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# Automated Human Presence, Body Posture And Walking Style (Gait Cycle) Detection System

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**Abstract –**
In recent years, automated human presence detection systems have gained significant attention in various fields, including surveillance, healthcare, and sports performance analysis. These systems aim to detect human movements and behaviors accurately and efficiently, which can be used for various purposes, such as security monitoring and health diagnosis.
This research presents an idea for detecting human presence, body posture, and walking style (gait cycle) using computer vision techniques. The system utilizes a machine learning-based object detection algorithm to detect human bodies in real-time. Subsequently, the system analyses the body posture and walking style and notifies about their abnormalities. The system is evaluated on a public dataset, and the results show that it achieves high accuracy in detecting human presence, body posture, and walking style. The system has potential applications in various fields, including surveillance, healthcare, and sports performance analysis.

***Keywords***— *presence detection, body posture detection, body walking style detection, gait cycle, face detection, machine-learning, cameras*

## INTRODUCTION

We are now living in an era of technology, where technology has become a part of our daily lives. The development of technology is something that we cannot avoid in this life. Technology is advancing day by day and it can create amazing tools and resources that can help us greatly in our work.
Presence detection technology has transformed various fields, including home automation, security systems, and smart buildings. With advanced machine learning and computer vision algorithms, presence detection systems have become highly accurate and reliable. This research aims to design and implement such a system that can enhance human comfort, safety, and security.
In the medical field, the human body posture and walking style (gait cycle) is another thing, which can be only checked through possible sensors. So, we will implement the checking of human posture and walking style (gait cycle) using cameras.
The problem statement highlights the challenges faced in accurately detecting human presence, body standing posture, and walking style. In many applications such as healthcare, safety, and security, the ability to detect human presence is essential. However, existing methods have limitations, such as the use of motion sensors or infrared sensors.
Similarly, detecting body standing posture accurately can be challenging due to the variability in human postures and positions.
Finally, detecting the walking style (gait cycle) is particularly difficult and requires advanced computer vision and machine learning techniques.
Developing an automated system that can accurately detect human presence, body standing posture, and walking style is essential for enhancing the functionality and effectiveness of many applications.

## LITERATURE REVIEW

In this research paper author made some research on that face of person should by save in face database and after it the system should matches the captured picture by camera which would be treated as object and then match it with picture saved in face database for attendance system. The face recognition-based attendance system in this research paper uses a hybrid feature extraction method using CNN-PCA (Convolutional Neural Network - Principal Component Analysis). This combination of methods is intended to produce a more accurate feature extraction method. This is very effective and efficient way to match result more accurate in real-time environment. In this method face will be detected from object then image will be reconstructed from 2D to 3D using CNN. Then for feature extraction it uses PCA method and for classification method on the proposed face recognition-based attendance system the Mahalanobis method used for accuracy. This method can match up to 98% accurate result of matching. [1]

The researchers made some research about automatic face recognition system for security or commercial applications. In practically this type of system is used for keeping track of employee attendance. Real-time image background subtraction is still a problem, making this a difficult operation. Principal; Component Analysis method is supposed to be high degree accurate and efficient in real-time. This system uses image of employee from database filled while filling enrolment form by employee to mark attendance. This system will keep record of time spend by individual employee in company. This system is basically opposition of traditional manual attendance or leave managing. In this system pictures of individual person will be captured via webcam or camera with different angles while enrolment form and then those images will be cropped or resize and save it in database after it face detection will be performed via Haar-Cascade algorithm. Now face recognition is perform while matching image with database and mark present in excel if matched otherwise mark absent. This method is secure and dependable and it costs very low requirement of only camera and computer. [2]

In this research paper author made some research about monitoring time and attendance of known environment. In this research authors focuses on two-factor approach for attendance via RFID, IoT and machine learning. In this system if known person enters in room then the process will pass through two step factors. A microcontroller, GSM module, RFID tag, an RFID reader are used for first step which is to find RFID card in its range. A camera with Multi-task Cascaded Convolutional Network (MTCNN) model is used for a second step in which face recognition will process. If both processes get matched with database, then the attendance will mark automatically and if not get any validation the notification message will be conveyed to Guardians. The RFID side microcontroller plays a primary role, while images play main role in the machine learning approach. This system will help to make attendance system improved without any consequences. [3]

This paper has some research about marking attendance via face recognition in real time environment like illumination, rotation and scaling. It would be time saving, accurate and cost effective. In this system captured picture will be matched with face database to mark attendance for this system they are using Histogram of Oriented Gradients (HOG) for detection of persons' faces in image and using machine learning algorithm LBPH classifier, for recognition of individual person. [4]

In this research paper authors made some research about overcoming on traditional attendance system issues like fraud while attendance and time wasting. In this paper authors proposed a solution about this that if we take picture of whole class and match it with database of students the most matched face with individual student face will be marked present in attendance sheet automatically. In this system, they are using pre-trained Haar-Cascade model for detection of faces from video or images and uses FaceNet for 128-dimensional encoding of face images due to get safe side from triplet loss. This system will check the similarity between the encodings of multiple face images to check the results that multiple images are coming from same student or not. In this system firstly enrolled picture of student will be save in 128-dimensional encoding in database and for attendance when picture is captured then it will also firstly convert in 128-dimensional encoding then matches with the database of student. This system will be effective, efficient and accurate for known environment in similar condition of captured image. [5]

In this research paper, the authors are mainly focusing on converting the current manual attendance system into an automated attendance system by using computer vision. The main reason to not use the manual system are tracking attendance via records is difficult to manage that are risky and takes a lot of time. The automated system also has add-on function of temperature check and hand sanitization to deal to covid-19 situation. [6]

The researchers proposed research about IoT-based automatic attendance management system using Middleware. In today-era, where technology is being advanced day by day and almost each task is being performed by technology. This research basically focuses on the build of an IoT-based automatic attendance management system for institutions where the attendance of known persons can be marked automatically by their presence that can be detected through an image. The working of the proposed system is, the system will click the picture of known environment and it will automatically detect the presence of persons and mark attendance, monitor it, record it and maintain it for future use by using web services. [7]

In this research paper, the authors proposed research about the development of a Deep Learning-Based Face Recognition System for Attendance System. The main purpose of this system is to reduce the technical and analytical errors from the system by using deep learning. The system will detect human faces and learn them from a live video source taken from a live camera. This system will be developed using Python, OpenCV and Haar Cascade and Deep learning algorithms. This system will be learning automatically until the video source is being provided by using deep learning algorithms and will be providing outputs with the accuracy of approximately 95%. [8]

This paper has some proposed research about the development of Smart Attendance Monitoring System which will use face recognition match the detected image to the database and mark attendance of students. At the time of attendance marking, it will also generate an email and send It to an administrator regarding the status of attendance of that particular student. After a period of time, when the system's recognition camera will be shutting down, all the non-marked (absent) students' names will be called one by one. The system will use HOG face detection algorithm and Cloud service for database storage. [9]

In this research paper, the authors proposed research about Live Automated Attendance System and Voice Assistance. This system will mark the attendance of students one time in a day when the student is present at the institute by recognizing their faces by capturing images and videos whether the light is dull or bright and will update the attendance status in the cloud service automatically. The system uses several methods before processing and after capturing images, that are Image Enhancement, Image Transformation, Image Classification. [10]

Modern meeting room, a smart system to make attendance quickly is mandatory. Most system grant access to each known person but this system help to track right person with the help of machine learning this meeting room uses Internet of Things (IoT) technology. In this system we use the Dib library OpenCV for video camera processing. This system eases the big organization system of attendance it deploys in big organization and it's a hap hazard of big organization to maintain correct record of their employees. By using machine learning, the devices can perform separate types of learning, such as image, voice,

shortest path, video pattern recognition, fault in power transmission systems, patterns in communication systems etc. After this it is very easy to maintain the record. [11]

Identification of any peoples in any organization or colleges for the purpose of attendance marking is one such a software of face recognition. The use of Attendance Management System is to performs the regular activities of attendance marking and analysis with reduced human intervention. In this method the camera is settled and it will capture the image, the faces are recognized after that recognized along with the data base an eternally the attendance is marked. This system is depended on face detection and recognition concept, that detects the employees or student using web cam when they arrive in the office or class room and marks the attendance by recognizing. [12]

The thermal sensor employing MEMS technology has enabled high accuracy, smaller footprint, low-noise, compact size, and contactless measurement in many embedded computing applications. This algo uses presence of human and proper functioning. This is very low and cheap coasting budget and it makes easy to realizing human presence by using Omron D6T-44L06 thermal sensor. This entire prototype has been built over Arduino Nano. The whole project conducted in two phases in first phase they create hardware and second phase they create neural network and this prototype help human presence and it makes easy for realizing human is present or not this very helpful of small startup business. This model has 99.6% efficient which has close to standard case. [13]

Attendance marking in a classroom is a hap hazard and very difficult task for teachers. The conventional method is very old and vulnerable and its expose in large and big classroom. It is difficult to identify the absentees and proxy students in class rooms. In order to overcome the challenges faced in the old one, a web-based mobile attendance system with facial recognition feature is proposed. It is incorporated in different classrooms and tested in large located in classrooms and make it huge impact between old one to new one they can use these devices. Mobile attendance, facial recognition, identification, attendance management. [14]

In this research author researched that there is much difficulty to get posture detected with accuracy. Till yet the posture detection is made on visual image analysis and wearable devices-based signal analysis. So, the author proposed a solution to use sensors with Artificial Intelligence which means to use AI-IoT. On which they implement multiple posture recognition algorithm based on multi-dimension data, along with-it AI algorithm running parallel with this system will generate reliable, effective and accurate result. [15]

Smart attendance system using OpenCV based is very helpful for those organization and institutes which facing difficulties. This model has smart techniques to identify the students in the classroom by facial recognition. This model also helps teachers to identify the students for making proxy of other students. This model integrates a camera that captures an input image, an algorithm for detecting face from an input image, encoding and identifying the face, marking the attendance in a spreadsheet and converting it into PDF file. The training database is created by training the system with the faces of the authorized students. The cropped images are then stored as a database with respective labels. The features are extracted using LBPH algorithm. [16]

To determine whether or not students are actually participating in learning activities, teachers need to be able to observe their students' actions and recognize reliable cues. By using videotaped teaching to highlight which indicators should be considered, teacher training can assist (inexperienced) teachers in developing these skills. However, this assumes that (a) valid indicators of students' engagement in learning are known and (b) work with videos is designed to minimize the effort required for manual coding and video examination. Utilizing recent technological advancements in areas like machine learning to enhance the analysis of classroom videos is one way to address these issues. If automated analyses are used, it may be possible to assess students' attention-related processes through visible indicators of (dis)engagement in learning. As a result, we validated a brand-new manual rating strategy and demonstrated the feasibility of a machine vision-based strategy using pilot classroom recordings of three lessons with university students. Self-reported cognitive engagement, involvement, and situational interest were significantly correlated with the manual rating system, as was predicted performance on a subsequent knowledge test. Estimates of the manual ratings were accurate using the machine vision-based approach, which was based on gaze, head position, and facial expressions. The automated analysis's prediction of post-test variables and correlations with manual ratings were both improved when a synchrony feature was added. The conversation centres around difficulties and significant following stages in bringing the robotized examination of commitment to the home room. [17]

In this research author is proposing work to identify gait cycle which are of 8 sub phases. For this purpose, multiple sensors will be attached to the lower body of the person by which it will be easy to identify the gait cycle, progression angle and covered distance in each step. This system will provide gait analysis for every sub-phase of gait cycle using the limb acceleration and foot pressure data for fast, normal, and slow gait speeds. Basically, this research proposed the high accuracy gait analysis solution using a wearable device and artificial neural networks. [18]

One of the greatest obstacles for educators, researchers, and policymakers is the lack of a system that can assess students' levels of engagement in light of the rise of online and distance learning. A method for determining students' level of engagement is presented here. It was made to work in real time and only makes use of the data provided by the typical built-in web-camera on laptop computers. We combine information about the movements of the eyes and head, and facial emotions to produce a concentration index with three classes of engagement: “very engaged”, “nominally engaged” and “not engaged at all”. The system was tested in a typical e-learning scenario, and the results show that it correctly identifies each period of time where students were “very engaged”, “nominally engaged” and “not engaged at all”. Additionally, the results also show that the students with best scores also have higher concentration indexes. [19]

Face recognition and detection works smarter to reduce workload of daily basis tasks. While a variety of approaches are possible, this technology matches a person's face's features to the database's data based on their recognition. A person's face is a representation of who they are. As a result, we have proposed a full-fledged facial recognition-based automated attendance system. Smart Attendance with Real-Time Face Recognition is a real-world solution that can handle the typical attendance

systems for employees and students. This system uses feature mapping to detect multiple faces, save facial features using feature mapping, and finally performs recognition based on the database. Computer vision will be able to locate and identify human faces in surveillance or webcam-captured images or videos quickly and precisely. While numerous methods and algorithms have been developed to improve face recognition, we have developed a compounded deep learning model to achieve the best results. Faces will be automatically detected, mapped, and recognized as the live video is streamed, and the date and time of their entry will be recorded in the database. In the future, the authorities will be able to easily search the database for all of the information. enhancing the existing systems and developing a more study model for processes that are better and more effective. [20]In this research paper author made some research how to make ideal posture to get relief from back pain problem. They are using flex sensor attached with spinal for knowing about back posture bend. If the posture is abnormal user get notified via buzzer or LCD. The given solution is to get safe from spinal or back bone issues which can be created by poor postures and an individual can monitor its posture continuously. [21]The attendance device was introduced in schools, colleges, and universities to maintain a level playing field and provide students with complete access to information. Traditional methods for elegantly marking college students' attendance exist. One of them involves calling the roll number, and the other involves having college students join a piece of paper to their roll number. Subsequently there has been a need to adjust this gadget in this sort of way that it might develop to be individual well disposed, considerably less time ingesting and proficient. This is a device that works automatically to take attendance of the entire class without causing any disruption or wasting time. In any organization, attendance control of students is a completely lengthy process that can take a significant amount of time. The problem of taking attendance every time by the instructor can also be very time-consuming and exhausting. Additionally, a biometric attendance device is available. We are unable to use a biometric attendance device because of the pandemic. Corona spread will rise in tandem with its use. According to the Centre for Disease Control and Prevention, people could become infected by touching a floor containing the virus, which could also survive for hours without a host. Using a camera, attendance could be recorded in an effort to take pictures of college students and staff. After that, it will mark attendance and evaluate the faces using the Student's and Staff database. The manual labour and discrepancies that would otherwise be associated with attendance maintenance will be significantly reduced by these automatic structures. The idea may include a large amount of software, one of which may include face identification. This software will help keep time and accurately identify and eliminate the chances of proxy attendance. The primary objective of this task is to implement a recognizer set of rules and build an automatic attendance device with the help of Open CV/Python libraries. [22]In the field of computer vision face recognition is making advancement. They fall apart significantly not with-standing true situations, for example, lighting conditions, movement obscure, camera goal, and so on. The empirical comparisons of machine learning open libraries in building attendance taking (AT) support systems employing indoor security cameras known as ATSS are demonstrated in this article. 120 students in five classes who study on the third floor of the FPT Polytechnic College building were recorded using our trial system. In addition to being usable as a school attendance system with CCTV, our design allows for flexible system scaling. The measurement results show that accuracy is suitable for many different environments. [23]In this research paper author made some research about human posture while using hardware and software both. They are using Raspberry pi system with deep learning algorithms. They have stored the normal and abnormal posture of human to give notification to law enforcement if any abnormal activity posture or pattern detects by Raspberry camera. [24]

## METHODOLOGY

In a known environment, In the current manual system, people are busy in their lives that they are unaware of the way of walking and standing in a correct way. This is very dangerous to the human body and health. So, we have proposed a system called "Automated Human Presence, Body Posture and Walking Style (Gait Cycle) Detection System". This system is designed to mark and monitor the presence of known person, monitor posture and walking style, and show status. This system can be used in any known environment like school, colleges, universities, hospitals, etc. The system will work as it will take videos from source and split in frames/images, for presence detection it will match the picture of known person with splitted frames, for posture it will convert the pose of person's body into a 2D vector and analyze and calculate the posture normality or abnormality and for walking style it will convert the walking style from side angle of person into 2D vector and analyze and calculate walking style normality or abnormality. If any abnormality is found in posture or walking style, then the system will show the status to the user.

### A. *System Working Steps*

- ***Video acquisition:*** This system will acquire video data of the environment. It will be possible by using high-resolution cameras.
- ***Human Presence Detection and Recognition:*** The system uses the extracted trees to detect and identify the presence of persons. This can be achieved by using facial recognition and detection systems such as Haar Cascade and LBPH.
- ***Body Posture and Gait Cycle Detection:*** Through person recognition, the system detects normality or abnormality in posture and gait. It will also display the status to the user.
- ***Machine Learning:*** A system can be trained with a large dataset of images or videos to improve the accuracy of the system. This allows the system to better identify human presence.

### B. *Hardware Components*

- ***Surveillance Cameras:*** A camera that records images or videos inside or outside a building or in a public or private place. We will be usings cameras for data capturing, face detection and recognition, posture and walking style detection purposes.

### *C. Software Components*

- ***Development Softwares (IDEs):*** For development of any software, some development tools must need. The different types of softwares and tools that are needed this project are Visual Studio Code, Python, Spyder, etc.
- ***Database Softwares:*** Every system works on some kind of data and that data is stored or being stored on some kind of database. So, for our system, we will use Google Firebase for database. So, for our system, we will be using Google Firebase for the database and its operations for the prototype concept of this project. In the future, the finished product will be running on SQL Database.

### *D. Algorithms*

Algorithms are a set of rules or instructions used to perform operations. We are using the below algorithms.

- ***Haar-Cascade:*** Haar Cascade is a popular object identification algorithm for finding objects in pictures or video streams. It has been effectively used in a few applications, including facial identification, surveillance systems, and image analysis.
  Simple rectangular shapes called Haar-like features signify differences in contrast within an image. These features are computed by subtracting the total pixel intensities within the rectangle's white and black regions. It takes a sizable dataset of both positive and negative images to train the Haar Cascade classifier. Negative photos, unlike positive images, lack the desired item of interest (such as faces). Through training on the dataset, the classifier develops the ability to distinguish between these two classes. The Haar Cascade technique moves a window across the input image at various scales and places throughout the detection stage. The presence or absence of the object is then determined by passing these features through a series of thresholding and filtering operations applied by a cascade of classifiers.
  The Haar Cascade algorithm is a powerful object detection method that makes use of a cascade of classifiers and Haar-like features to find objects in pictures or video streams. It balances speed and accuracy and has achieved substantial success in detection applications.
- ***LBPH:*** LBPH stands for Local Binary Pattern Histogram, it is a face recognition algorithm used to recognize faces. If we talk about accuracy, it is better than the Fisherface and Eigenface algorithms, because the LBPH algorithm recognizes the front face of the person.
  The LBPH algorithm compares the histograms of a facial image with those in a database during recognition. Different distance measures, such as Euclidean distance or Chi-square distance, are used to assess how similar two histograms are to one another.
  In short, is a texture-based method for extracting and representing facial features using binary patterns and histograms. It provides a straightforward but efficient solution for face recognition problems.
- ***Mediapipe:*** Google's Mediapipe machine learning algorithm and framework aims to build emotional pipelines in real-time. Developers can create apps that process and analyze multimedia data such as images, video, and audio on a simple and efficient platform.
  Mediapipe is essentially a graph-based processing approach, where the operation of an algorithm is represented as a directed graph. Each node in the graph performs a specific task, such as feature extraction, data preprocessing, or machine learning inference. These nodes are connected to each other to form a pipeline that enables data to move across the graph and into various processing stages. It provides pre-built modules, such as object recognition, facial recognition, pose estimation, hand tracking, etc. that can be quickly integrated, in addition to providing the developers with the tools to modify and enable executed modules previously implemented successfully.
  All things considered, Mediapipe provides a solid and scalable foundation for building real-time sensory pipelines. It is a useful tool for programmers to build multimedia analysis and machine learning applications due to its graph-based process model, pre-built modules, and customization for different hardware platforms.

### DATA ANALYSIS

The results of the Automated Human Presence, Body Posture, and Walking Style (Gait Cycle) Detection System demonstrate its effectiveness in detecting the human presence, analyzing body postures, and identifying walking styles. The system achieved a high average detection accuracy of up to 90%
Moreover, it successfully identified abnormal body postures and walking styles.
These results highlight the system's potential for applications in healthcare, and sports performance analysis, offering precise and automated monitoring capabilities for enhanced safety, well-being, and performance assessment.

### *E. Results*

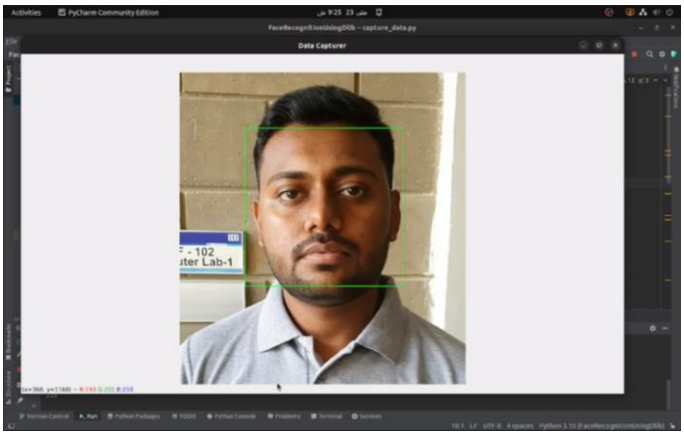
The results of the Automated Human Presence, Body Posture, and Walking Style (Gait Cycle) Detection System demonstrated high accuracy and effectiveness in detecting the human presence, analyzing body posture and walking style. The system achieved an average detection accuracy of up to 80% to 90% in real-time scenarios. Additionally, the system successfully identified abnormal body postures and walking styles.

Each dataset of a person consists of 500 images. So, for test purposes, So, for test purposes, we trained dataset of 2000 images.

| **Person Name** | **Total training images** *( TTI )* | **No. of perfect training images** *( NoPTI )* | **No. of faulty training images** *( NoFTI )* | **Error** ( $\frac{NoFTI}{TTI}$ ) | **Recognition Accuracy** *( min - max )* |
|---|---|---|---|---|---|
| Muhammad Saqib | 500 | 458 | 42 | 0.08% | 74% - 90% |
| Mubbashir Ahmed | 500 | 488 | 12 | 0.02% | 76% - 87% |
| Muhammad Sudaid Khan | 500 | 490 | 10 | 0.02% | 75% - 90% |
| Hafiz Muhammad Osama Saleem | 500 | 482 | 18 | 0.03% | 76% - 87% |

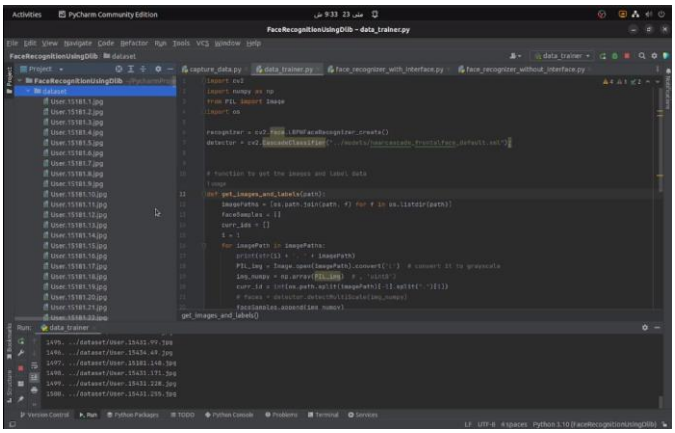
These results affirm the system's potential as a valuable tool in fields such as surveillance, healthcare offering precise and automated monitoring capabilities for enhanced safety, well-being, and performance assessment.

***Data Capture:***



First, it will ask for the ID of a person. After that, it will start the data capturing process by capturing images of a person through any video source. It will split the video into frames and detect the face from the frame using Haar Cascade model. After that, it will capture the image of only the face from that frame and save the captured image in a folder named "dataset" in the local drive for further processing and training. It will capture 500 images of each person and create a dataset.
We can increase the length of the dataset from 500 to the desired length to increase accuracy. In this module, we are using opencv for computer vision to perform image processing tasks.

***Data Trainer:***



After successfully data capturing, we will move to the next module of data training of the captured datasets. It will access all the datasets stored in the folder named "dataset" from the local drive. After successfully accessing all the images, it will start the training process by detecting face from the image and generating the face encodings and saving the encodings in an array with the ID of the person's image. When the process is finished, it will save all the face encodings along with their IDs in a file named "trainer.yml". This file is our trained data file and it will be used for face recognition.
In this module, we are using:

- opencv for computer vision to perform image processing tasks

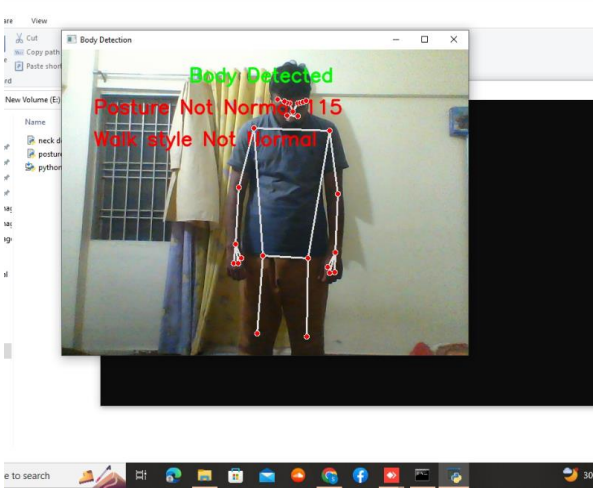
- numpy for array based operations
- PIL for manipulation of images in various formats
- os to perform read and write files in operating system

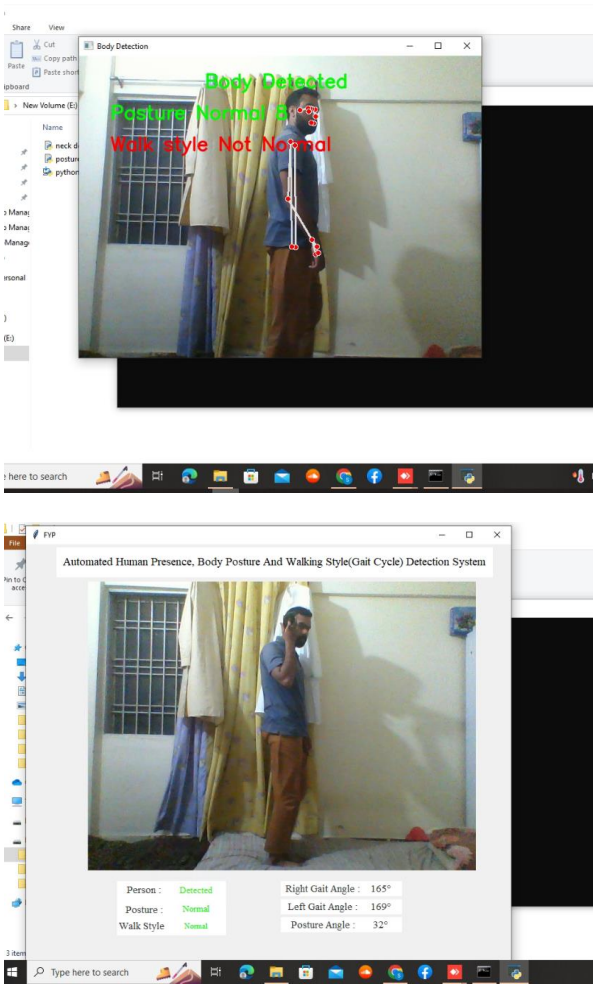
***Face Recognition:***


After successful training of dataset, we will move towards the next module that is face recognition. First, the system will split the video from any source into frames then it will detect any face from the frame. If any face is found then it will generate its encodings and it will match the face encodings from the trained dataset file "trainer.yml" and if any match is found then it will mark the presence of that person into the database.
In this module, we are using:

- opencv for computer vision to perform image processing tasks
- numpy for array based operations
- os for read and write operations in operation system
- firebase for connection and storing the data into firebase database
- datetime for date and time operations
- cvzone for creating the rectangles on every face

***Posture and Walking Style Detection:***






In the module body posture and walking style detection, first, the system will get video from any source, it will split the video into frames, and it will check in the frame if any person is available or not. If any person is found, then it will check the posture of the person. If the person is in the correct posture, then the system will show the status "Normal", if not, it will show "Abnormal". The walking style will also be checked by merging frames and calculations. If the calculations will not match with the correct walking style calculations, then it will show the status as "Abnormal" and if they match then it will show the status "Normal".
In this module, we are using:

- opencv for computer vision to perform image processing tasks
- mediapipe for the detection of body posture and walking style
- math for performing the math calculations

**LIMITATIONS**

It is important to acknowledge that there are some limitations in the proposed system that are stated below.

- *Environmental factors:* The system's accuracy and performance may be affected by environmental factors such as lighting conditions, background clutter, and camera placement. These factors can potentially impact the system's ability to detect and analyze the human presence, body posture, and walking style accurately.
- *Hardware requirements:* The system may require specific hardware components, such as high-performance cameras or sensors, to achieve optimal results. This can limit the system's accessibility and increase implementation costs.
- *Variability in human movement:* Humans exhibit a wide range of body postures and walking styles, which can pose challenges for accurate detection and analysis. The system may have limitations in capturing and interpreting these variations effectively.
- *Privacy considerations:* The system involves capturing and analyzing individuals' body movements, which raises privacy concerns. Security of the collected data with applicable privacy regulations must be implemented.
- *Dependency on training data:* The accuracy and performance of the system's machine learning algorithms rely on the quality and diversity of the training data. Insufficient or biased training data can result in reduced accuracy and limited generalizability of the system.
- *Dress Code:* In the Body Posture and Walking Style module, the dress code should be like shirt or t-shirt and pant or trouser then it will detect the body posture and walking style correctly.

## CONCLUSION

As discussed in the report, the project will work in a closed and known environment. The records/data of the environment will be provided to this system. It will detect the face of each person who is present in the environment using video provided through cameras and after recognition, it will perform presence marking. After that, this system will check the standing posture and walking style of individuals and will notify them about the analyzed posture and walking style abnormalities.

This project is developed for daily use of every organization and every known and closed environment e.g., schools, colleges, universities, offices, clinics, or hospitals.

All the features mentioned were implemented after being carefully taken into consideration. The project was designed and constructed after detailed analysis and study.

The project outcomes serve as a foundation for further advancements in automated human presence detection and analysis, opening new possibilities for enhancing safety, efficiency, and overall well-being.

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