

PERSONALIZED VIRTUAL FITNESS TRAINER

Madduri Nithin Kumar*¹, Chikine Varshith*², Durgam Rajeshwar*³,
Gandede Mani Chandra*⁴, K Ramesh Babu*⁵

*^{1,2,3,4}Student, Department Of Computer Science, Vidya Jyothi Institute Of
Technology, Hyderabad, India.

*⁵Assoc. Prof., Department Of Computer Science, Vidya Jyothi Institute Of Technology,
Hyderabad, India.

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ABSTRACT

The global obesity pandemic is significantly worsened by widespread physical inactivity, underscoring the critical role of fitness in promoting a healthy lifestyle. Alarming, a vast majority of fitness enthusiasts, approximately 90%, exhibit improper exercise techniques, putting themselves at risk of serious injuries and long-term health complications. Addressing this issue, our project introduces an AI Virtual Trainer, leveraging advanced pose estimation technologies such as Mediapipe and BlazePose. This innovative tool meticulously analyzes users' posture during exercises and provides real-time guidance, including counts and repetitions tailored to each exercise type. Moreover, incorporating voice guidance further enhances user experience, facilitating seamless execution of workouts. By offering a cost-effective and accessible alternative to traditional physical trainers, particularly valuable during challenging circumstances like the COVID-19 pandemic, our AI Virtual Trainer aims to empower individuals to achieve optimal fitness safely and effectively.

Key words: MediaPipe, Computer Vision, Virtual Fitness Trainer, BlazePose.

I. INTRODUCTION

In the 21st century, factors like internet use, work stress, and time constraints contribute to declining physical fitness perceptions. Despite the belief that fitness requires costly gym memberships, virtual fitness trainers offer a more accessible alternative, leveraging VR and integrated sensors for accuracy. While numerous health apps exist, diversity in virtual trainer technology remains limited. Integrating AI, the AI Fitness Trainer desktop app recognizes user stances, tracks repetitions, and provides form suggestions using Blaze Pose tool for pose estimation. Pose estimation, a key technique in computer vision, finds applications in fields like augmented reality, animation, games, and robotics.

A Virtual Fitness Trainer project can have several modules to cover different aspects of fitness training. Here are some potential modules:

User Authentication and Registration[user module]: Allow users to create accounts and log in securely. Users can set up and manage their personal profiles, including fitness goals, current fitness levels, and any health considerations.

Application: where this module is handled with the user inputs and the view of computer vision and the camera inputs.

Login/Sign up Module: Allow users to create accounts and log in securely. Users can set up and manage their personal profiles, including fitness goals, current fitness levels, and any health considerations.

Application Module: where this module is handled with the user inputs and the view of computer vision and the camera inputs.

II. RELATED WORKS

On-device Realtime Pose Estimation & Correction [1]

Ashish Ohri et al. presented how to create an application with an appealing user experience that can perform real-time on-device pose estimation and correction. **Lightweight OpenPose, Pifpaf, Tensorflow-Lite, and TensorflowJS** are just a few of the advanced deep learning-based pose estimation models and techniques that

the authors have tested. The findings indicate that only a small number of models have good accuracy and speed and that the choice of models relies on the use case.

Human Pose-Estimation and low-cost Interpolation for Text to Indian [2] Sowmya Jayaram Iyer et al. suggested a neural pose machine implementation and the use of extremely low-cost approaches to acquire human pose estimation from **RGB films**. To encourage study in this area is one of the objectives of the proposal. A sign synthesizer was developed using the suggested technique. The proposed model can only make a probabilistic prediction of the body's critical points because it is reliant on prior and subsequent placements.

AI Fitness Coach at Home using Image Recognition [3]

The application of image recognition in AI-powered fitness coaching is the main topic of the study "**AI Fitness Coach at Home Using Image Recognition**" by **Ji et al.** The authors outline an application that makes use of image recognition to give users personalized workout advice and feedback in the ease of their own homes. The system has a camera that records video of the user's motions, which are later examined by machine learning algorithms to deliver precise and individualized feedback. The system can accurately distinguish various activities with a high degree of accuracy, according to the authors' evaluation of it.

AI Fitness Trainer [4]

In this paper, the authors presented an AI Trainer, a software application that recognizes a user's exercise posture and offers tailored, in-depth suggestions on how the user can correct their form. Pose Trainer identifies a user's pose using the cutting-edge pose estimate module known as "**BlazePose**" from "**MediaPipe**" and then assesses the posture of an activity to provide helpful feedback. The authors created a machine learning method for evaluating and recording a dataset of over 1000 key point coordinates of body parts in both the proper and erroneous form.

TFPose: Direct Human Pose Estimation with Transformers [5]

Weian Mao et al. introduced the first transformer-based pose estimation framework with a regression-based solution. The shortcomings of heatmap-based pose estimation are overcome by the simplicity and clarity of the suggested approach. The findings demonstrate that cutting-edge performance may be attained with intensive training and experimentation utilizing the **MS COCO and MPII datasets**.

SmartCoach Personal Gym Trainer [6]

In this research, an improved back propagation method is suggested for use in creating a personal exercise trainer device. It provides a comprehensive training program, tracks the user's progress, counts down the reps, and notifies the user when a move is executed improperly. The workout is real-time, so an effective algorithm must be applied. The **Adaptive Modified Backpropagation (AMBP)** algorithm is an enhanced algorithm.

III. METHODOLOGY

- 1. Literature Review:** The abstract begins by referencing studies highlighting the link between inactivity and the global obesity pandemic, as well as the importance of fitness for a healthy lifestyle. This indicates that the project is informed by existing research and literature on the subject.
- 2. Data Analysis:** The abstract states that 90% of fitness enthusiasts lack proper exercise technique, suggesting that the project may have involved analyzing data related to exercise habits and techniques to identify common issues and areas for improvement.
- 3. Technology Implementation:** The project utilizes pose estimation technologies such as Mediapipe and BlazePose to develop an AI Virtual Trainer. This suggests that the project involves implementing advanced technologies to analyze users' exercise poses and provide guidance.
- 4. Development of AI Algorithms:** The AI Virtual Trainer is described as a tool that recognizes users' posture during exercise and assists them with counts and repetitions based on exercise type, along with providing voice guidance. This indicates that the project likely involved developing AI algorithms capable of analyzing and interpreting users' movements in real-time.
- 5. Testing and Evaluation:** The abstract implies that the AI Virtual Trainer has been developed and tested to ensure its effectiveness in guiding users through exercises safely and effectively. This suggests that the project likely involved iterative testing and evaluation to refine the tool's functionality and performance.

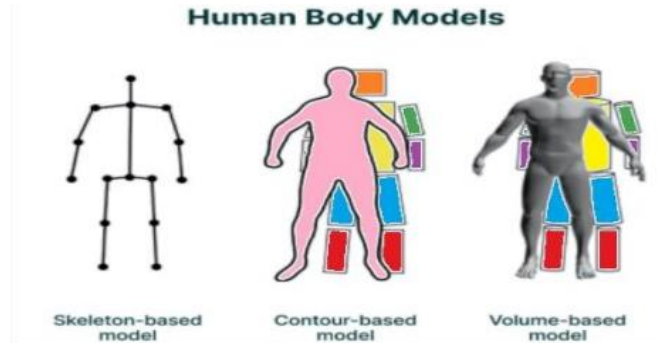


Figure 1:



Figure 2:

IV. RESULTS

A detailed guide is given below about how the Personalized Virtual Fitness Trainer works for different users and different purposes.

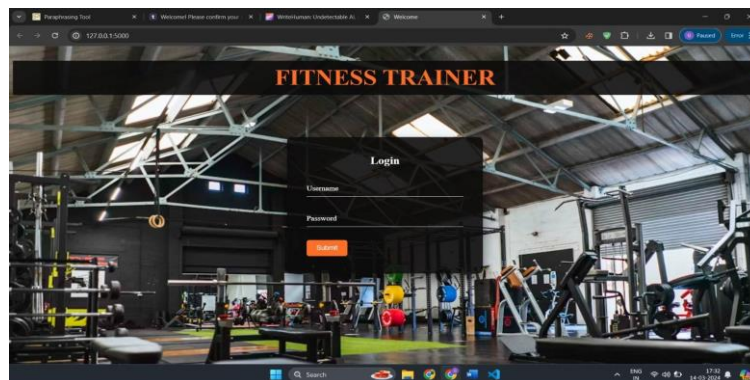


Figure 3: Login Page.

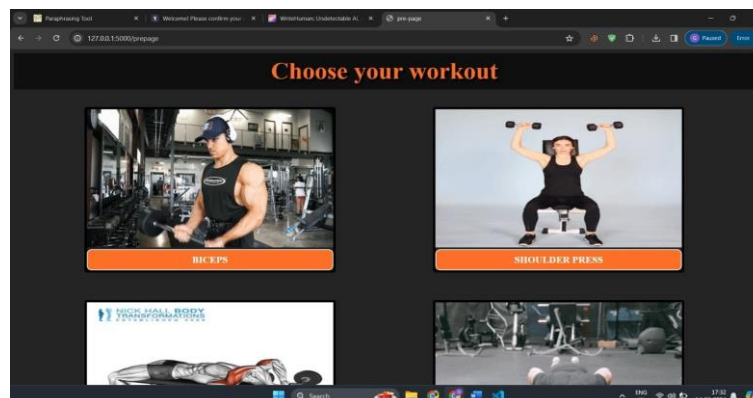


Figure 4: Select the type of exercise(Main page)

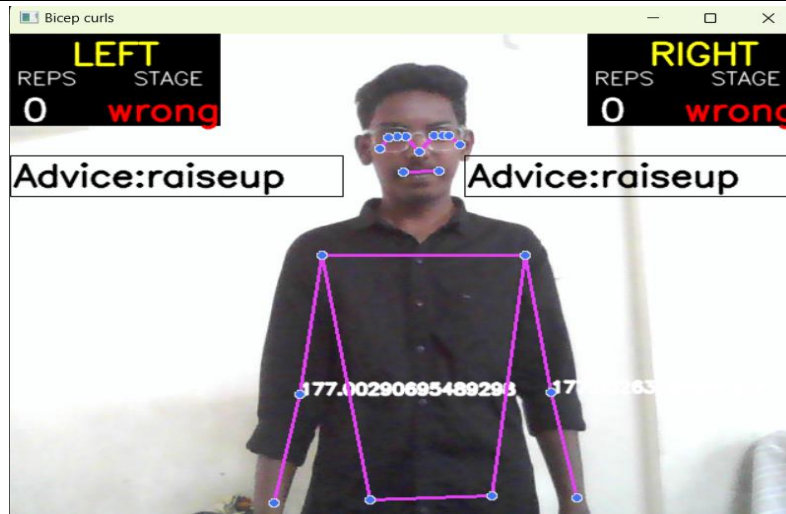


Figure 5: Webcam Access

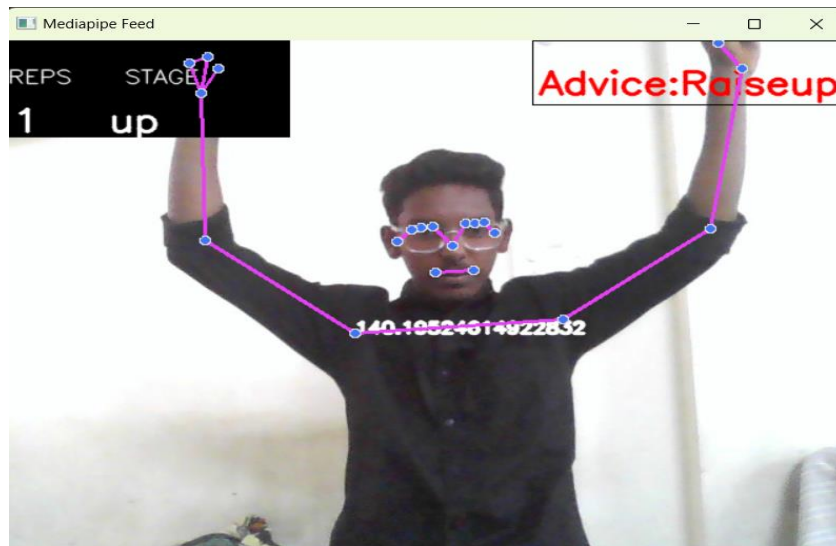


Figure 6: Stage Up/Down.

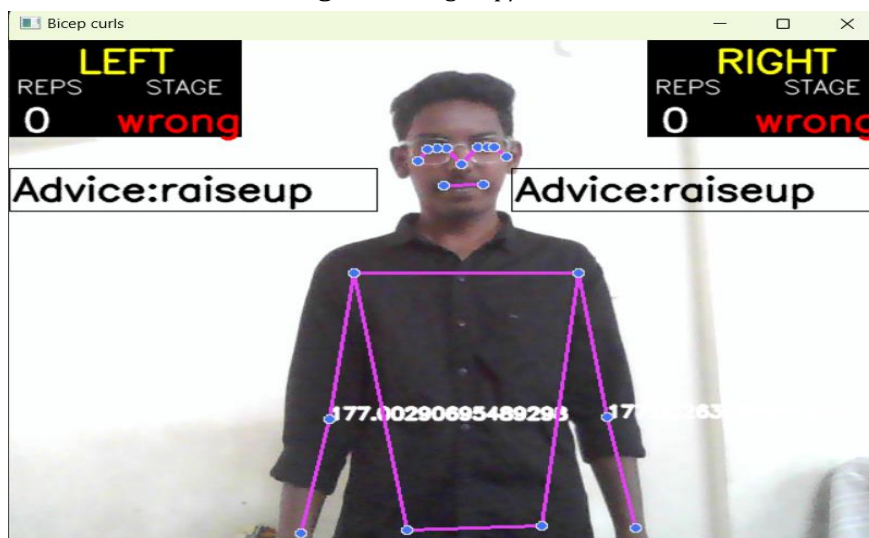


Figure 7: Stage Wrong.



Figure 8: Repetations

V. DISCUSSION

The application can generate personalized workout routines based on factors such as fitness level, goals, time constraints, and equipment availability. Users can choose from a variety of exercise programs, including strength training, cardio, flexibility, and specialized workouts tailored to specific activities or sports. Incorporating progress tracking features allows users to monitor their fitness journey over time. The application can track metrics such as weight, body measurements, exercise performance, and adherence to workout and nutrition plans. Advanced analytics can provide insights into trends, patterns, and areas for improvement, empowering users to make informed decisions about their fitness strategies. Utilizing AI algorithms for real-time feedback and coaching during workouts enhances the effectiveness and safety of exercise sessions. The application can analyze movement patterns, provide form corrections, offer motivational cues, and adjust workout intensity based on user performance and feedback. Integrating with wearable fitness trackers or smart watches allows users to sync data seamlessly between devices. This integration enables more accurate tracking of physical activity, sleep patterns, heart rate, and other health metrics, providing a comprehensive overview of the user's health and fitness status. Creating a community within the application fosters engagement, motivation, and accountability among users. Features such as social sharing, challenges, leaderboards, and group workouts enable users to connect with friends, join fitness communities, and support each other in their fitness journeys. Providing educational resources, articles, videos, and tutorials on fitness, nutrition, and wellness empowers users with knowledge and guidance to make healthy lifestyle choices. The application can offer tips, advice, and evidence-based information to help users understand the principles of exercise, nutrition, and overall well-being. Collaborating with certified fitness trainers, nutritionists, and health professionals allows users to access expert guidance and support within the application.

VI. CONCLUSION

Numerous issues can be resolved by the application of various technologies in the field of fitness. Our lives are made easier by the fitness-related equipment and applications, which also facilitate our fitness journey. This application allows users to perform their own workouts at home, increasing their efficiency. It helps to detect the person's body, identify its pose, and analyze the posture to give the count based on the kind of exercise. It works differently for different exercise postures. We learned how to use the various Python packages and libraries as well as how their applications may be useful to people. A complete computer vision application that uses pose estimation and supports the user is what we call AI Fitness Trainer.

Pros:

1. Addressing a Global Issue: The abstract highlights the importance of fitness in combating the worldwide obesity epidemic, emphasizing the relevance of the project in addressing a significant health concern.
2. Accessibility: By providing an alternative to traditional physical trainers, particularly during challenging times like the COVID-19 pandemic, the project offers accessibility to fitness guidance for individuals who may not have access to in-person trainers.
3. Cost-Effective Solution: Offering a virtual trainer eliminates the need for expensive gym memberships or personal trainers, making fitness guidance more affordable and accessible to a wider range of individuals.
4. Customized Guidance: The AI Virtual Trainer can provide personalized guidance and feedback based on individual users' needs and abilities, potentially leading to more effective and efficient workouts.

VII. REFERENCES

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