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AI BASED SPORTS TRAINER AND FITNESS GUIDE

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Abstract --- Every year over 10 million people are recorded as obese and over 2.8 million deaths are caused due to obesity. These numbers are elevated even more last two years due to the pandemic and lockdown. This is mainly due to unhealthy food habits and not working out regularly. This has become a major issue all around the world. Gyms and public parks are open now but we are at the tip of the pandemic is no time soon it can be over but any time another pandemic can occur so people are afraid to go out to gyms and public places where many are gathered also private gyms are costly. So this problem is solved using Artificial intelligence by creating an application that can track exercises, suggest diet plans, and can even instruct how to do the exercises. This will be very helpful in tracking exercises and make it even more fun to exercise. In this application it uses a media pipe for human position detection which gives us 34 plot points in the human body to detect using that we can able to identify the angle between legs, arms, and shoulder by using this we will be able to identify and track the exercise

Keywords--- AI, Mediapipe, Pose estimation, OpenCV, Virtual assistant

I.INTRODUCTION

In our work, we introduce Fitcercise, an software that detects the user's workout pose counts the required workout repetitions and gives personalized, distinctive evaluations approximately enhancing the user's frame posture. This is an AI-primarily based totally Workout Assistant and Fitness manual to manual humans who don't have to get right of entry to to the health clubnasium however, are nonetheless inclined to paintings out at domestic to preserve their body and health and maintain their frame in excellent shape.

To assist them in carrying out the exercises efficaciously and save you them from chronicle and immediate injuries. This additionally gives a customized fitness manual and weight loss plan in conjunction with a customized day by day exercising calorie count. The software additionally presentations essential fitness insurances and regulations furnished through the authorities of India for the not unusual place humans and test the eligibility standards the use of API and Web services. Staying at domestic for lengthy durations of time can grow to be boring, specifically whilst maximum a laugh activities are achieved outdoors, that is tough thinking about the current situation of pandemics and lockdown. But this can't be a applicable excuse for being unproductive due to the fact it's far an remarkable concept to make use of the more time we get into our personal fitness.

Most gyms have a extensive form of workout gadget and additionally, have running shoes that manual us approximately the workout and its accurate posture. But the unavailability of the above gadget and running shoes may be an crucial motive that may prevent us from doing the workout at domestic. We aim to construct an AI-primarily based totally instructor that might assist you workout greater effectively to your personal homes. The project specializes in developing an AI set of rules that will help you work out, through figuring out the first-rate and amount of repetitions that is achieved through the use of pose estimation running at the CPU.

This project, with the intention to have a non-distractive interface, intends to make exercise greater smooth and greater fun. We are going to peer a top level view of the contribution of those families, their algorithms, advantages, disadvantages, its efficiency as compared to different present technologies, programs and viable destiny work.

II.LITERATURE SURVEY

[1] **The effectiveness of a personalized virtual fitness trainer in teaching physical education by applying the artificial intelligent algorithm**

Inactivity has been the main cause of obesity which has affected many people worldwide. Studies show that fitness is an important goal for a healthy lifestyle and has been used as a measurement for health-related quality of life. A fitness trainer can motivate and teach users to do fitness activities. However, to use a human fitness trainer may involve high cost and is not suitable for a certain school setting. A personalized virtual fitness trainer has the potential to replace a human trainer whenever possible. It can help physical education teachers in schools to motivate students to exercise. This study discussed the design and development of an AI-based application coined as an Intelligent Virtual Fitness Trainer (IVFIT) as an attempt to provide a personalized physical learning experience for school students

[2] **Smart gym trainer using human pose estimation**

Human body pose estimation or detection in computer vision/graphics is that the study of algorithms, systems, and pre-trained models that recover the pose of an articulated body, which consists of joints and rigid parts using imagebased observations. it's one of the longest-lasting prevalent problems in computer vision the reason being the complexity of the models that relate observation with the pose, and since of the variability of situations during which it'd be useful. Pose estimation may be a difficult problem and a lively subject of research because the physical body has 244 degrees of freedom with 230 joints. Although not all movements between joints are evident, the physical body consists of 10 large parts with 20 degrees of freedom. Algorithms must account for giant variability introduced by differences in appearance thanks to clothing, body shape, size, and hairstyles. Additionally, the results could also be ambiguous thanks to partial occlusions from self-articulation, like an individual's hand covering their face, or occlusions from external objects. Finally, most algorithms estimate pose from monocular (twodimensional) images, taken from a traditional camera. Other issues include varying lighting and camera configurations. The challenges are made even more complex to match up to additional performance requirements. These images lack the three-dimensional (3-D) information of an actual body pose, resulting in further ambiguities.

[3] **AI based workout assistant and fitness guide**

an application that detects the user's exercise pose counts the specified exercise repetitions and provides personalized, detailed analysis about improving the user's body posture. This is an AI-based Workout Assistant and Fitness guide to guide people who don't have access to the gym but are still willing to work out at home to maintain their physique and fitness and keep their body in good shape. To help them perform the exercises correctly and prevent them from chronicle and immediate injuries. This also provides a personalised health guide and diet plan along with a personalised daily workout calorie count. The application also displays necessary health insurances and policies provided by the government of India for the common people and check the eligibility criteria using API and Web services. Staying at home for long periods of time can become boring, especially when most fun activities are done outdoors, which is difficult considering the current scenario of pandemics and lockdown. But this cannot be a relevant excuse for being unproductive because it is an excellent idea to utilize the extra time we get into our own health.

III.DATA USED

As most of the solutions use the key points and the heatmaps, first we require to pose alignment data for each pose. We can take into consideration the different test cases where if the complete body is visible and there are detectable key points for the body parts. To make sure that the pose detector can perform in heavy occlusions which are some different test cases than normal ones, we can make use of occlusionsimulating augmentation. The training data set has 60000 images with a few images

doing the same pose that have different key points and 25000 frames in which the user performs the actual exercise.

IV.IMPLEMENTATION AND ALGORITHM

We have used python and different libraries such as opencv and mediapipe which is a library using ML algorithms along with different numerical and algorithms.

The MediaPipe pose estimation tool uses a 33 key points approach wherein it detects the key points and accordingly uses and studying the data set estimates the pose. It tracks The pose from the real-time camera frame or RGB video by using the blaze pose tool that has a Machine Learning approach in pose detection. This approach uses a double step tracker machine learning pipeline which is efficient in media pipe solutions. Using the tracker locates the region of interest of the activity or posture in the real-time video. It then predicts the key points in the region of interest using the real-time video frame as an input. But the point to be noted is that the tracker is invoked only during the start or whenever the model is unable to detect the body key points in the frame.

We have created a module named PoseModule.py and defined various functions in it and imported this module to our main project file aiTrainer.js to utilize these functions. We are basically first detecting the landmark positions on the body in the video with the help of MediaPipe.

Then the angle between the points is calculated and a range is determined. This range can be demonstrated by a 0-100 % efficiency bar on the output video frame. We also calculate the number of repetitions of the exercise and display the count in the output video.

Formula for calculating angle formed by 3 points:

Angle = math.degrees(math.atan2(y3-y2,x3-x2)- math.atan2(y1-y2,x1-x2))

In the output following data is displayed: fps rate, counter for repetitions, landmark points, the angle between landmark points and status bar.

This project can be implemented on pre-recorded videos as well as in real-time through a webcam.

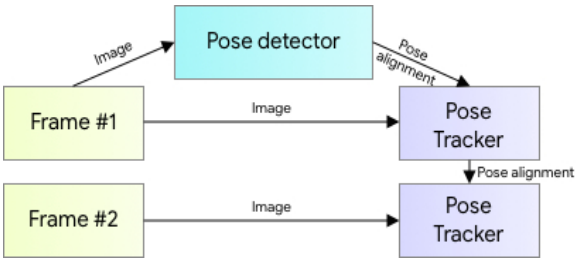

Figure 1: Human pose estimation pipeline overview

Neural network architecture:

The estimator in our application first estimates the position of the 33 key points of the user and later utilises the user alignment. We utilise the combination of heatmap and the regression way. In the training model, we utilise the above approaches and then prune the resultant layers from the test model. We used the heatmap to analyse the light-weight integration and used it by the encoder. The solution is inspired by the Stacked Hourglass solution. We used skip-connections in all levels in order to get a balance in higher and lower characteristics. The slopes or the gradients were not going back to the heatmap in the train set model. For their last post-processing stage, the bulk of current object identification methods use the Non-Maximum Suppression (NMS) algorithm. For hard objects with minimal degrees of freedom, this method works effectively. This algorithm, however, fails in cases that feature highly articulated human postures, such as individuals waving or hugging. This is because the NMS algorithm's intersection over union (IoU) criterion is satisfied by several, confusing boxes. Refer to Fig 3 for the System Implementation plan

V.BLOCK DIAGRAM

1. User Login: The user will login into the system using face recognition and save the personal data of the user into the respective account.

2. Gym: The application contains different

exercise routines which have different exercises that the user can do in real-time and has different pose correction and set repetition counter tools.

3.Yoga: The application contains different yoga poses which have different yoga asanas that the user can do in real-time and has different pose correction and set repetition counter tools.

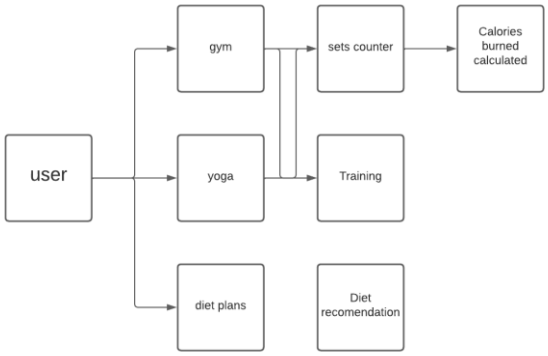

Figure 2: Block diagram of the system

4. Sets counter: It counts the set of repetitions the user does of a particular exercise in real-time by identifying the position of the user.

5. Training: It will have necessary training videos link to it user can watch to train themselves properly

6. Diet recommendation: It will recommend diet plans based on the user body type and needs

7. Calories loss: It is calculated based on user age, height, weight, gender, intensity of the exercise and number sets done in exercise

VI. FUNCTIONAL REQUIREMENTS

1. Pose estimator has the ability to detect the pose and count the repetitions along with the posture guide

2. Personalised calorie counter depending upon the exercises performed.

3. Diet planners exhibit different diets depending upon the health conditions and calorie intake.

4. A platform to display different health insurances and policies provided by the Indian government along with the benefits and eligibility criteria.

5. Display different exercise routines according to the health conditions and focus majorly on being fit and weight loss

VII. SYSTEM ARCHITECTURE

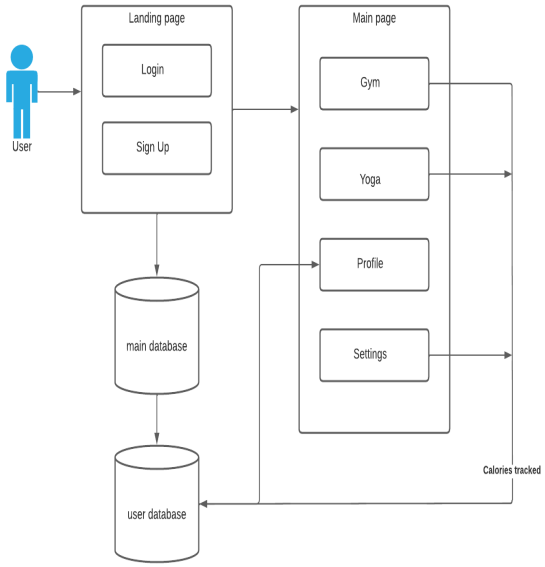

Figure 3: System architecture of the system

VIII. ADVANTAGES

1. There are numerous applications available in the market which guide the user about the exercises to be performed. But through this application, we not only guide the user regarding which exercise to perform but also about the correct posture and counting the repetitions using computer vision.

2. Monitor the user in real-time keeping track of the quality repetitions of a particular exercise, thus keeping his form intact and correct throughout their workout. This will educate newbies about different exercise routines and their correct postures to prevent injuries.

3. The application also offers personalised health advice and nutrition ideas while keeping the daily calorie log in the database.

4. The application can not only be used by individuals at homes but by increasing the scope can be used in gyms as smart trainers thus reducing the human intervention.

5. Our main motive is to spread awareness about the importance of good health and fitness among common people.

IX. LIMITATIONS

1. The application can estimate the poses and count repetitions for a limited number of exercises as pose estimation using computer vision for some exercises and postures can be difficult.

2. The application is developed as a cross-web application and is not used as a mobile android/ios application.

3. The application cannot capture multiple people in the frame in the real-time system.

X. APPLICATION

The application can be used indoors at home or in the gyms to get pose detection and correction suggestions. It can also be used to keep the daily log of calories of each user and suggest changes and exercises accordingly. Apart from this, the application can be used to spread awareness about the different health-related government schemes and different health insurance-related information.

XI. CONCLUTION AND FUTURE WORK

Nowadays our life is becoming busier and we hardly find time in our schedules to be healthy and fit and exercise daily. This has caused many diseases and health issues. Implementation of Artificial Intelligence in the field of fitness can solve many problems. The health-related applications and devices are making our lives easier and eases our fitness journey. Individuals can use this application in their own workouts, hence making them more efficient are less error-prone. In this process, we learnt how to use the OpenCV library and package and how the application of machine learning can be beneficial to humans.

There is a lot of scope of development in this project. The project can be upgraded to support more exercises. A User interface can be added for easy navigation through the exercises. The data collected by the AI trainer can be saved and processed for the next sessions. Daily steps tracker can also be added. The trainer will suggest you workout plan and its intensity according to your body type and weight. This application can be developed into a complete android/ios application for ease of use.

From the brief insight provided above, it shows that "AIbased workout assistant and fitness guide" uses some concepts of blaze pose, requires a camera to capture the body pose as input to the system generated and with the help of pose estimator, will provide the stats of calories burnt and exercise count as output in human-readable form. Future work may include the movement of the camera vertically and horizontally to capture another wide variety of exercises or it may include the use of multiple cameras to capture the body pose from various angles in order to feed the template of other exercises.

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