CHAPTER-1

INTRODUCTION

CHAPTER - 1

INTRODUCTION

1.1 Overview

Over the last decade, e-learning has revolutionized how students learn by providing them access to quality education whenever and wherever they need. However, students often get distracted due to various reasons, which affect the learning capacity to an excellent extent. Many researchers are trying to enhance the quality of online education, but we'd like a holistic approach to deal with this issue. This paper intends to provide a mechanism that uses the camera feed and microphone input to watch the real-time attention level of students during online classes. We explore various image processing techniques and machine learning algorithms throughout this study. We propose a system that uses five distinct non-verbal features to calculate the eye score of the student during computer based tasks and generate real time feedback for both students and the organization. we will use the generated feedback as a heuristic value to research the overall performance of students as well because the teaching standards of the lecturers.

The demand and need for online education are increasing rapidly. Almost all the schools and colleges throughout the world have shifted to the online mode of lectures and exams due to the recent corona virus outbreak, and this trend will most likely continue in the upcoming years. The increasing demand for online education opens the gate to automation in the field. One major issue in the online mode of lectures is that students tend to lose their concentration after a certain period and there is no automated mechanism to monitor their activities during the classes. Some students tend to just start a lecture online and move away from the place, or might even use a proxy to write online tests for them. This situation also takes place in online course platforms such as EdX and Coursera where the student tries to skip lectures just for the sake of completion and certification. The loss in concentration not only affects the student’s knowledge level but also hurts the society by producing low-skilled laborers.

1.2 Problem Identification and Definition

1.2.1 Problem Identification :

Some students tend to just start a lecture online and move away from the place, or might even use a proxy to write online tests for them. This situation also takes place in online course platforms such as EdX and Coursera where the student tries to skip lectures just for the sake of completion and certification. The loss in concentration not only affects the student's knowledge level but also hurts the society by producing low-skilled laborers.

1.2.2 Problem Definition:

The demand and need for online education are increasing rapidly. Almost all the schools and colleges throughout the world have shifted to the online mode of lectures and exams due to the recent corona virus outbreak, and this trend will most likely continue in the upcoming years. The increasing demand for online education opens the gate to automation in the field. One major issue in the online mode of lectures is that students tend to lose their concentration after a certain period and there is no automated mechanism to monitor their activities during the classes. Some students tend to just start a lecture online and move away from the place, or might even use a proxy to write online tests for them.

1.3 Objectives :

- To present a method that uses a camera feed and a mouthpiece contribution to monitor student's continuing attention levels during online classes.
- To improve the quality of online education.
- To tackle the issues involved in online education using five parameters. We used the face recognition model to verify the student attending the online class.
- we have implemented and used lightweight models to reduce the processing time.

CHAPTER-2

LITERATURE SURVEY

CHAPTER - 2

LITERATURE SURVEY

A Survey on State-of-the-Art Drowsiness Detection Techniques

Drowsiness or fatigue is a major cause of road accidents and has significant implications for road safety. Several deadly accidents can be prevented if the drowsy drivers are warned in time. A variety of drowsiness detection methods exist that monitor the drivers' drowsiness state while driving and alarm the drivers if they are not concentrating on driving. The relevant features can be extracted from facial expressions such as yawning, eye closure, and head movements for inferring the level of drowsiness. The biological condition of the drivers' body, as well as vehicle behaviour, is analysed for driver drowsiness detection. This paper presents a comprehensive analysis of the existing methods of driver drowsiness detection and presents a detailed analysis of widely used classification techniques in this regard

Methodology Used: SVM, Hidden Markov Model, CNN

Advantages:

- It provides details of behavioural, vehicular and physiological parameters-based drowsiness detection techniques.

Disadvantages:

- It consumes more time to train the model.
- Accuracy is less than 80%.

An Experimental Study on the Influence of Environmental Noise on Students' Attention

The aim of this study was to explore the influences of environmental noise on individuals 'attention in learning spaces. The environmental noise with different sound source compositions and characteristics were divided into three typical levels, namely low 55dB, medium 65dB, high 75dB, based on the field survey data of 10 typical schools in a high-density city, Shenyang, China.

In conclusion, it was found that a higher environmental noise level led to lower accuracy and the longer reaction time, and attention was disturbed more seriously; and, a higher environmental noise level required more fixation points to capture information which means more efforts were needed to maintain the attention.

Methodology Used: visual tracking test

Advantages:

- In this paper most participants had the highest accuracy under the influence of low environmental noise (75%).

Disadvantages:

- Accuracy is less.
- It is suitable to monitor the noise in online classes.

Real-time Smart Attendance System using Face Recognition Techniques

Face recognition is one of the biometric methods to improve this system. Being a prime feature of biometric verification, facial recognition is being used enormously in several such applications, like video monitoring and CCTV footage system, an interaction between computer & humans and access systems present indoors and network security. This paper proposes a model for implementing an automated attendance management system for students of a class by making use of face recognition technique, by using Eigenface values, Principle Component Analysis (PCA) and Convolutional Neural Network (CNN). After these, the connection of recognized faces ought to be conceivable by comparing with the database containing student's faces. This model will be a successful technique to manage the attendance and records of students.

Methodology Used: Eigenface values, Principle Component Analysis (PCA) and Convolutional Neural Network (CNN)

Advantages:

- It give 85% accuracy in smart attendance system.

Disadvantages:

- It is suitable to make automatic attendance.
- It is not suitable to track attention span of students.

Deep Sparse Representation Classifier for facial recognition and detection system.

This paper proposes a two-layer Convolutional Neural Network (CNN) to learn the high-level features which utilizes to the face identification via sparse representation. Feature extraction plays a vital role in real-world pattern recognition and classification tasks. The details description of the given input face image, significantly improve the performance of the facial recognition system. Sparse Representation Classifier (SRC) is a popular face classifier that sparsely represents the face image by a subset of training data, which is known as insensitive to the choice of feature space. The proposed method shows the performance improvement of SRC via a precisely selected feature exactor. The experimental results show that the proposed method outperforms other methods on given datasets.

Methodology Used: two-layer Convolutional Neural Network (CNN) for feature extraction and SRC for classification

Advantages:

- SRC provides better classification result even if a simple feature extraction method is used.
- Accuracy is high.

Disadvantages:

- It is not suitable to track attention span of students.

An Emotion Recognition Model Based on Facial Recognition in Virtual Learning Environment

This study proposes a learning emotion recognition model, which consists of three stages: Feature extraction, subset feature and emotion classifier. A Haar Cascades method is used to detect the input image, a face, as the basis for the extraction of eyes and mouth, and then through the Sobel edge detection to obtain the characteristic value. Through Neural Network classifier training, six kinds of different emotional categories are obtained. Therefore, it can help teachers to change teaching strategies in virtual learning environments according to the student's emotions.

Methodology Used: Haar cascade with CNN

Advantages:

- It can help teachers to change teaching strategies in virtual learning environments according to the student's emotions.

Disadvantages:

- It is not suitable to track attention span of students.

CHAPTER–3
SYSTEM ANALYSIS

CHAPTER-3

SYSTEM ANALYSIS

3.1 Existing System

There are several existing systems for real-time attention span tracking in online education. Some of these systems use eye-tracking technology, while others rely on machine learning algorithms to analyse data such as mouse movement and keyboard activity.

Here are some examples of existing systems:

Eye-tracking software: Eye-tracking software is used to measure where a person is looking on a screen, and for how long. This technology can be used to track a student's attention during an online class, and to identify when they may be losing focus or becoming distracted. One example of an eye-tracking system used in online education is Tobi Pro.

Mouse tracking software: Mouse tracking software can be used to analyse a student's mouse movements during an online class. This technology can be used to identify when a student is clicking away from the class or becoming distracted. One example of mouse tracking software used in online education is Mouse flow.

Machine learning algorithms: Machine learning algorithms can be used to analyse data such as mouse movement, keyboard activity, and other behavioural data to predict when a student may be losing focus or becoming distracted. One example of a system that uses machine learning algorithms to track attention span in online education is Attention Insight.

It is important to note that the use of these systems raises ethical concerns about privacy and data collection. Institutions should be transparent about the use of these systems and obtain consent from students before implementing them.

3.2 Proposed System

A proposed system for real-time attention span tracking in online education could involve a combination of technologies and data analysis methods. Here are some key components that could be included in such a system:

Video conferencing platform: The system could integrate with a video conferencing platform such as Zoom or Microsoft Teams to track students' attendance and engagement during online classes.

Eye-tracking technology: The system could use eye-tracking technology to measure where a student is looking on the screen and for how long. This could provide real-time data on students' attention levels and identify when they may be losing focus.

Facial expression recognition: Facial expression recognition technology could be used to identify students' emotions and engagement levels during online classes. This could be used to provide real-time feedback to instructors on students' engagement levels.

Machine learning algorithms: The system could use machine learning algorithms to analyze data such as mouse movement, keyboard activity, and other behavioral data to predict when a student may be losing focus or becoming distracted.

Dashboard for instructors: The system could provide a dashboard for instructors to view real-time data on students' attention levels, engagement, and participation during online classes. This could help instructors adjust their teaching strategies to better engage students.

Overall, a system for real-time attention span tracking in online education could provide valuable insights for instructors and help improve students' learning outcomes. However, it is important to carefully consider the ethical implications and ensure that privacy protections are in place.

CHAPTER-4

SYSTEM REQUIREMENT SPECIFICATION

CHAPTER-4

SYSTEM REQUIREMENT SPECIFICATION

4.1 Functional Requirements

This section describes the functional requirements of the system for those requirements which are expressed in the natural language style.

1. Create a desktop application which using Tkinter framework.
2. User should start our application.
3. System will start the camera and continuously monitor the user.
4. System will detect the user face and extract the face features using HAAR cascade classifier.
5. System will apply OpenCV mechanism to detects eyeblinks body moments,
6. If there span detected system will make alarm
7. System will efficiently identify the attention span of the students.

4.2 Non Functional Requirements

These are requirements that are not functional in nature, that is, these are constraints within which the system must work.

- The program must be self-contained so that it can easily be moved from one Computer to another. It is assumed that network connection will be available on the computer on which the program resides.
- **Capacity, scalability and availability.**
  The system shall achieve 100 per cent availability at all times.

  The system shall be scalable to support additional clients and volunteers.

- **Maintainability.**
  The system should be optimized for supportability, or ease of maintenance as far as possible.

- **Randomness, verifiability and load balancing**.
  The system should be optimized for supportability, or ease of maintenance as far as possible. This may be achieved through the use documentation of coding standards, naming conventions, class libraries and abstraction. It should have randomness to check the nodes and should be load balanced.

4.3 Software Requirements

- **Operating System :** Windows 10,11 / Linux
- **Programming Language** : Python 3.2
- **Libraries:** Open CV, Scikit Image, NumPy
- **IDE:** Visual Studio Code
- **Browser:** Google Chrome

4.4 Hardware Requirements:

- **Processor** Intel i5 or above
- **Processor speed:** 2.44 GHz or above
- **RAM:** 8 GB or above
- **Storage space:** 120GB or above
- **Camera:** USB camera
- **Internet:** 5 Mbps

CHAPTER-5

SYSTEM DESIGN

CHAPTER-5

SYSTEM DESIGN

System Design interviews have gained a lot of streams over the last couple of years and are considered as an important event on the day of onsite interviews with the majority of product development companies. These interviews tend to be very open-ended and conversational. The interviews are judging the candidate based on theirtechnical skills involving thinking about the big picture, articulation, friendliness, curiosity, and logical understanding of the presented problem domain. The candidate is given an example of a popular system and asked to brainstorm a design for the same. During the process, candidates are expected to ask clarifying questionsand think through every component, including the data model, keeping scalability, redundancy, fault tolerance, etc. in mind .System Design is essential to develop a model of system before writing any software that is used tocontrol the system or to interact with it during the design process, we try to develop system models at different levels of abstraction. Design process involves data flow diagram and data structures including library function used in the program. The project is developed using below objects.

5.1 SYSTEM ARCHITECTURE:

This system makes use of five parameters to calculate the attention-span level of the student attending the online class. Facial recognition is used to validate the student’s attendance. The attention span score is calculated using blink rate, facial expression, eye gaze, background noise, and body posture and is updated continuously for a window length of 5 seconds. Instead of sequential execution, all the models required to calculate the attention span are executed in parallel once the online lecture starts.

The real-time monitoring component would provide real-time feedback to instructors on students' engagement levels and participation during online classes. This could involve using a dashboard or notification system to alert instructors when a student's attention level drops below a certain threshold.

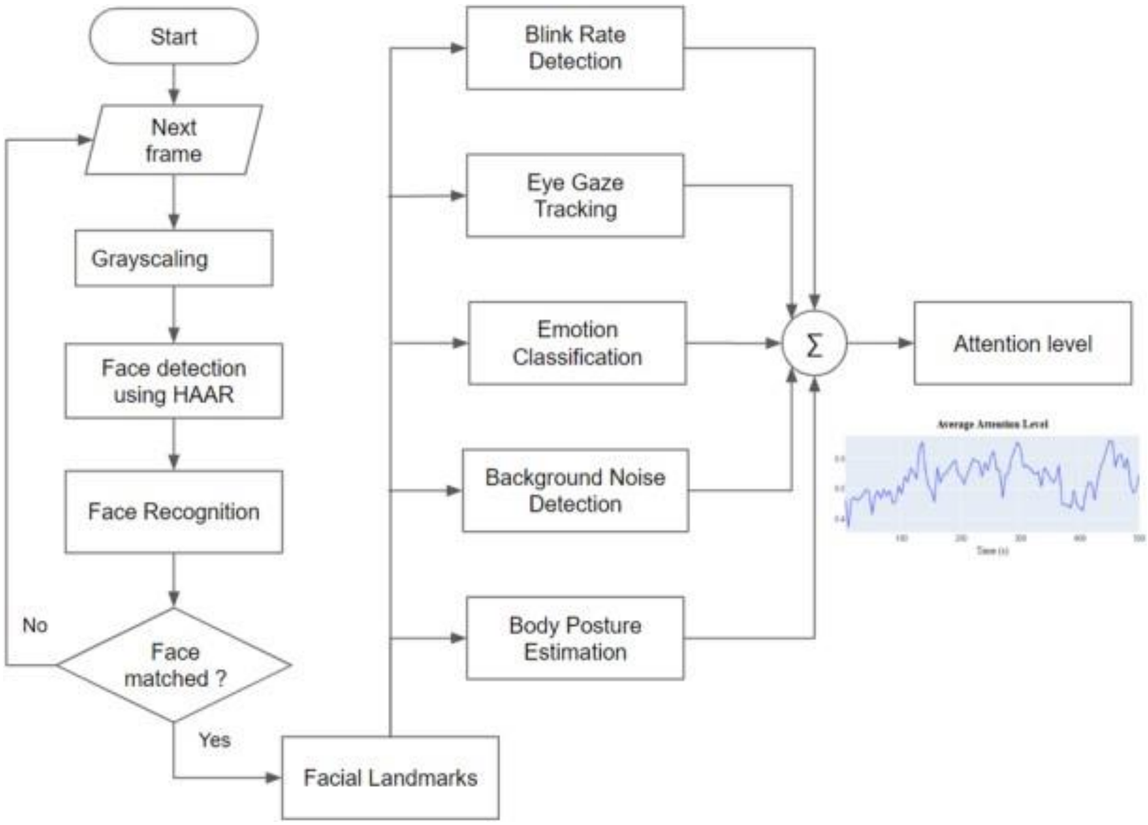

Fig 5.1.1 : System architecture

Overall, the system architecture for real-time attention span tracking in online education would involve a combination of hardware, software, and data analysis techniques. By providing instructors with real-time feedback on students' engagement levels, this system could help improve the effectiveness of online education and enhance students' learning outcomes.

5.2 DATA FLOW DIAGRAMS :

1. The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.
2. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.

3. DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.
4. DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.

Level-0:

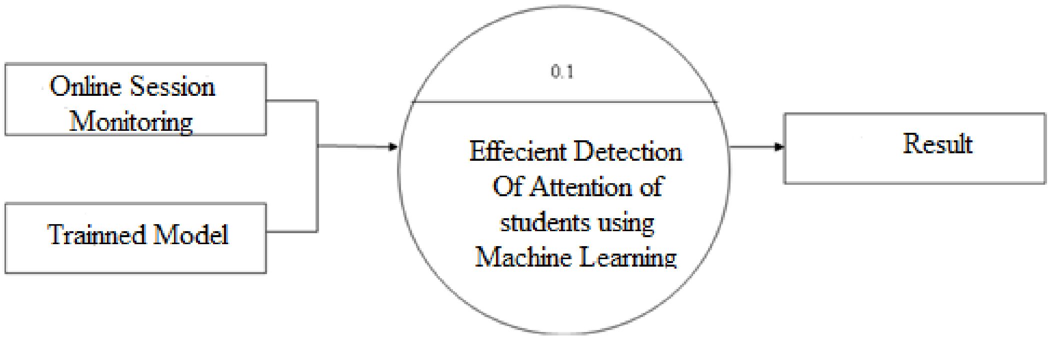

Fig.5.2.1 : Level-0: Data Flow Diagram

Level: 0 describes the overall process of the project. We are passing academic online sessions and its Trained Model as input system will efficiently detect attention spam in the classes using machine learning algorithm.

Level-1:

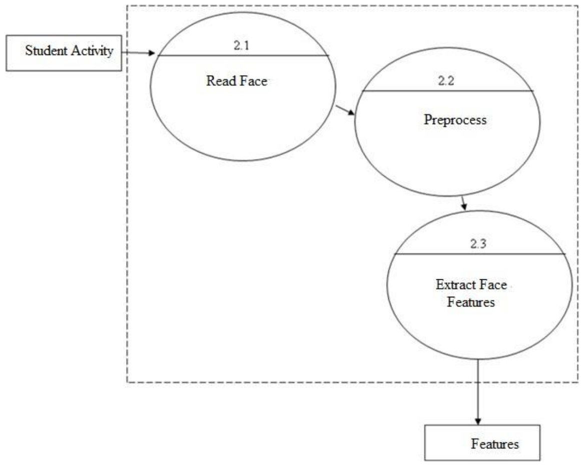

Fig.5.2.2 : Level-1: Data Flow Diagram

Level: 1 describes the first step process of the project. We are passing student activities of online meeting System will read activities and detect the face and preprocess and extract the features like, eyes, nose, mouth etc..

Level-2:

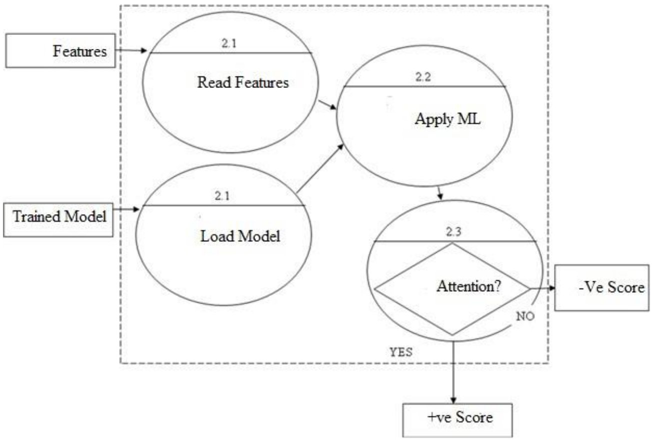

Fig.5.2.3 : Level-2: Data Flow Diagram

Level: 2 describes the final step process of the project. We are passing extracted features data from level 1 and trained model as input. System will read features and Load the model and predict attention of student and provide the score.

5.3 FLOW CHARTS

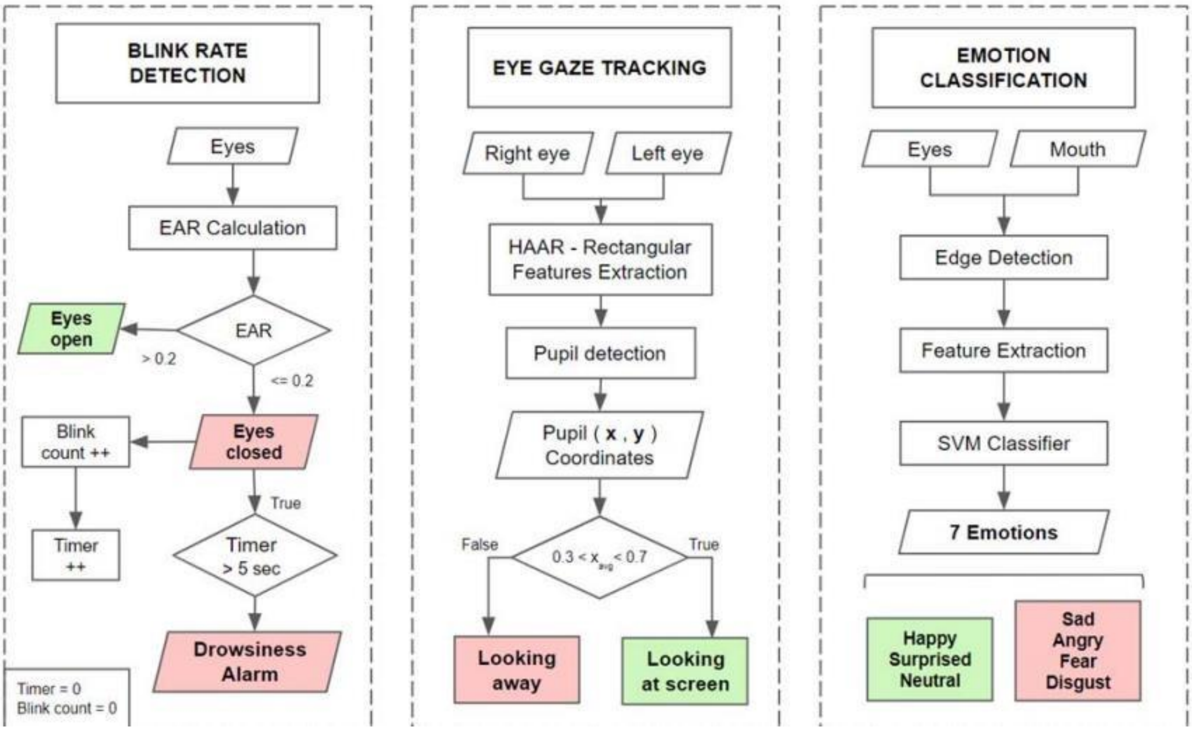

Fig no 5.3.1 : Flow chart

Here's a possible flow chart for real-time attention span tracking in online education:

Start: The online class begins.

Detect user activity: Use a software tool to detect user activity, such as mouse movements, keyboard typing, or screen changes.

Track time: Record the start time of each user activity.

Set timeout: Set a timeout duration to determine the maximum duration for a single user activity. For example, if a user is idle for more than 5 minutes, consider them disengaged.

Calculate attention span: Compare the duration of each user activity to the timeout duration. If a user's activity duration is less than the timeout duration, consider them engaged. Otherwise, consider them disengaged.

Display results: Display the results of attention span tracking in real-time. You can use visual aids, such as graphs or colors, to make it easy to understand.

End: The online class ends.

Note: This is just an example flow chart and the actual implementation may vary depending on the software tools used and the specific requirements of the online class.

5.4 USE CASE DIAGRAM

This use case is initiated by the Real Time Attention Span Tracking System, which continuously monitors students' attention levels and provides real-time feedback to the Instructor.

Overall, the use case diagram shows how the Real Time Attention Span Tracking System interacts with both the Online Instructor and the Student to provide real-time feedback on students' engagement levels during online classes.

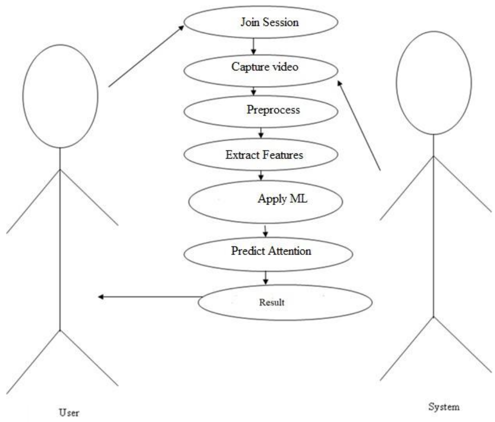

Fig. 5.4.1 : Use Case Diagram

5.5 Sequence Diagrams

A sequence diagram in Unified Modelling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.

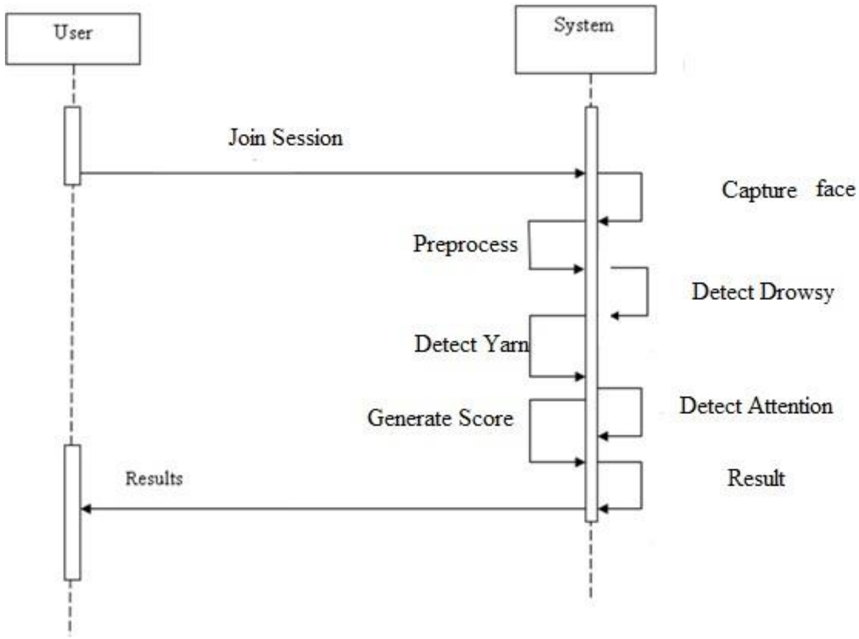

Fig.5.5.1 : Sequence Diagram

The Real Time Attention Span Tracking System sends real-time updates to the Online Instructor's dashboard, which displays the Student's attention level and engagement, as well as attendance data.

The Online Instructor can use this information to adjust their teaching style and engage with the Student if they notice a drop in their attention level.

Overall, the sequence diagram shows how the Real Time Attention Span Tracking System provides real-time feedback to the Online Instructor on the Student's engagement level, allowing them to improve the effectiveness of online education.

5.6 Activity Diagram:

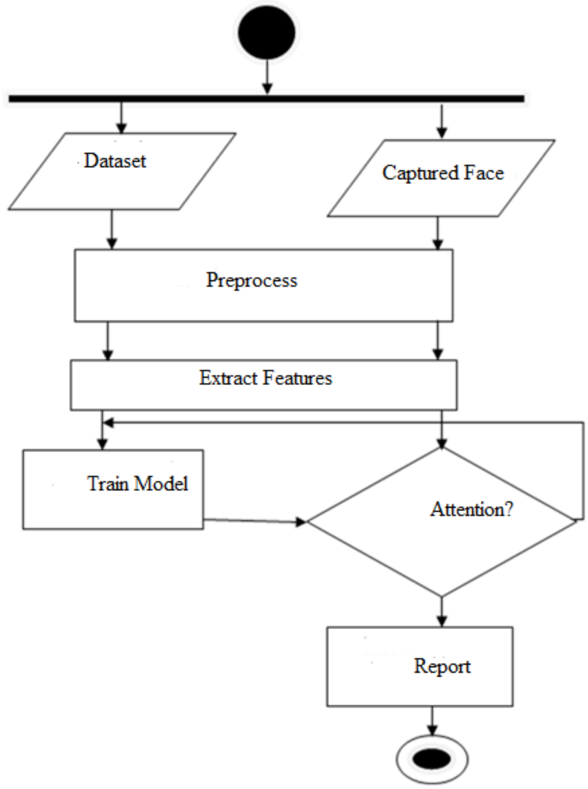

Fig.5.6.1 : Activity Diagram

The Real Time Attention Span Tracking System begins to monitor the Student's attention level using a variety of methods such as eye-tracking, mouse tracking, and facial expression recognition.

The system analyses the attention data to determine the Student's level of engagement in the class .The system updates the Instructor's dashboard with real-time data on the Student's attention level and engagement.

The system ends with the End activity. Overall, the activity diagram shows how the Real Time Attention Span Tracking System tracks and analyses the Student's attention level in real-time and provides this data to the Instructor, allowing them to adjust their teaching methods to improve the effectiveness of online education.

CHAPTER-6
IMPLEMENTATION

CHAPTER-6

IMPLEMENTATION

6.1 METHODOLOGY:

We are planning to implement this project using the following steps.

1. To detect Facial Landmark we are using Haar cascade algorithm.
2. To Face Recognition we are using LBPH algorithm
3. To detect body pose we are using CNN or R-CNN

6.1.1 Haar Cascade

Here we will work with face detection. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, haar features shown in below image are used. They are just like our convolutional kernel. Each feature is a single value obtained by subtracting sum of pixels under white rectangle from sum of pixels under black rectangle.

Now all possible sizes and locations of each kernel is used to calculate plenty of features. (Just imagine how much computation it needs? Even a 24x24 window results over 160000 features). For each feature calculation, we need to find sum of pixels under white and black rectangles. To solve this, they introduced the integral images. It simplifies calculation of sum of pixels, how large may be the number of pixels, to an operation involving just four pixels. Nice, isn't it? It makes things super-fast.

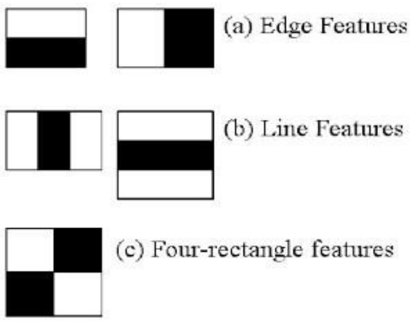

Fig 6.1.1 : Haar Features extraction

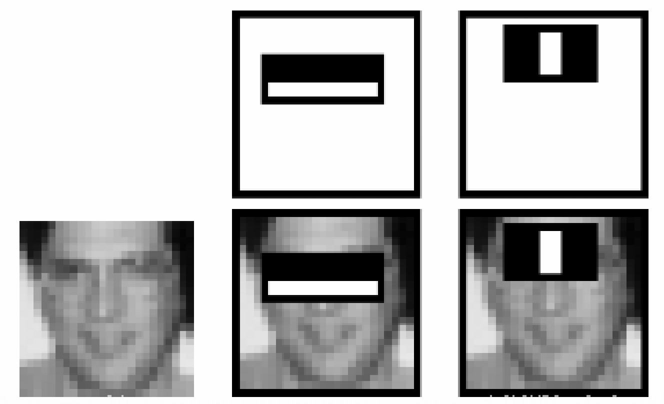

Fig 6.1.2 : Feature Mapping

6.1.2 LBPH

Local Binary Patterns Histogram algorithm. It is based on local binary operator. It is widely used in facial recognition due to its computational simplicity and discriminative power.

The steps involved to achieve this are:

- creating dataset
- face acquisition
- feature extraction
- Classification

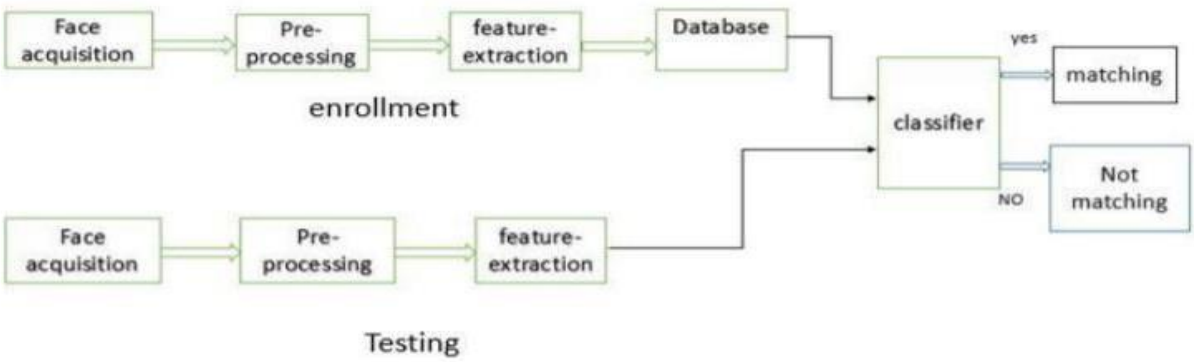

Fig 6.1.3 : LBPH architecture

STEPS:

- Suppose we have an image having dimentions N x M.
- We divide it into regions of same height and width resulting in m x m dimension for every region.
- Local binary operator is used for every region. The LBP operator is defined in window of 3x3.

$$LBP(x_c, y_c) = \sum_{p=0}^{P-1} 2^p s(i_p - i_c)$$

- here '(Xc,Yc)' is central pixel with intensity 'Ic'. And 'In' being the intensity of the neighbor pixel.
- Using median pixel value as threshold, it compares a pixel to its 8 closest pixels using this function.

$$s(x) = \begin{cases} 1, & x \geq 0 \\ 0, & x < 0 \end{cases}$$

- If the value of neighbor is greater than or equal to the central value it is set as 1 otherwise it is set as 0.
- Thus, we obtain a total of 8 binary values from the 8 neighbors.
- After combining these values we get a 8 bit binary number which is translated to decimal number for our convenience.
- This decimal number is called the pixel LBP value and its range is 0-255.

6.1.3 CNN

OpenPose also uses CNN as its main architecture. It consists of a VGG-19 convolutional network that is used to extract patterns and representations from the given input. The output from the VGG-19 goes into two branches of convolutional networks.

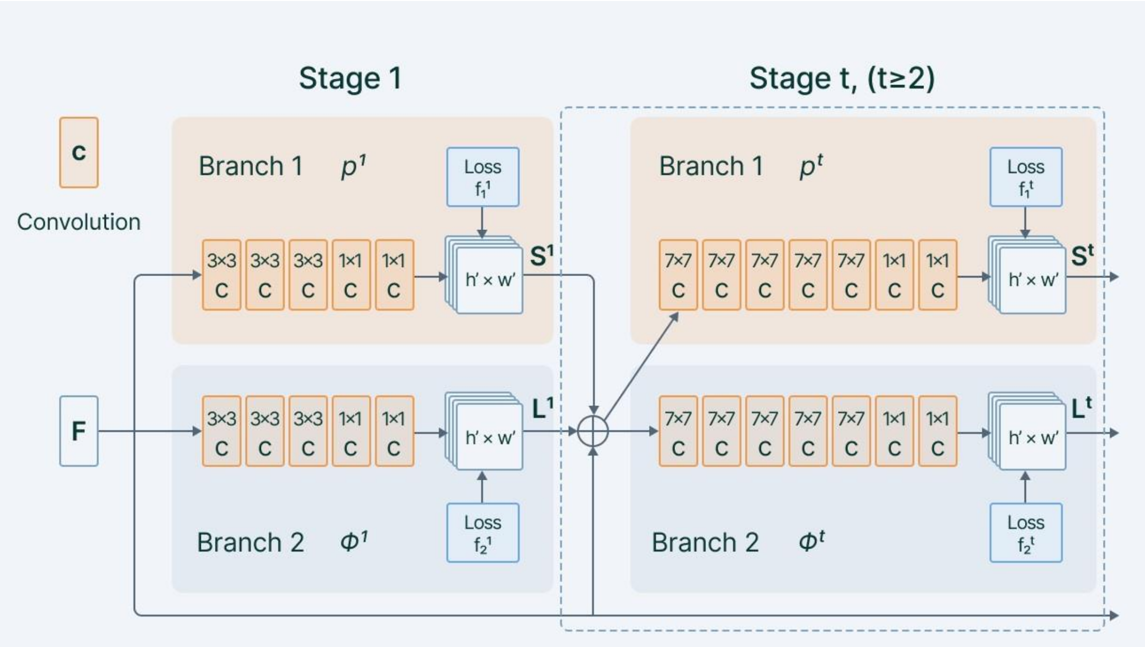

Fig no 6.1.4 : Open Pose Architecture

6.2 MODULES DESCRIPTION

We have implemented this project using following modules.

1. Facial Landmark Detection
2. Blink Rate Detection
3. Eye-gaze Tracking
4. Emotion Classification
5. Overall score Calculation

6.2.1 Facial Landmark Detection

Face detection is implemented using the Viola-Jones algorithm, which uses a windowing mechanism to scan images for identifying features of human faces. The project provides an efficient real-time approach to extract 68 key points from the detected face image using OpenCV's dlib library as shown in following figure We use rectangular regions to extract Haar features from the image. The landmarks are classified into five categories of facial features: eyebrows, eyes, nose, mouth, and jaw, which are denoted sequentially using the key points. We will be using these individual landmark features as inputs to further modules. We can improve the accuracy of the face detection module by computing more number of key points. However, this increases the processing time.

Pseudo code:

Facial Landmark Detection

Input: Captured face

Output: Identification of facial features

Step 1: Capture student face

Step 2: Convert into gray

Step 3: Extract the face features using haarcascade classifier.

Step 4: Detect the face landmarks in the frame.

Step 5: Return landmark

6.2.2. Blink Rate Detection

Blink rate is one of the important factors to determine the state of mind - whether the student is actively listening or drowsy during the class. In this module, we crop the regions containing the eye pairs and divide each eye into two halves.

We calculate the Eye Aspect Ratio (EAR) using Euclidean distances for every frame as per Formula (1) to identify whether the eyes are open or closed. We also have a countdown timer, which is activated once a blink is detected, to keep track of the number of seconds the eyes are closed. It can be concluded that the user is feeling drowsy (loss of attention) if the eyes are found to be closed for more than two seconds and an alert will be given both visually and warning alarm sounds.

Pseudo code:

Blink Rate Detection

Input: Eye Co-ordinates

Output: Drowsy score

Step 1: Capture student face

Step 2: Read eye coordinates

Step 3: calculate eye width and height.

Step 4: Apply Euclidean distance formula to detect the eye blinking ratio .

Step 5: Return Drowsy score

6.2.3. Eye-gaze Tracking

The eye-gaze of a student is tracked to determine where he is looking at and is often closely associated with the distraction level of the student. we analyze the extracted eye region coordinates for rectangular features to identify eye regions containing the pupil. The pupil coordinates (x, y) of each eye are calculated and mapped to determine the eye gaze direction. Based on the resolution of the screen, we have established two possible classes of eye gaze: looking at the screen and looking away (right or left). We collected 150 images with two different classes: looking straight and looking away. Our model was able to classify the eye gaze correctly for 113 images with an accuracy of 75.33%.

Pseudo code:

Eye Gaze Tracking

Input: Eye Co-ordinates

Output: eye moment score

Step 1: Capture student face

Step 2: Read eye coordinates

Step 3: Detect eye pupil.

Step 4: Measure eye pupil movements.

Step 5: Return eye pupil movement score.

6.2.4. Emotion Classification

The emotion of the person attending the online class plays a major role in his attention level. This study uses facial features such as eyes, nose, and mouth, extracted using Haarcascade classifier and facial landmark detector. Mini exception algorithm is used to classify the emotion of the students into seven different classes - angry, disgust, fear, happy, sad, surprise, and neutral.

Pseudo code:

Emotion detection

Input: face image

Output: Emotion score

Step 1: Capture student face

Step 2: Convert to gray

Step 3: Extract the face features.

Step 4: Apply Miniexception model.

Step 5: Detect the emotion

Step 6: Return emotion score.

6.2.5. Overall Attention level Detection

All the scores from the above parameter scores (blink rate detection, eye gaze tracking, emotion classification, body posture estimation, and background noise detection) are normalized to calculate the attention score as per Formula (2). with the predicted attention level of the student along with the scores for each parameter updated in real-time. We do not use face recognition in the scoring method because it does not contribute to determining the attention level of the student; rather we use it for biometric authentication and automated attendance of the students.

$$Att = \frac{\sum score(i)}{n} * 100 \qquad (2)$$

Pseudo code:

Overall Attention score

Input: All the scores from previous modules

Output: Attention score

Step 1: Read all score

Step 2: Calculate average of it

Step 3: Return attention score.

6.3 SOURCE CODE

```
import cv2
import os
from keras.models import load_model
from keras.preprocessing.image import img_to_array
import numpy as np
from pygame import mixer
```

```
import time
mixer.init()
sound = mixer.Sound('alarm.wav')
face = cv2.CascadeClassifier('haar cascade files\haarcascade_frontalface_alt.xml')
leye = cv2.CascadeClassifier('haar cascade files\haarcascade_lefteye_2splits.xml')
reye = cv2.CascadeClassifier('haar cascade files\haarcascade_righteye_2splits.xml')
lbl=['Close','Open']

model = load_model('models/cnncat2.h5')

emotion_model_path = 'models/_mini_XCEPTION.106-0.65.hdf5'
detection_model_path = 'haarcascade_files/haarcascade_frontalface_default.xml'
face_detection = cv2.CascadeClassifier(detection_model_path)
emotion_classifier = load_model(emotion_model_path, compile=False)
EMOTIONS = ["angry" ,"disgust","scared", "happy", "sad", "surprised","neutral"]
harcascadePath = "haarcascade_frontalface_default.xml"
faceCascade = cv2.CascadeClassifier(harcascadePath);
path = os.getcwd()
cap = cv2.VideoCapture(0)
font = cv2.FONT_HERSHEY_COMPLEX_SMALL
count=0
score=0
thicc=2
rpred=[99]
lpred=[99]
label=""
while(True):
    ret, frame = cap.read()
    height,width = frame.shape[:2]
     gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
   faces = face.detectMultiScale(gray,minNeighbors=5,scaleFactor=1.1,minSize=(25,25))
```

```
left_eye = leye.detectMultiScale(gray)
    right_eye =  reye.detectMultiScale(gray)
     cv2.rectangle(frame, (0,height-50) , (200,height) , (0,0,0) , thickness=cv2.FILLED )
    escore=0
    if len(faces)>0:
        for (x,y,w,h) in faces:
            cv2.rectangle(frame, (x,y) , (x+w,y+h) , (100,100,100) , 1 )
            roi = gray[y:y + h, x:x + w]
            roi = cv2.resize(roi, (48, 48))
            roi = roi.astype("float") / 255.0
            roi = img_to_array(roi)
            roi = np.expand_dims(roi, axis=0)
            preds = emotion_classifier.predict(roi)[0]
            emotion_probability = np.max(preds)
            label = EMOTIONS[preds.argmax()]
            print("Label==",label)
            for (x,y,w,h) in right_eye:
            r_eye=frame[y:y+h,x:x+w]
            count=count+1
            r_eye = cv2.cvtColor(r_eye,cv2.COLOR_BGR2GRAY)
            r_eye = cv2.resize(r_eye,(24,24))
            r_eye= r_eye/255
            r_eye=  r_eye.reshape(24,24,-1)
            r_eye = np.expand_dims(r_eye,axis=0)
            rpred = model.predict_classes(r_eye)
            if(rpred[0]==1):
                lbl='Open'
            if(rpred[0]==0):
               lbl='Closed'
              break
```

```
for (x,y,w,h) in left_eye:
    l_eye=frame[y:y+h,x:x+w]
    count=count+1
    l_eye = cv2.cvtColor(l_eye,cv2.COLOR_BGR2GRAY)
    l_eye = cv2.resize(l_eye,(24,24))
    l_eye= l_eye/255
    l_eye=l_eye.reshape(24,24,-1)
    l_eye = np.expand_dims(l_eye,axis=0)
    lpred = model.predict_classes(l_eye)
    if(lpred[0]==1):
        lbl='Open'
    if(lpred[0]==0):
        lbl='Closed'
    break

if(rpred[0]==0 and lpred[0]==0):
    score=score+1
    cv2.putText(frame,"Closed",(10,height-20), font, 1,(255,255,255),1,cv2.LINE_AA)
# if(rpred[0]==1 or lpred[0]==1):
else:
    score=score-1
    cv2.putText(frame,"Open",(10,height-20), font, 1,(255,255,255),1,cv2.LINE_AA)

if lpred[0]==0:
    escore=0
else:
    if label=="happy":
        escore=100
    elif label=="surprised":
        escore=80
```

```
        elif label=="neutral":
            escore=50
        elif label=="angry":
            escore=30
        elif label=="sad":
            escore=20
        elif label=="disgust":
            escore=10
        else:
            escore=70
    if(score<0):
        score=0
    cv2.putText(frame,'Score:'+str(score),(100,height-20), font,
1,(255,255,255),1,cv2.LINE_AA)
    cv2.putText(frame,'Overall Score:'+str(escore)+"/100",(350,height-20), font,
1,(255,255,255),1,cv2.LINE_AA)
    if(score>15):
        cv2.imwrite(os.path.join(path,'image.jpg'),frame)
        try:
            sound.play()
    except: # isplaying = False
            pass
        if(thicc<16):
            thicc= thicc+2
        else:
            thicc=thicc-2
            if(thicc<2):
                thicc=2
        cv2.rectangle(frame,(0,0),(width,height),(0,0,255),thicc)
  else:
```

```
 cv2.putText(frame,'No Face Detected',(100,height-20), font,
1,(255,255,255),1,cv2.LINE_AA)

    cv2.imshow('frame',frame)
    if cv2.waitKey(1) & 0xFF == ord('q'):
        break
cap.release()
cv2.destroyAllWindows()
```

CHAPTER-7
TESTING

CHAPTER-7

TESTING

SYSTEM TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the

Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

7.1 TYPES OF TESTS

7.1.1 Unit testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated.

7.1.2 Integration testing

Integration tests are designed to test integrated software components to determine if they actually run as one program .Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent.

7.1.3 Functional test

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

Valid Input : identified classes of valid input must be accepted.

Invalid Input : identified classes of invalid input must be rejected.

Functions : identified functions must be exercised.

Output : identified classes of application outputs must be exercised.

Systems/Procedures: interfacing systems or procedures must be invoked.

7.1.4 White Box Testing

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

7.1.5 Black Box Testing

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box .you cannot “see” into it. The test provides inputs and responds to outputs without considering how the software works.

7.1.6 Test strategy and approach

Field testing will be performed manually and functional tests will be written in detail.

7.1.7 Test objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, messages and responses must not be delayed.

7.1.8 Features to be tested

- Verify that the entries are of the correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

Test Results: All the test cases mentioned above passed successfully. No defects encountered.

7.2 Test Cases

Table no 7.1: Test case 1

Test Case#	UTC01
Test Name	User input format
Test Description	To test user input as face
Input	User’s face
Expected Output	It should read capture and display on screen
Actual Output	Captured and display on screen
Test Result	Success

Table no 7.2: Test Case 2

Test Case#	UTC02
Test Name	User input format
Test Description	To test user input as face
Input	null
Expected Output	Idle state
Actual Output	Idle state
Test Result	Success

Table no 7.3: Test case 3

Test Case#	UTC03
Test Name	Attention tracking
Test Description	To test weather it is detecting drowsiness and emotion or not?
Input	Face
Expected Output	It Should predict attention score based on the training
Actual Output	Predicted Attention closer to training algorithm and display result
Test Result	Success

Table no 7.4: Test case 4

Test Case#	UTC04
Test Name	Test case for importing valid python libraries
Test Description	To test whether an algorithm to implement congestion nodes works without sklearn and scikit-learn, keras, tensorflow models
Input	Import all valid libraries sklearn, keras, tensorflow models libraries
Expected Output	An error should be thrown specifying “error importing libraries sklearn, keras, tensorflow models”
Actual Output	An error is thrown
Test Result	Success

CHAPTER-8

CONCLUSION AND FUTURE ENHANCEMENT

CHAPTER-8

CONCLUSION AND FUTURE ENHANCEMENT

we have implemented a system to tackle the issues involved in online education using five parameters. We used the face recognition model to verify the student attending the online class. We used the other five parameters - blink rate, eye gaze, emotion, posture, and noise level to calculate the attention level of the student throughout the lecture. Since this involves real-time processing, we have implemented and used lightweight models to reduce the processing time. We visualize the scores in the form of a live graph and generate automated reports. The feedback generated can be used for: 1) Evaluating student performance 2) Improving teaching standards 3) Preventing malpractice during online examinations As a part of future works, we can improve our system's performance further by training our models using more data. Also, the same attention tracking mechanism can be further optimized to simultaneously work with multiple subjects in a classroom using video footage from the CCTV cameras. Moreover, we have used human observed attention scores as ground truth-values as we currently do not have any dataset for measuring the attention span during online lectures. A standard dataset can help to evaluate the system's performance more reliably.

Real-time attention span tracking in online education has the potential for several future works. Integrating attention span tracking with LMS can provide insights to both students and instructors about the effectiveness of the course content and their engagement levels. Attention span tracking can help in identifying areas of interest and disinterest among students. This can enable personalized learning by tailoring course content to individual students' needs and preferences. Attention span tracking data can be integrated with adaptive learning systems to provide more accurate and personalized recommendations. Attention span tracking data can be integrated with gamification techniques to provide more effective engagement incentives.

BIBLIOGRAPHY

[1] Mark B. Abelson, MD, CM, FRCSC, ORA staff, Andover, Mass, It's Time to Think About the Blink, Review of Ophthalmology June 2011.

[2] Liping Shen, Minjuan Wang, and Ruimin Shen, "Affective e-Learning: Using "Emotional" Data to Improve Learning in a Pervasive Learning Environment", International Forum of Educational Technology & Society 2009.

[3] Bixler, R., D'Mello, S. Automatic gaze-based user-independent detection of mind wandering during computerized reading. User Model User-Adap Inter 26, 33–68 2016.

[4] Smallwood, J., Fishman, D.J. & Schooler, J.W. Counting the cost of an absent mind: Mind wandering as an underrecognized influence on educational performance. Psychonomic Bulletin & Review 14, 230– 236 2007.

[5] M. Ramzan, H. U. Khan, S. M. Awan, A. Ismail, M. Ilyas, and A. Mahmood, "A Survey on State-of-the-Art Drowsiness Detection Techniques," in IEEE Access, vol. 7, pp. 61904-61919, 2019.

[6] Zhen Zhang, Yuan Zhang, An Experimental Study on the Influence of Environmental Noise on Students' Attention, EuroNoise 2018 conference.

[7] S. Sawhney, K. Kacker, S. Jain, S. N. Singh, and R. Garg, "Real-time Smart Attendance System using Face Recognition Techniques," 2019 9th International Conference on Cloud Computing, Data Science & Engineering (Confluence), Noida, India, 2019, pp. 522-525.

[8] Eric-Juwei Cheng, Kuang-Pen Chou, Shantanu Rajora, Bo-Hao Jin, M. Tanveer, Chin-Teng Lin, Ku-Young Young, Wen-Chieh Lin, Mukesh Prasad, Deep Sparse Representation Classifier for facial recognition and detection system.

[9] Stanley, Darren, "Measuring attention using Microsoft Kinect" (2013). Thesis. Rochester Institute of Technology.

[10] C. Morimoto, D. Koons, A. Amir, and M. Flickner, "Pupil detection and tracking using multiple light sources," Image Vis. Comput, vol. 18, no. 4, pp. 331–336, 2008.

APPENDIX

SNAPSHOTS

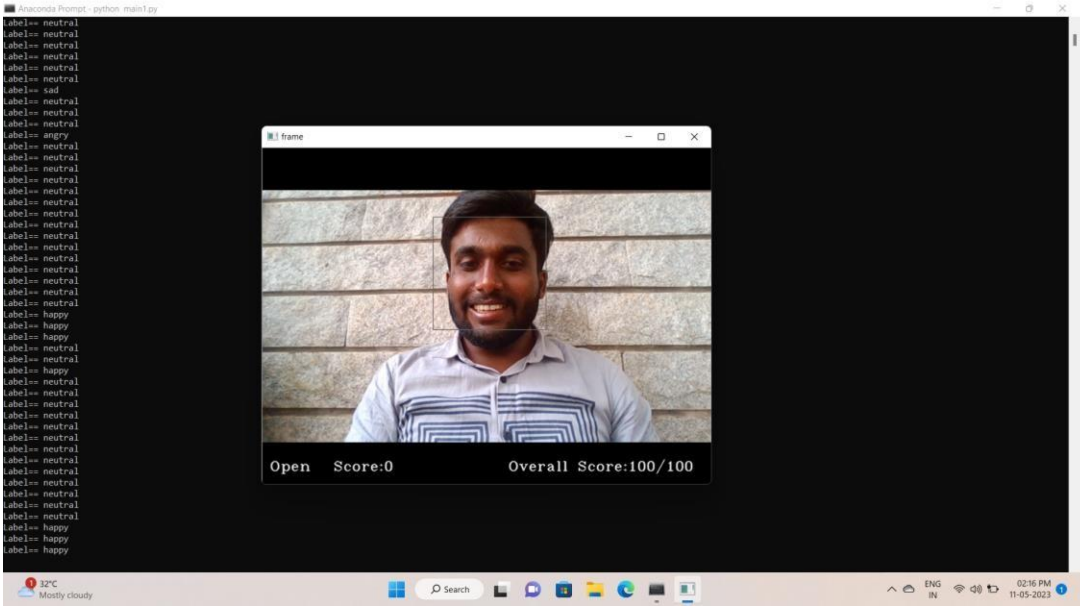

Fig no 9.1: Student at happy mode

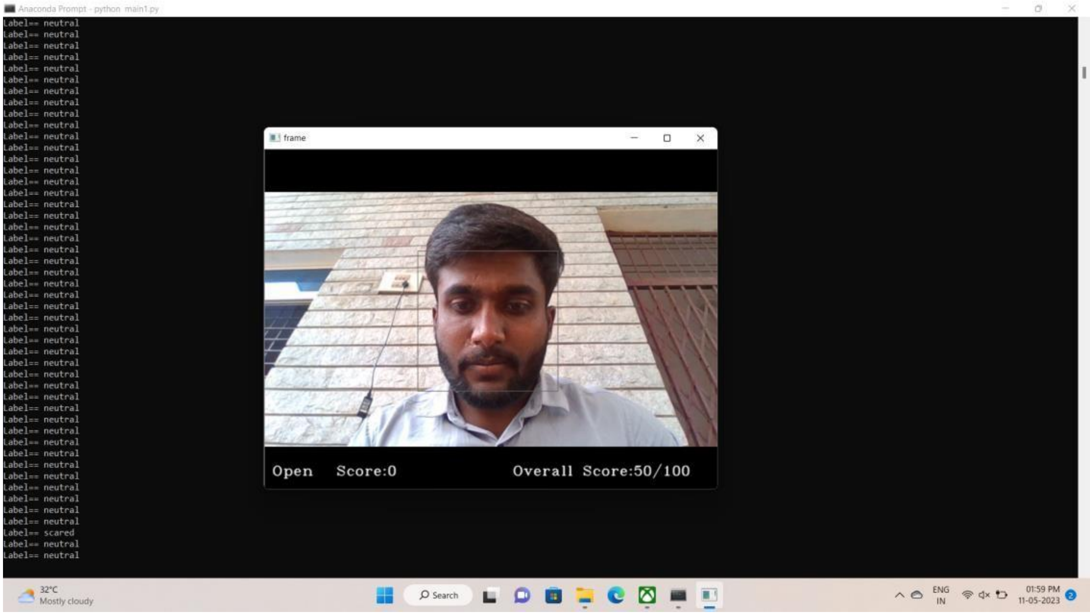

Fig no 9.2: Student at neutral mode

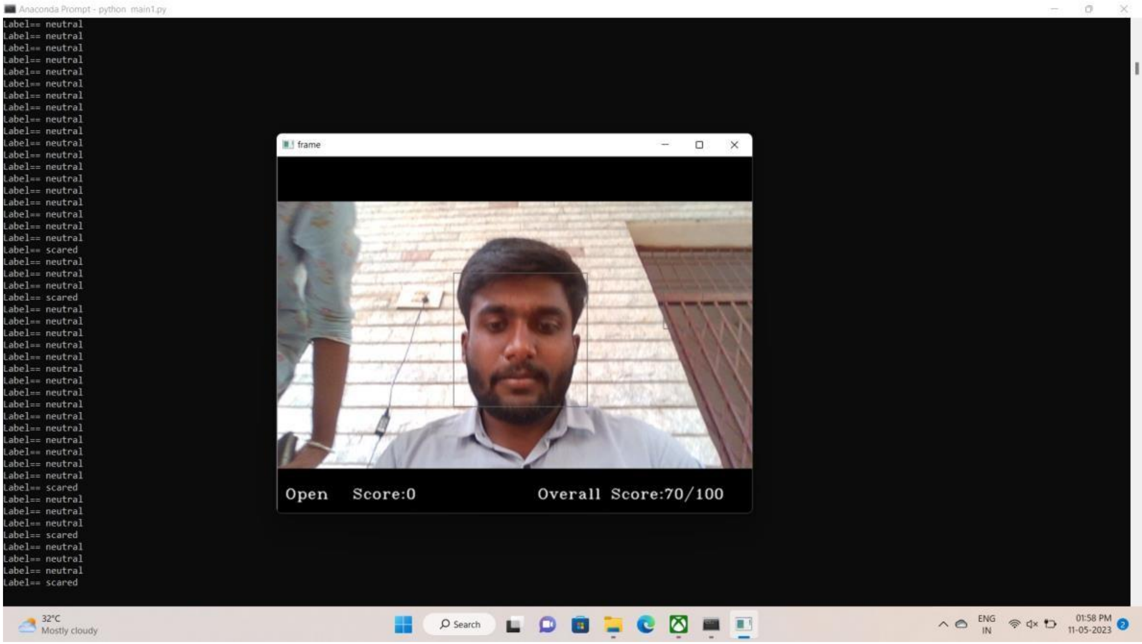

Fig no 9.3: Student at Scared mode

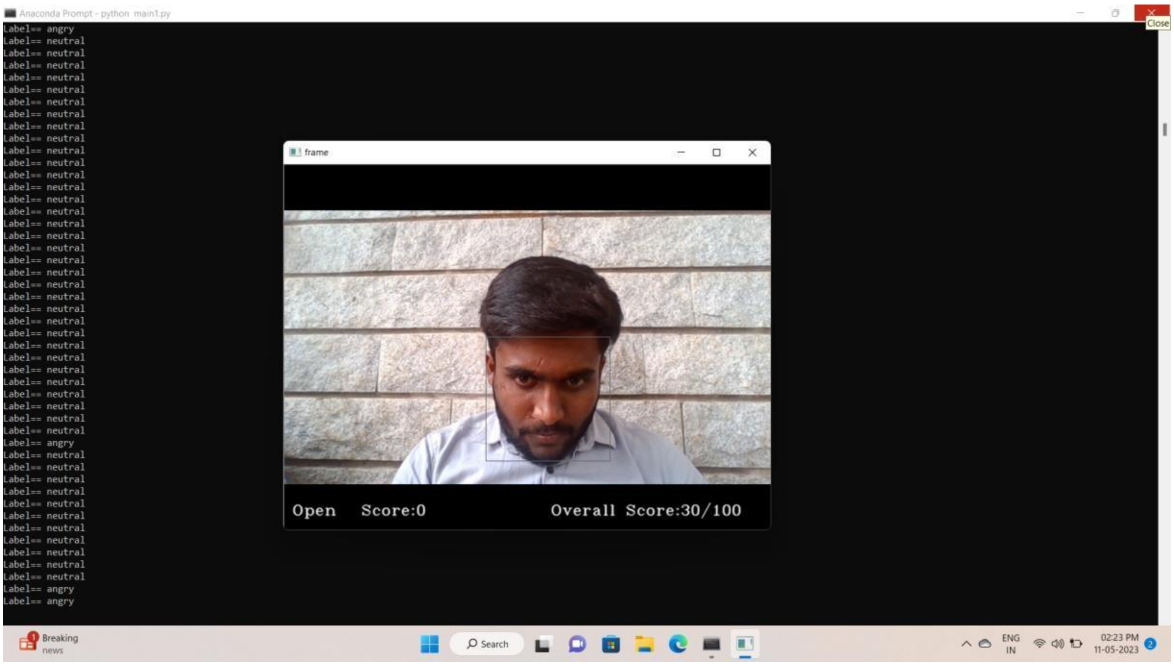

Fig no 9.4: Student at Angry mode

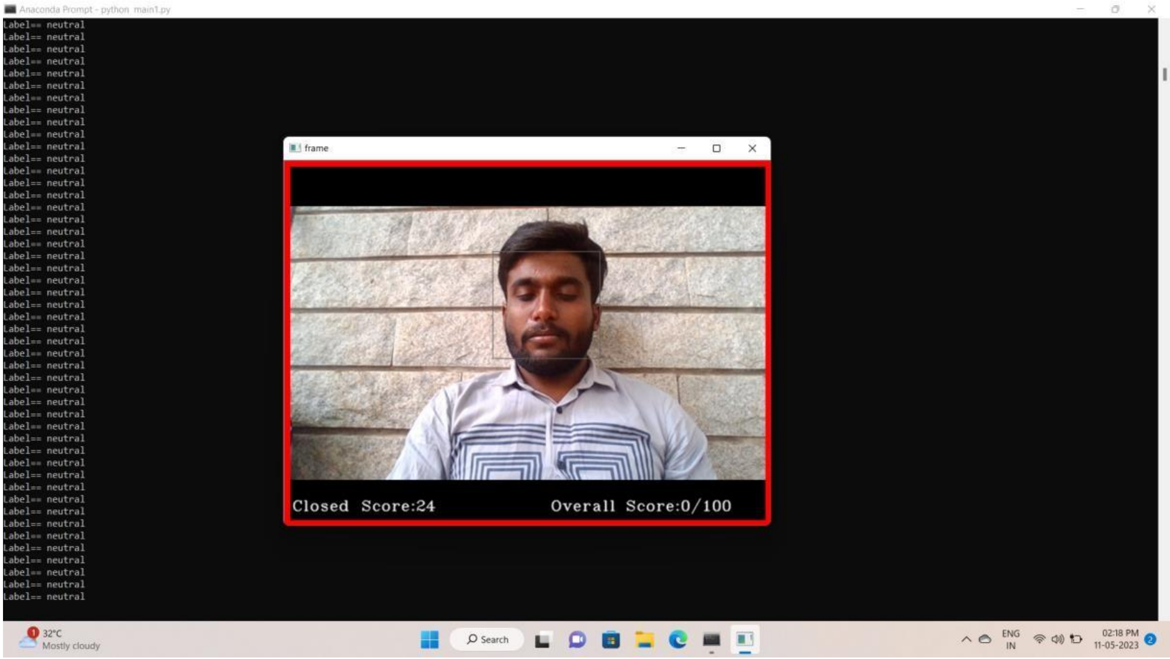

Fig no 9.5: Student at Sleepy mode

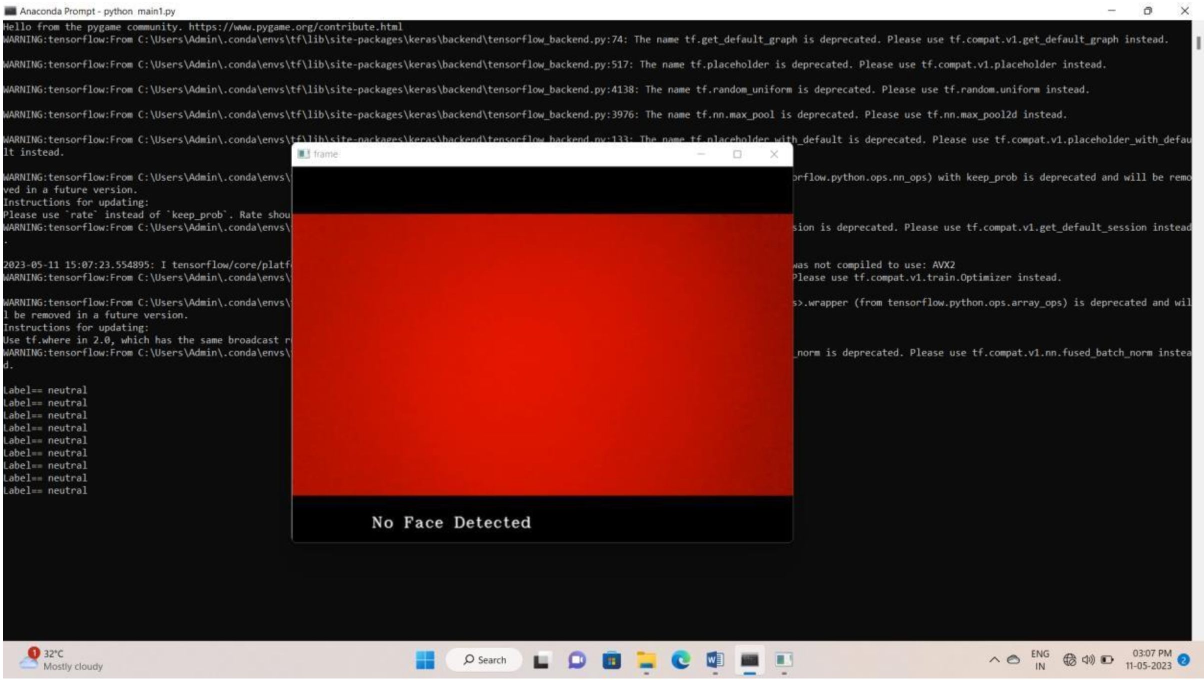

Fig no 9.6: No Face Detected

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Real-time Attention Span Tracking in Online Education

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Abstract: *Over the last decade, e-learning has revolutionized how students learn by providing them access to quality education whenever and wherever they want. However, students often get distracted because of various reasons, which affect the learning capacity to a great extent. Many researchers have been trying to improve the quality of online education, but we need a holistic approach to address this issue. This project intends to provide a mechanism that uses the camera feed and microphone input to monitor the real-time attention level of students during online classes. We explore various image processing techniques and machine learning algorithms throughout this study. We propose a system that uses five distinct non-verbal features to calculate the attention score of the student during computer based tasks and generate real-time feedback for both students and the organization.*

Keywords: Artificial Intelligence, Attention, Blink rate, Drowsiness, Eye gaze tracking, Emotion classification, Face recognition, Body Posture estimation, Noise detection.

I. INTRODUCTION

The demand and need for online education are increasing rapidly. Almost all the schools and colleges throughout the world have shifted to the online mode of lectures and exams due to the recent corona virus outbreak, and this trend will most likely continue in the upcoming years. The increasing demand for online education opens the gate to automation in the field. One major issue in the online mode of lectures is that students tend to lose their concentration after a certain period and there is no automated mechanism to monitor their activities during the classes. Some students tend to just start a lecture online and move away from the place, or might even use a proxy to write online tests for them. This situation also takes place in online course platforms such as EdX and Coursera where the student tries to skip lectures just for the sake of completion and certification. The loss in concentration not only affects the student's knowledge level but also hurts the society by producing low-skilled laborers.

II. LITERATURE SURVEY

The demand and need for online education are increasing rapidly. Almost all the schools and colleges throughout the world have shifted to the online mode of lectures and exams due to the recent corona virus outbreak, and this trend will most likely continue in the upcoming years. The increasing demand for online education opens the gate to automation in the field. One major issue in the online mode of lectures is that students tend to lose their concentration after a certain period and there is no automated mechanism to monitor their activities during the classes. Some students tend to just start a lecture online and move away from the place, or might even use a proxy to write online tests for them. This situation also takes place in online course platforms such as EdX and Coursera where the student tries to skip lectures just for the sake of completion and certification. The loss in concentration not only affects the student's knowledge level but also hurts the society by producing low-skilled laborers.

Objectives of Literature Survey

Learning the definitions of the concepts.
Access to latest approaches, methods and theories.
Discovering research topics based on the existing research
Concentrate on your own field of expertise– Even if another field uses the same words, they usually mean completely.

It improves the quality of the literature survey to exclude sidetracks– Remember to explicate what is excluded.
Before building our application, the following system is taken into consideration:
A Survey on State-of-the Art-Drowsiness Detection Techniques. SVM, Hidden Markov Model, CNN.
An Experimental Study on the Influence of Environmental Noise on Students Attention. Visual tracking test.
Some of these problems include:

Accuracy and reliability: One of the biggest challenges with real-time attention span tracking is ensuring that the system is accurate and reliable. Existing systems use various sensors and algorithms to track attention, but these can sometimes be prone to errors or inaccuracies.
Interpretation and analysis: Even if the attention tracking data is accurate, it can be difficult to interpret and analyze the data to determine the underlying causes of attention lapses. For example, a student may lose focus because they are bored with the material, or because they are struggling to understand it.
Privacy and ethical concerns: Attention tracking systems can potentially be intrusive and raise privacy concerns, especially if they involve the use of cameras or other invasive sensors. There are also ethical concerns related to the use of such systems, such as the potential for bias or discrimination based on the data collected.
Integration with existing systems: Real-time attention tracking systems need to be integrated with existing online education platforms, such as learning management systems (LMS), to be effective. However, this can be a challenging task, especially if the platform does not provide the necessary APIs or data access points.
Cost and scalability: Implementing a real-time attention tracking system can be costly, especially if it involves developing custom hardware or software solutions. Additionally, scaling such a system to accommodate a large number of users can be a significant challenge, especially if it requires significant infrastructure and computing resources.

III. PROBLEM STATEMENT

The demand and need for online education are increasing rapidly. Almost all the schools and colleges throughout the world have shifted to the online mode of lectures and exams due to the recent corona virus outbreak, and this trend will most likely continue in the upcoming years. The increasing demand for online education opens the gate to automation in the field. One major issue in the online mode of lectures is that students tend to lose their concentration after a certain period and there is no automated mechanism to monitor their activities during the classes. Some students tend to just start a lecture online and move away from the place, or might even use a proxy to write online tests for them.

IV. PROPOSED SYSTEM:

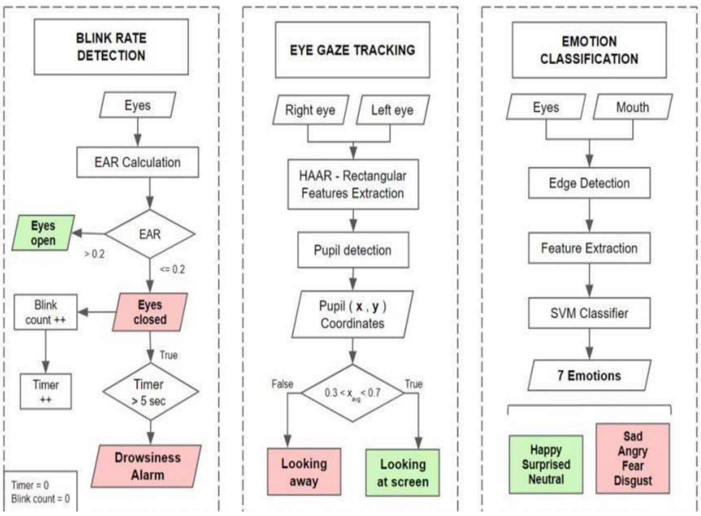

Fig-1: Work flow

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Haar Cascade:

Here we will work with face detection. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, haar features shown in below image are used. They are just like our convolutional kernel. Each feature is a single value obtained by subtracting sum of pixels under white rectangle from sum of pixels under black rectangle.

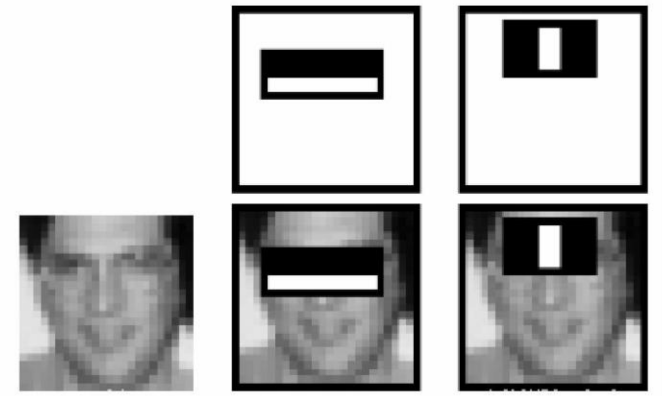

Fig-2: Feature Mapping

Local Binary Patterns Histogram algorithm. It is based on local binary operator. It is widely used in facial recognition due to its computational simplicity and discriminative power.

The steps involved to achieve this are:

- Creating dataset
- Face acquisition
- Feature extraction
- Classification

The LBPH algorithm is a part of open cv.

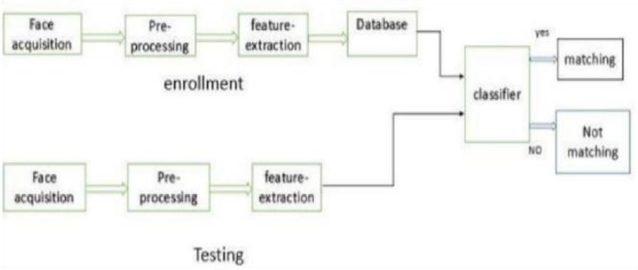

Fig-3: LBPH architecture

CNN

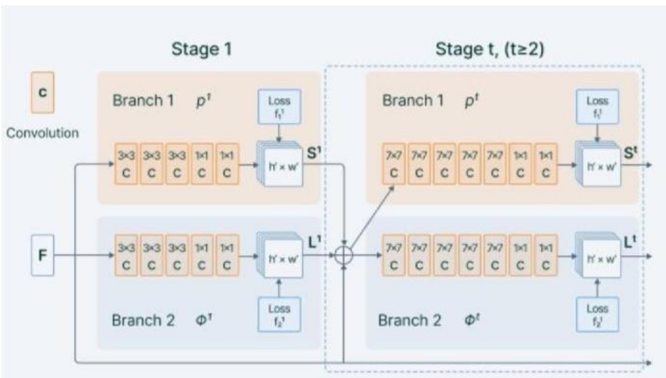

Fig-4: Open Pose Architecture

Open Pose also uses CNN as its main architecture. It consists of a VGG-19 convolutional network that is used to extract patterns and representations from the given input. The output from the VGG-19 goes into two branches of convolutional networks

V. SYSTEM ARCHITECTURE

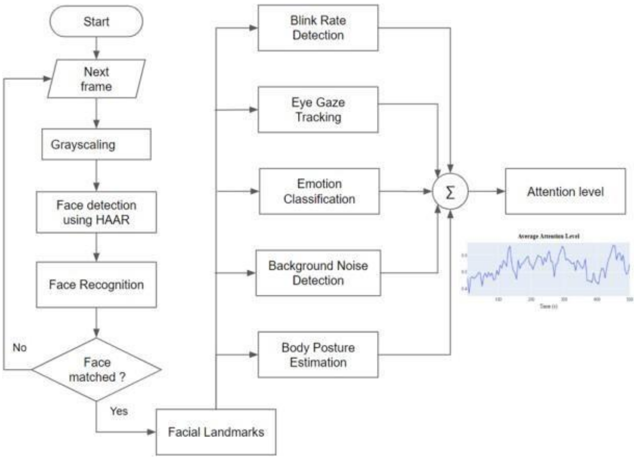

Fig-1: System Architecture

This system makes use of five parameters to calculate the attention-span level of the student attending the online class. Facial recognition is used to validate the student's attendance. The attention span score is calculated using blink rate, facial expression, eye gaze, background noise, and body posture and is updated continuously for a window length of 5 seconds. Instead of sequential execution, all the models required to calculate the attention span are executed in parallel once the online lecture starts.

Data Flow Diagrams

The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.

The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.

DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.

DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.

Level 0:

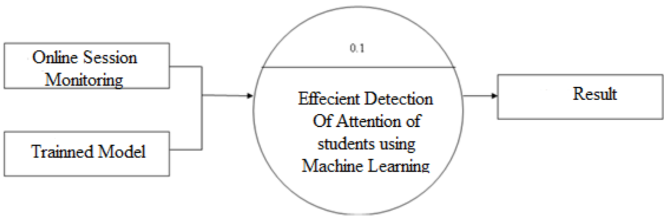

Fig-2: Level 0 Data Flow Diagram

Level 0: describes the overall process of the project. We are passing academic online sessions and its Trained Model as input system will efficiently detect attention spam in the classes using machine learning algorithm.

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Level 1:

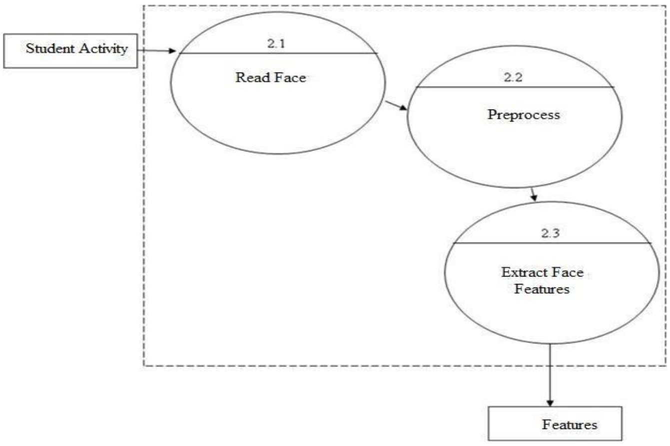

Fig-3: Level 1 Data Flow Diagram

Level 1: describes the first step process of the project. We are passing student activities of online meeting System will read activities and detect the face and preprocess and extract the features like, eyes, nose, mouth etc..

VI. CONCLUSION

We have implemented a system to tackle the issues involved in online education using five parameters. We used the face recognition model to verify the student attending the online class. We used the other five parameters - blink rate, eye gaze, emotion, posture, and noise level to calculate the attention level of the student throughout the lecture. Since this involves real-time processing, we have implemented and used lightweight models to reduce the processing time. We visualize the scores in the form of a live graph and generate automated reports. The feedback generated can be used for: 1) Evaluating student performance 2) Improving teaching standards 3) Preventing malpractice during online examinations As a part of future works, we can improve our system's performance further by training our models using more data. Also, the same attention tracking mechanism can be further optimized to simultaneously work with multiple subjects in a classroom using video footage from the CCTV cameras. Moreover, we have used human observed attention scores as ground truth- values as we currently do not have any dataset for measuring the attention span during online lectures. A standard dataset can help to evaluate the system's performance more reliably.

REFERENCES:

[1]. M. Ramzan, H. U. Khan, S. M. Awan, A. Ismail, M. Iyas, and A. Mahmood, "A Survey on State- of-the-Art Drowsiness Detection Techniques", in IEEE Access, vol. 7, pp. 61904-61919, 2019.

[2]. Zhen Zhang, Yuan Zhang, "An Experimental Study on the Influence of Environmental Noise on Student'sAttention", EuroNoise 2018 conference.

[3]. S. Sawhney, K. Kacker, S. Jain, S. N. Singh, and R. Garg, "Real-time Smart Attendance System using Face Recognition Techniques", 2019 9th International Conference on Cloud Computing, Data Science & .Engineering (Confluence), Noida, India, 2019, pp. 522-525.

[4]. Eric-Juwei Cheng, Kuang-Pen Chou, Shantanu Rajora, Bo-Hao Jin, M. Tanveer, Chin-Teng Lin,Ku- Young Young, Wen-Chieh Lin, Mukesh Prasad,"Deep Sparse Representation Classifier for facial .recognition and detection system".

[5]. D. Yang, Abeer Alsadoona, P.W.C. Prasad*a, A.K. Singh, A. Elchouemi, "An Emotion Recognition Model Based on Facial Recognition in Virtual Learning Environment".

[6]. Zhen Zhang, Yuan Zhang, An Experimental Study on the Influence of Environmental Noise on Students' Attention, EuroNoise 2018 conference.

[7]. S. Sawhney, K. Kacker, S. Jain, S. N. Singh, and R. Garg, "Real-time Smart Attendance System using Face Recognition Techniques," 2019 9th International Conference on Cloud Computing, Data Science & Engineering (Confluence), Noida, India, 2019, pp. 522- 525.

[8]. Eric-Juwei Cheng, Kuang-Pen Chou, Shantanu Rajora, Bo-Hao Jin, M. Tanveer, Chin-Teng Lin, Ku- Young Young, Wen-Chieh Lin, Mukesh Prasad, Deep Sparse Representation Classifier for facial recognition and detection system.

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