outcomes are inferred using visualization tools. Based on the output, the socioeconomic and physical stress-causing factors have been encoded and prioritized. Frequently stated stress factors should be reduced to help the students to excel in their academic performance and activate social activities, thereby decreasing individual health issues like migraine headaches, spectacle-wearing, and so on [9]

The paper "TheMentalHealth Evaluation System ofCollege StudentsBased on Data Mining"proposed by Peng Li and this paper explains to solve the problems of high misevaluation rate and low work efficiency in the current mental health evaluation process of college students, a mental health evaluation system based on data mining algorithms is proposed. First, analyze the research status of college students' mental health evaluation and data mining algorithms and build a mental health evaluation system framework; then, collect college students' mental health questionnaire data, use the Apriori algorithm based on a three-dimensional matrix to analyze and classify, traverse each attribute of each transaction in the two-dimensional matrix, and directly obtain the frequent item set, frequent binomial set, and frequent three-item set by reading the three-dimensional attribute matrix and the mental health evaluation data to obtain mental health intelligent evaluation results. Finally, specific simulation experiments are used to analyze the feasibility and superiority of the mental health intelligence evaluation system.results show that the system in the article overcomes the shortcomings of the current mental health intelligence evaluation system, improves the accuracy of mental health intelligence evaluation, improves the efficiency of mental health intelligence evaluation, and the system is more stable, which can meet the actual requirements of current college students' mental health evaluation [12].

From these papers, we have discovered that detecting stress in a different field should be difficult by predicting it from a single parameter so we analyze the difficulties to build a better product to detect stress in workplaces.

DATASET	ALGORITHM	FACIAL/SPEECH	ACCURACY
FER	CNN	Facial	92
FER	KNN	Facial	88
CK+(cohn-kanade)	CNN	facial	92.1

EmoDB	DNN	speech	78
KeioESD	ANN	speech	89
Ravdees	DNN	speech	76.08

The above tables givean overview of our literature survey. In our proposed system, we are combining both facial and speech recognition to detect stress. because expressing stress varies from person to person some people may show it on their face while some may not. While some people may show in their speech while some may not. So to overcome this confusion and give accurate results we are combining both facial recognition and speech recognition, to provide accurate results

III. EXISTING SYSTEM

In the existing system, image processing techniques are used to detect emotions, which is not accurate. Some of the existing work includes machine learning algorithms, in which facial features are extracted from the input image by using image pre-processing techniques. Thus, it leads to lower accuracy. Also, it classifies emotions into a limited number of emotions. Many of the existing methods use still images and emotions were perceived by measuring the dimensions of lips and eyes. Currently, the system failed to identify whether the person is stressed or not based on the predicated emotion as well as the amount of stress in the image. Existing work makes predictions on the uploaded input facial image, which is not real-time stress detection and that detection is not implemented by recognizing the speech recognization**.**So, the existing system which processesseparate speech and facial may fail to give accuracy.Also, this system classifies limited emotions i.e., 2 or 3 emotions. Many of the existing system detects the stress in still images and it does not have any live detection process.Then this system fails to identify whether the person is stressed or not.

FACIAL RECOGNITION

Fig 3.1 Flow diagram for facial recognization

SPEECH RECOGNITION

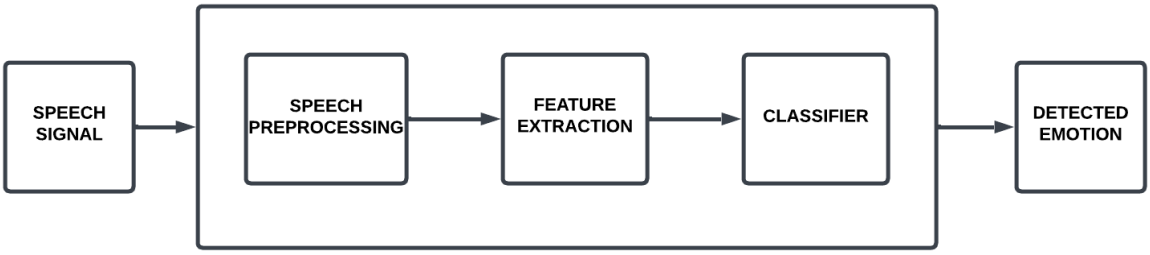

Fig.3.2 Flow diagram for speech recognisation

IV. PROPOSED SYSTEM

This concept seeks to address the present mental stress status of the people who are working as an employee in their workplaces by monitoring them based on real-time scenarios. Here the fundamental work for stress detection is carried out using a deep learning algorithm (CNN). Corresponding facial features are captured by the webcam which gets access permission from the user and the speech features are also captured by the microphone which gets permission from the user. Therefore, the system access both the webcam and microphone. The webcam and microphone continuously run in the background to analyze the user's emotions for the detection of stress.

We are collecting the facial and speech emotion dataset from FER2013 and RAVDEES respectively. The dataset of FER2013 consists of 30000 facial RBG images of different expressions with the size of 48*48 and the facial images are labeled into 7 types. The dataset of RAVDEES consists of 7356 files of both speech and song of 24 professional actors. The user logins the web application and it asks permission to access the webcam and microphone it gets verified by the particular user to capture images of the user during their worktime and it also records the user's speech to recognize the emotion. This system runs until the user gets quit the website.The datasets are trained using the CNN algorithm for both facial and speech recognization. The captured picture is fed into the CNN algorithm to get rid of unwanted noisy data and unrelated data and the captured audio also fed into the algorithm to clear the background noise of the audio been captured for the analysis. Feature extraction is done for the input that has been given in real-time. The images are divided to grid patterns into various images. The true positive images are labeled as 1 and the false negative images are labeled as 0. Then the extracted features are compared with the dataset to detect the stress.

Capturing both facial and speech emotions to detect stress gives more accuracy of stress in the user from the existing system. This will be a great thing to recover people from their work stress. Open Cv is a library that plays a significant part in object detection: moreover, as soon as the face is recognized, a rectangular box is placed around it so that we can easily recognize the object present in the video.

This model is built with an idea based on recent news on IT employees getting self-slaughter because of stress in their workspace so this model overcomes the situation of suicides in the workplace. Based on real-time data, the model gives the exact output that the users show emotion in their workspaces.

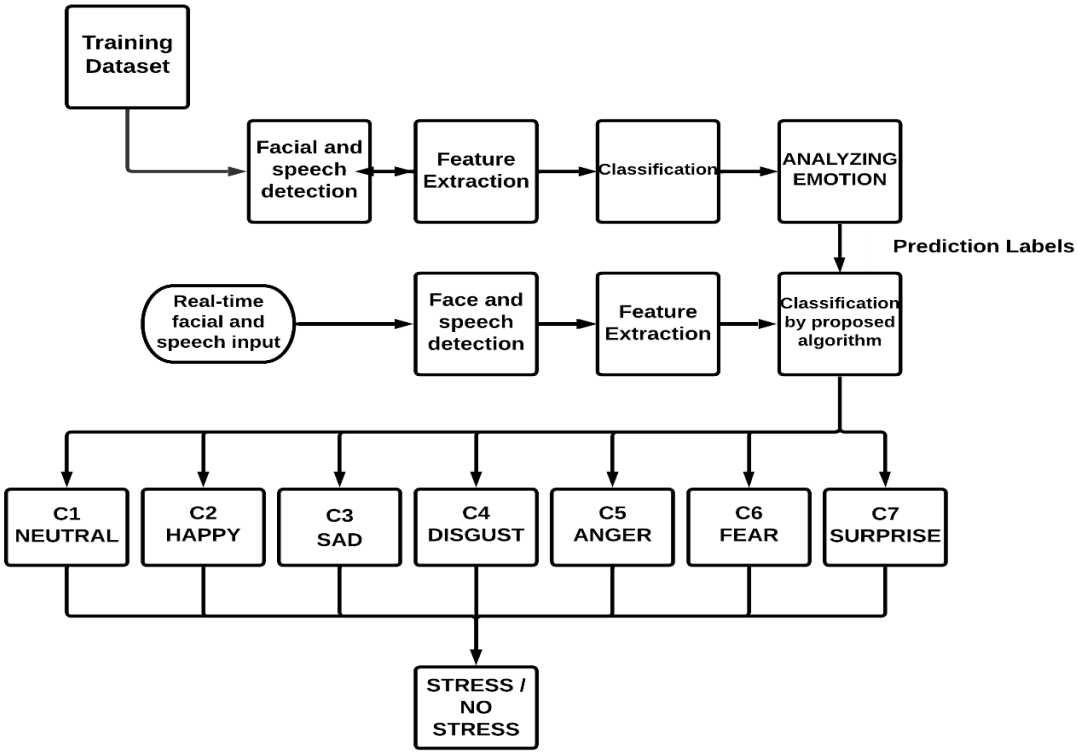

Fig.4.1 Architecture diagram of the proposed system

V. RESULT DISCUSSION

To discuss the performances of our proposed system, we compare the performance of our proposed model with other models. The result of our proposed system for stress detection is highly promising in accuracy. This shows our system is effective in identifying stress in users who are working in front of systems. The usage of CNN effectively detects stress because CNN accepts and analysis the dataset in such a way that they are in. By analyzing the stress, the system produces the result and shows the system's confidence. With the help of this confidence, the user could understand their mental status better. The system will also show the types of emotions in percentage by analyzing the facial and speech emotion from the real-time video. Previously the system only detects the stress by analyzing the facial landmarks and head movement and the stress in the speech was detected separately. The performance accuracy obtained on the FER2013 was 92% and on the RAVDEES 94.% using the CNN algorithm. By using these datasets in the system with CNN the system provides 98% of the accuracy of stress detection. Our system can give a great accuracy level.

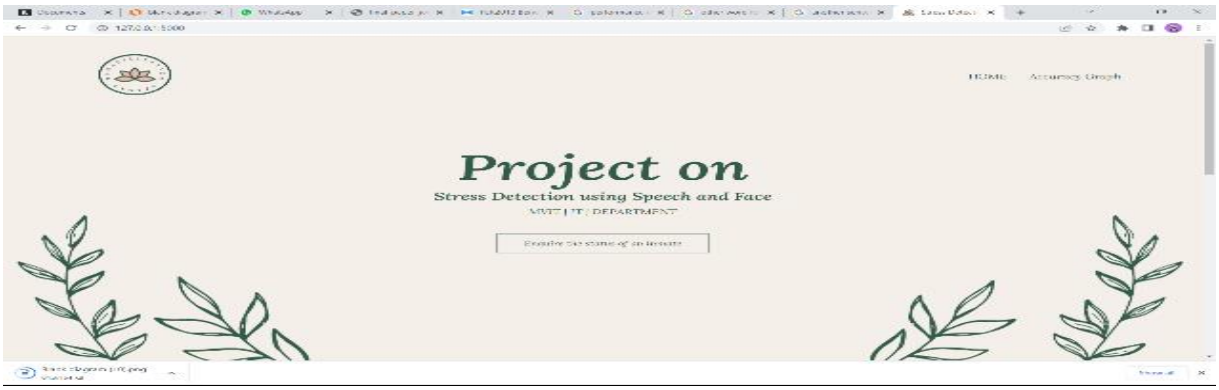

Fig 5.1 Home page

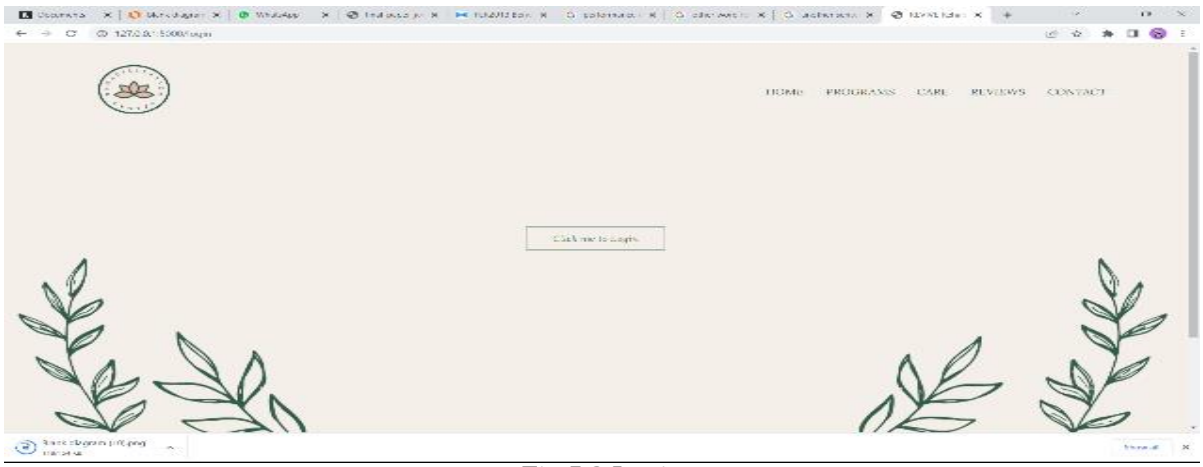

Fig 5.2 Login page

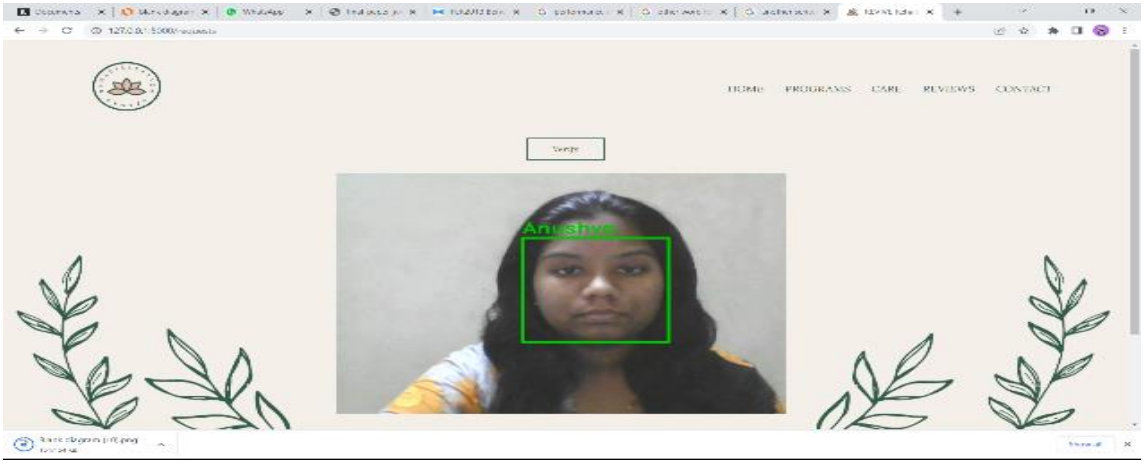

Fig 5.3 Analyzing both facial and speech

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Fig 5.4 Separately showing how the speech has been taken

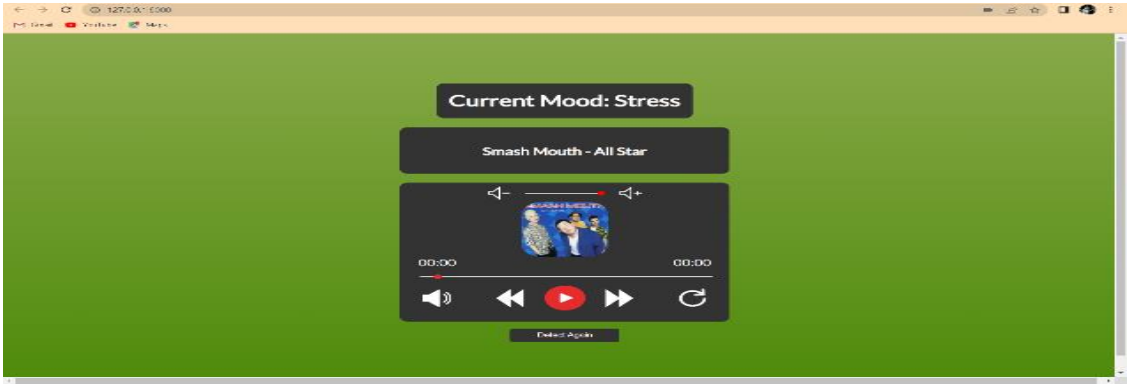

Fig 5.4 Stress detected

When compared to other algorithms CNN provide the highest accuracy when we take FER2013 and Ravdees dataset. When the dataset is trained using KNN (K- Nearest neighbour) algorithm it gives 88% of accuracy. And when it is trained with the CNN algorithm it gives 92% of accuracy. Similarly in speech

recognization when the RAVDEES dataset is used in the CNN algorithm it gives the highest accuracy of 94.33 when compared to the DNN and KNN algorithms, where it provides 76.08 and 92 percent of accuracy respectively. Since CNN provides the highest accuracy, we have taken it to combine both facial emotion and speech recognition to detect stress. The below table compares the FER2013 and RAVDEES datasets with different types of algorithms.

DATASET	ALGORITHM USED	FACIAL/SPEECH	ACCURACY
FER	KNN	FACIAL RECOGNITION	88
FER	CNN	FACIAL RECOGNITION	92
Ravdees	DNN	SPEECH RECOGNITION	76.08
Ravdees	CNN	SPEECH RECOGNITION	94.33
Ravdees	KNN	SPEECH RECOGNITION	92

Fig.5.6. Datasets compared with different algorithms for accuracy

The existing system detects stress through facial and speech separately. When it comes to accuracy it varies from person to person. Some may show their stress through speech and some may show it through their facial expressions. So, with the existing system, we cannot find the stress level accurately. To overcome this, we combined both facial emotion recognition and speech recognition and we take the average to find the stress level from the emotions detected from both facial and speech recognition. In our proposed system we have used CNN algorithm for both facial expression and speech recognition, so compared to other algorithms that have been used in old systems the proposed system gives high accuracy.

DATASET	ALGORITHM	FACIAL/SPEECH	ACCURACY
FER2013	CNN	FACIAL	92%
RAVDEES	CNN	SPEECH	94.04%
FER2013 & RAVDEES	CNN	FACIAL &SPEECH	98%

Fig.5.7 Accuracy of the proposed system

VI. CONCLUSION

In conclusion, real-time stress detection based on facial emotion and speech recognition has the potential to be a valuable tool in the workspace. By analyzing facial expressions and speech patterns, the technology can accurately detect when an individual is experiencing stress, and provide them with support and resources to manage it. This could lead to improved productivity, increased job satisfaction, and better overall well-being for employees. However, it is important to consider the ethical implications of implementing such technology in the workplace, such as ensuring data privacy and avoiding discrimination. This technique can help the user to understand their mental status in their workspace and they can overcome the situation with any other things. In the future, we will improve it by providing the results as per week and month vice in a graph chart.

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