FitVision: Smart Posture Analysis for Effective Workouts

Submitted in partial fulfillment of the requirements of the degree

BACHELOR OF ENGINEERING IN **COMPUTER ENGINEERING**

By

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CERTIFICATE

This is to certify that the Mini Project entitled **"FitVision: Smart Posture Analysis for Effective Workouts"** is a bonafide work of **Dhruva Chaudhari (03), Kevin Patel(45), M.Kaif Qureshi (48), Krishnam Raja (49)** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of **"Bachelor of Engineering"** in **"Computer Engineering" .**

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Mini Project Approval

This Mini Project entitled "**FitVision: Smart Posture Analysis for Effective Workouts**" by **Dhruva Chaudhari (03), Kevin Patel(45), M.Kaif Qureshi (48), Krishnam Raja (49)** is approved for the degree of **Bachelor of Engineering** in **Computer Engineering.**

Examiners

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Date:

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Contents

Abstract

FitVision is a groundbreaking project that harnesses the power of AI and Computer Vision to transform the way exercise form is assessed in the fitness industry. With the fitness and exercise trend on the rise, ensuring that individuals perform exercises correctly is paramount to preventing injuries and optimizing workout effectiveness. Traditionally, assessing one's own form accurately has been a challenge, often necessitating the involvement of trainers or coaches for feedback. FitVision addresses this issue by offering a convenient and cost-effective solution for form assessment at any time.

This innovative system employs advanced computer vision techniques to detect and analyze users' body movements in real-time, providing comprehensive feedback on key factors such as alignment and range of motion. The personalized feedback offered by FitVision empowers users to progressively enhance their form, leading to safer and more effective workouts. FitVision stands as a testament to the incredible potential of AI and Computer Vision in improving the health and well-being of individuals worldwide. By seamlessly integrating technology into the fitness routine, this project offers a game-changing approach to form assessment, contributing to a safer and more rewarding fitness journey.

KEYWORDS - AI, Computer Vision, real-time analysis, fitness industry, personalized feedback

Acknowledgment

We wish to express our heartfelt gratitude to all those who have contributed to the successful completion of this book report. We are deeply indebted to our project mentor, Prof. Abha Tewari, for her unwavering support, invaluable guidance, and expert insights throughout the course of this project. Her dedication and commitment were instrumental in shaping our ideas into a well-executed report.

We also extend our sincere appreciation to our dedicated group members, Kevin Patel, M.Kaif Qureshi, Krishnam Raja, and Dhruva Chaudhari, whose collaborative efforts, creativity, and hard work made this project a reality. Our diverse skill sets and unwavering teamwork have been a constant source of inspiration.

We are grateful to Dr. Nupur Giri, Head of the Department of Computer Engineering, for providing us with a conducive environment for learning and innovation. Her constant encouragement and support have been pivotal in the project's success.

Furthermore, we would like to extend our thanks to Dr. J. M. Nair, Principal of [Your Institution Name], for offering us a platform to perform this project. His vision and leadership have fostered an environment that encourages research and innovation, and for that, we are truly thankful.

We also acknowledge the support and cooperation of our friends and family, who provided us with encouragement and understanding throughout the duration of this project.

List of Abbreviations

AI : Artificial Intelligence

CV : Computer Vision

DL : Deep Learning

IDE : Integrated Development Environment

OpenCV : Open Source Computer Vision Library

FPS : Frames Per Second

UI : User Interface

API : Application Programming Interface

GUI : Graphical User Interface

YOLO : You Only Look Once (a real-time object detection system)

List of Figures

1. Introduction

1.1 Introduction

In the tapestry of human well-being, health stands as a vital cornerstone, with regular physical exercise emerging as a pivotal thread. The well-established advantages of consistent exercise encompass improvements in cardiovascular vitality, enhanced muscular prowess, enduring stamina, meticulous weight management, and a significant reduction in susceptibility to chronic diseases such as heart disease, strokes, and diabetes. However, an often-underestimated aspect of these benefits is the profound influence of precise execution, where exercise form and technique hold a key position.

Recognizing the intricate interplay between fitness and form, our project, FitVision, seeks to address this critical aspect. FitVision embodies the development and implementation of advanced instruments tailored for the precise evaluation of exercise form, guided by the synergy of Artificial Intelligence (AI) and Computer Vision technologies.

1.2 Motivation

The journey towards personal health and well-being is a path we all tread throughout our lives. At its core, this journey is not merely a pursuit of aesthetics or physical prowess; it is a quest for vitality, resilience, and a higher quality of life. Each day presents an opportunity to take a step towards a healthier, happier self, and it is with this profound belief that we embark on our mission.

Our motivation is rooted in a deep understanding of the vital role that health and well-being play in our lives. A sound body and mind are not only assets but also prerequisites for realizing our dreams, cherishing our relationships, and experiencing the beauty of life to the fullest. We recognize that personal health and well-being are the cornerstones upon which every other aspect of our existence rests.

Moreover, our project, "FitVision: Smart Posture Analysis for Effective Workouts," resonates with the conviction that we can utilize the power of technology to enhance our health journeys. By leveraging artificial intelligence and computer vision, we seek to not only exercise smarter but also more safely. We aspire to empower individuals with the knowledge and tools to exercise with precision, to reduce the risk of injuries, and to revel in the joy of progress.

1.3 Problem Statement & Objectives

In the pursuit of a healthy lifestyle and fitness goals, individuals often engage in various exercise routines. However, ensuring proper exercise form is essential to prevent injuries and maximize workout effectiveness. Traditional methods of assessing exercise form rely on manual observation, which can be subjective and error-prone. To address this challenge, our project, FitVision, seeks to leverage cutting-edge technologies - Artificial Intelligence (AI) and Computer Vision - to provide a comprehensive and accurate solution for exercise form assessment.

Research Objectives

Our research objectives encompass a multifaceted approach to enhance exercise form assessment and its impact on individual fitness journeys:

System Development: Our primary aim is to develop FitVision, a deep learning-based exercise form assessment system. This intelligent system is designed to analyze video recordings of individuals performing various exercises, offering insights that go beyond the surface.

Data Compilation: We will create an extensive database encompassing a myriad of exercise form variations and deviations. This resource will be pivotal in training the FitVision model, ensuring its ability to provide accurate assessments.

Algorithm Enhancement: Deep learning algorithms are at the core of FitVision's ability to identify subtle to significant errors in exercise form and technique. We will delve into algorithm refinement, empowering FitVision to offer precise guidance.

Actionable Feedback: FitVision's true utility lies in its capacity to provide actionable feedback and recommendations to users. It's not just about identifying issues; it's about offering solutions for improvement.

Efficacy Evaluation: We are committed to rigorous evaluation to determine the effectiveness of FitVision. Controlled studies and user feedback will provide insights into how this technology can enhance exercise technique and reduce their risk of injuries.

Impact Assessment: Beyond individual fitness, we will explore the broader impact of FitVision on fitness training, wellness coaching, and healthcare. Usability, accessibility, and user satisfaction will be at the forefront of our assessment.

Continuous Improvement: As a dynamic project, we are dedicated to the ongoing refinement and optimization of FitVision. Research findings and user experiences will guide the evolution of this technology.

Sharing Insights: We believe in contributing to the scientific community. As such, we will share our research findings, methodologies, and insights, fostering a collaborative approach to the advancement of technology-driven fitness solutions.

User Experience and Interface Design: Beyond the technical aspects, our research will also focus on enhancing the user experience. We recognize the importance of user-friendliness, intuitive design, and visual appeal to foster meaningful user interactions with FitVision.

2. Literature Survey

2.1 Survey of Existing System

Sr. no.	Title	Author	Summary	Link
1.	Towards Understanding People's Experiences of AI Computer Vision Fitness Instructor Apps	Andrew Garbett, Ziedune Degutyte, James Hodge, and Arlene Astell	Involving 12 participants, the study evaluated five AI fitness instructor apps. The analysis revealed five themes: computer vision limitations, visual feedback, AI interaction, user adaptation, and instructor engagement. The findings led to five design considerations in feedback, personalization, and AI relationship-building, gathered from participant interviews and thematic transcript analysis.	https://doi.org/10.1145/3461778.3462094
2.	Joint Coordinate Regression and Association For Multi-Person Pose Estimation, A Pure Neural Network Approach.	Yu, D., Xie, Y., An, W., Zhang, L., & Yao, Y. (2023)	The summary of the project involves a novel one-stage end-to-end multi-person 2D pose estimation algorithm, known as Joint Coordinate Regression and Association (JCRA), that produces human pose joints and associations without requiring any post-processing. The proposed algorithm is fast, accurate, effective, and simple. The one-stage end-to-end network architecture significantly improves the inference speed of JCRA. Meanwhile, the authors devised a symmetric network structure for both the encoder and decoder, which ensures high accuracy in identifying key points.	https://arxiv.org/abs/2307.01004

3.	Realtime Multi-Person 2D Pose Estimation using Part Affinity Fields	Z. Cao, T. Simon, S. -E. Wei and Y. Sheikh	The image is first processed through a baseline network (first 10 layers of VGG-19) to extract feature maps. These maps are then processed by a multi-stage CNN to generate Part Confidence Maps (2D maps for body part locations) and Part Affinity Fields (2D vector fields encoding part associations). Finally, a greedy algorithm processes these maps and fields to determine the poses of each person in the image.	https://ieeexplore.ieee.org/document/8099626
4.	Keep it SMPL: Automatic Estimation of 3D Human Pose and Shape from a Single Image	F. Bogo, A. Kanazawa, C. Lassner, P. Gehler, J. Romero, and M. Black	The process involves detecting 2D joint locations using a CNN-based method like DeepCut, fitting a 3D SMPL model to these locations by minimizing an objective function, and preventing the 3D model from interpenetrating by enforcing constraints on the pose and shape.	https://arxiv.org/abs/1607.08128
5.	Pose Trainer: Correcting Exercise Posture using Pose Estimation	Chen, S., & Yang, R.R. (2020)	The paper describes the technical approach of Pose Trainer as a pipeline system consisting of multiple system stages. They use OpenPose, a pre-trained model that can detect human body key points in videos, for pose detection. After posture evaluation, where the authors use heuristic-based and machine learning models to detect the quality of a user's predicted pose for a given exercise. They evaluate their posture identifier in different ways depending on the algorithm.	https://arxiv.org/abs/2006.11718

6.	AI Personal Trainer Using Open CV and Media Pipe	K. Ohri, A. N. Reddy, S. S. Pappula, P. B. D. Varma, S. L. Kumar, and S. G. Yeada,	OpenCV: used to mark an exoskeleton on the user's body and display reps count on the screen. Media Pipe: used to detect the form of the user's body during the workout using Blaze Pose, which is a state-of-the-art pose detection tool. Flask: used to develop the front-end of the web application. ChatterBot: used to implement the chatbot that answers user's queries. Numpy: used for extracting the data points.	https://www.irjet.net/archives/V10/i1/IRJET-V10I1131.pdf
7.	Towards Accurate Multi-person Pose Estimation in the Wild	G. Papandreou, T. Zhu, N. Kanazawa, A. Toshev, J. Tompson, C. Bregler, and K. Murphy	The proposed method is a two-stage cascade approach for multi-person pose estimation. In the first stage, the Faster RCNN object detector is used to predict the location and scale of bounding boxes likely to contain people. In the second stage, a fully convolutional ResNet is used to estimate the key points of each person within each bounding box. The system predicts dense heatmaps and offsets for each keypoint type, and uses a novel aggregation procedure to obtain highly localized keypoint predictions.	https://arxiv.org/abs/1701.01779
8.	Real-time human pose recognition in parts from single depth images	K. Ohri, A. N. Reddy, S. S. Pappula, P. B. D. Varma, S. L. Kumar, and S. G. Yeada,	The methodology used is a two step approach. 1: Feature extraction which involves extracting features from the image or video data that are relevant to the identification of body parts. These features can be extracted using	https://ieeexplore.ieee.org/document/5995316

			techniques such as edge detection, shape and texture features. 2: Classification, which involves classifying the extracted features into different body parts. This can be done using a variety of machine learning techniques, such as support vector machines (SVMs) and Neural networks	

2.2 Limitation Existing system or Research gap

1. Accuracy and Reliability of AI Components:

The AI model demonstrated inconsistent performance, with inaccuracies in joint detection and occasional false positives and negatives, impacting its overall reliability in providing accurate exercise form assessments.

Variability in lighting conditions further exacerbated the accuracy issues, making it challenging to maintain dependable results in different environments.

2. Ethical, Social, and Privacy Implications:

Privacy concerns arose due to the system's collection of personal data and exercise videos, necessitating the implementation of robust data protection measures to address these ethical and privacy-related lacunas.

Users expressed concerns regarding the system's potential to amplify body image issues and set unrealistic expectations, emphasizing the need to consider the ethical and social implications of its use.

3. Diversity and Accessibility:

The AI model struggled to recognize exercises performed by individuals from diverse backgrounds, leading to issues related to representation and inclusivity in the system.

Accessibility concerns surfaced as the user interface design failed to accommodate the needs of users with disabilities, impacting the overall usability and inclusivity of the system.

4. Occlusion and Crowded Scenes:

In traditional methods of assessing exercise, issues emerged with occlusion, where exercise movements were obscured by objects or other individuals in crowded gym or fitness class settings, affecting the accuracy of form assessment.

Crowded fitness classes posed a challenge for trainers attempting to monitor each participant's form, making it difficult to provide precise feedback, highlighting the limitations of manual observation in such scenarios.

2.3 Mini Project Contribution

The "FitVision: Smart Posture Analysis for Effective Workouts" project, while primarily focused on enhancing exercise form assessment through AI and Computer Vision, has the potential to make significant contributions to the environment. While the primary goal of the project is to improve fitness and reduce the risk of exercise-related injuries, the environmental benefits can be realized through various aspects:

Reduced Commuting and Travel: FitVision encourages individuals to exercise at home, reducing the need for commuting to gyms or fitness centers. This can lead to a decrease in greenhouse gas emissions associated with transportation, contributing to cleaner air and reduced congestion in urban areas.

Energy Efficiency: By promoting at-home workouts, FitVision supports the efficient use of energy resources. Home workouts typically consume less energy than running large fitness facilities with extensive lighting, heating, and cooling requirements.

Paperless Approach: FitVision primarily operates digitally, providing exercise guidance and feedback through software. This reduces the need for printed workout guides, minimizing paper consumption and the environmental impact of paper production.

3. Proposed System

3.1 Introduction

The proposed system, FitVision, is a cutting-edge solution designed to revolutionize the assessment of exercise form by leveraging the power of Artificial Intelligence (AI) and Computer Vision. FitVision's primary objective is to address the critical challenge of ensuring that individuals perform exercises with precise form, a key factor in achieving optimal fitness results and reducing the risk of injuries. The system's methodology encompasses the systematic collection of a diverse exercise dataset, followed by video preprocessing, pose estimation, and deep learning model training. FitVision's user-centric approach extends to providing real-time feedback and recommendations to users, empowering them to make informed adjustments to their exercise routines. This not only enhances the effectiveness of their workouts but also promotes exercise safety. FitVision's potential impact extends beyond individual fitness, with the system offering the possibility of contributing to fitness training, wellness coaching, and healthcare. By amalgamating advanced technology with fitness aspirations, FitVision is poised to reshape the fitness landscape, making exercise more effective, safer, and user-friendly.

3.2 Architectural Framework / Conceptual Design

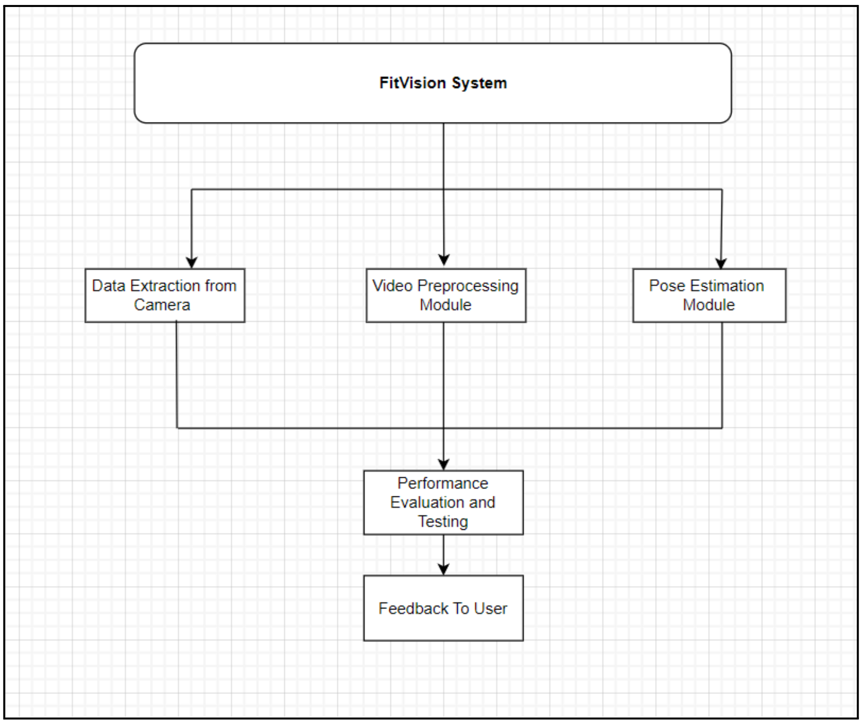


Fig 3.1 : Architectural Framework / Conceptual Design

3.3 Algorithm and Process Design

Algorithm Design:

- **Pose Detection Algorithm:** Fitvision utilizes the MediaPipe framework for real-time pose detection. The algorithm continuously captures video frames from the user's camera and analyzes the frames to detect key body landmarks, such as joints and body parts. This provides the foundational data for exercise analysis.

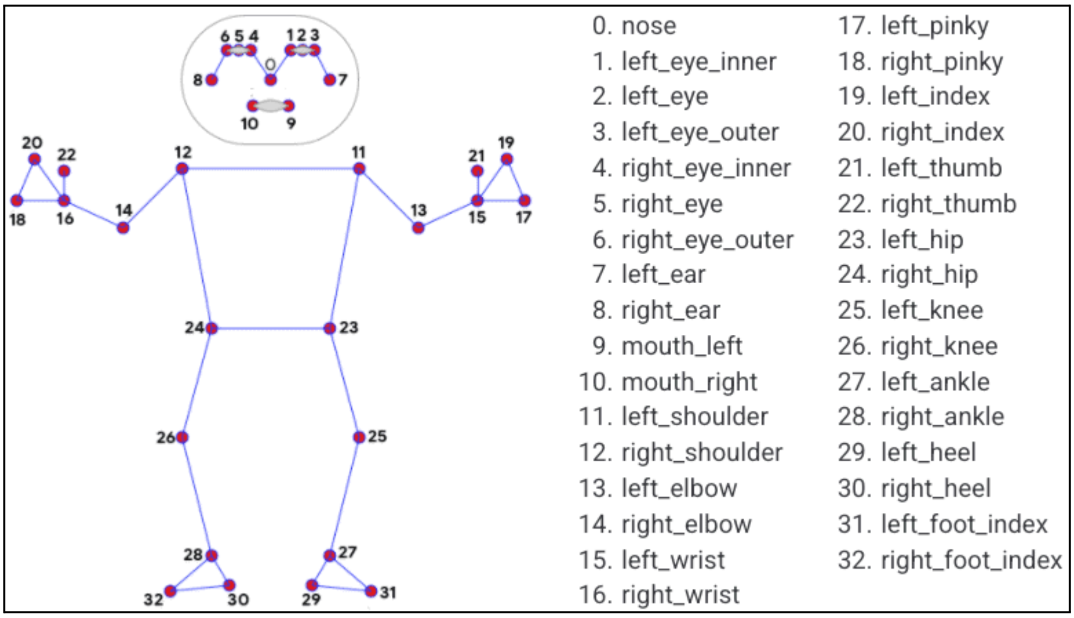


Fig 3.2 : MediaPipe pose landmark

  - MediaPipe Pose is an ML solution for high-fidelity body pose tracking, inferring 33 3D landmarks and background segmentation masks on the whole body from RGB video frames utilizing the BlazePose, which is a superset of COCO, BlazeFace, and BlazePalm topologies.
  - The pipeline for MediaPipe pose consists of a two-step detection-tracking pipeline similar to MediaPipe Hands and MediaPipe Face Mesh solutions. Using a detector, the pipeline first locates the person/pose region-of-interest (ROI) within the frame. The tracker subsequently predicts the pose landmarks and segmentation mask within the ROI using the ROI-cropped frame as input.

- **Form Analysis Algorithm:** Computer Vision techniques are applied to the detected poses. Fitvision's algorithm assesses the user's form and movement during exercises by comparing the user's actual pose to the expected ideal pose for a given exercise. Deviations from the correct form are identified.

- **Feedback Generation Algorithm:** Based on the form analysis, Fitvision's algorithm generates real-time feedback. This feedback includes recommendations for improvement, such as adjusting posture, alignment, or movement speed. The algorithm considers predefined exercise-specific criteria and form guidelines.

- **Security Algorithm:** Fitvision incorporates security algorithms to protect user data and privacy. This includes data encryption, user authentication, and secure data storage practices.

Process Design:

- **User Registration:** Users not supposed to share any personal information. This identifier is used to customize their workout experience without requiring detailed personal information.

- **Real-Time Video Streaming:** Users initiate live video streaming from their device's camera to the Fitvision platform. This streaming forms the basis for real-time analysis.

- **Pose Detection:** Fitvision's pose detection algorithm starts capturing video frames and identifying body landmarks, creating a real-time 2D skeleton of the user.

- **Form Analysis:** The algorithm analyzes the user's form in real-time. It compares the user's pose with the ideal pose for the exercise being performed.

- **Feedback Delivery:** If the user's form deviates from the ideal, Fitvision's algorithm generates instant feedback. This feedback is presented on the user interface, offering guidance for corrections.

- **Workout Progress Tracking:** Fitvision records the user's workout data, including exercise duration, repetitions, and feedback received. Users can access their workout history and track their progress over time.

- **Personalized Workouts:** Fitvision generates personalized workout plans based on the user's preferred identifier and workout preferences. It adapts to the user's fitness level and goals, offering a tailored fitness experience.

- **Security and Privacy:** Fitvision's security algorithm ensures that user data is protected. Secure connections and user authentication are enforced, and data is stored in a protected environment.

- **Feedback and Recommendations:** Users can review post-workout summaries that include performance statistics and recommendations for improvement. Fitvision continuously learns from user data to provide more accurate and personalized feedback.

- **Data Management:** Fitvision employs efficient data management techniques to handle large datasets of exercises, poses, and user preferences. Regular updates and optimizations ensure the platform's effectiveness.

- **Compliance:** Fitvision adheres to data protection regulations and regularly undergoes security audits to maintain user trust and privacy.

3.4 Methodology

The methodology for developing the exercise form assessment involves a systematic approach to design, implementation, and evaluation. The process encompasses video preprocessing, model development, and a feedback system for exercise form. The following steps outline the comprehensive methodology for building the AI-driven exercise form assessment:

1. GUI for Fitvision:

- Fitvision's graphical user interface (GUI) facilitates user interaction while capturing and reviewing workouts.
- Users receive feedback in real time while working out, and the UI makes this engagement possible.

2. Video Preprocessing:

- Video preprocessing tasks using OpenCV include normalizing pixel values, applying noise reduction techniques, and resizing video frames to a consistent resolution and frame rate.
- Standardize video inputs by resizing them to the same resolution and frame rate, ensuring consistency for subsequent analysis.
- Normalize pixel values in frames to enhance the performance of the pose estimation model.
- Apply noise reduction techniques to enhance frame clarity, particularly for videos captured in diverse lighting or conditions.

3. Pose Estimation Model:

- Select a robust pose estimation model capable of accurately detecting bodily joint positions, such as Mediapipel.
- Integrate the chosen model into the project framework, including library installation, dependency setup, and interfaces for video input and joint position output.
- Utilize the pose estimation model to process all exercise videos, extracting joint locations such as elbow, knee, and shoulder coordinates.

4 . Feedback to User:

- Summarize form feedback and offer suggestions for improvement to users based on the AI analysis.

5. Testing and Validation:

- Test the system using a diverse range of exercise videos to validate the accuracy of form assessment and the effectiveness of feedback provided.
- Fine-tune the model and algorithms based on testing outcomes, ensuring continuous improvement.

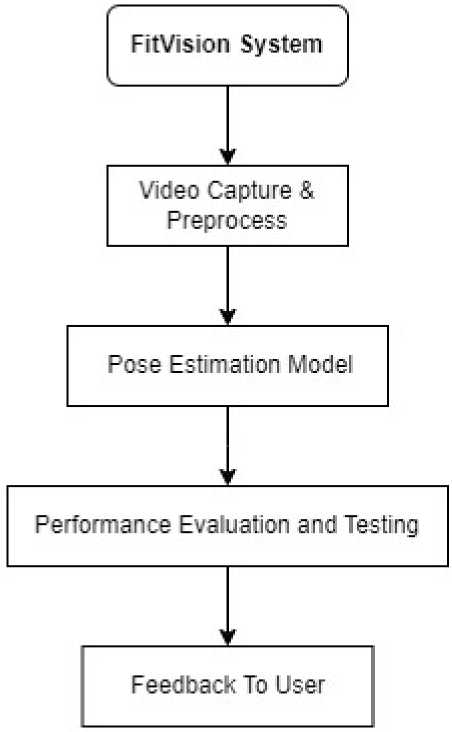


Fig 3.3 : Block Diagram

3.5 Hardware & Software Specifications

Hardware Requirements:

- **High-performance GPUs or TPUs:**
  - To efficiently train deep learning models and process large travel datasets. Minimum- i3 7th generation
- **Sufficient RAM:**
  - Needed for memory-intensive computations during video preprocessing and model training. - 4GB or more
- **Camera:**
  - Webcam or external camera for recording workout videos for research and development.

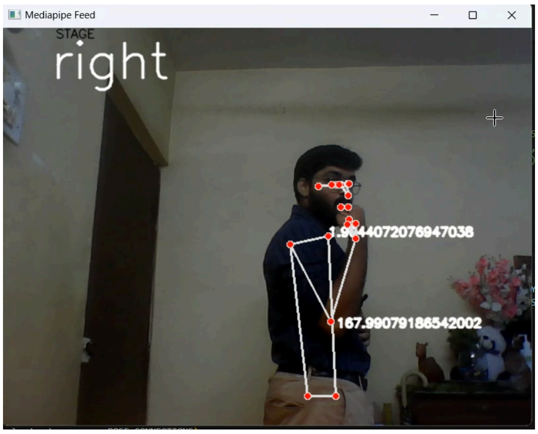
Software Requirements:

- **Programming Languages:**
  - Python or other suitable languages for deep learning frameworks like TensorFlow or PyTorch.
- **Deep Learning Framework:**
  - Utilizing TensorFlow, PyTorch, or similar frameworks for implementing and training neural network architectures.
- **Computer vision libraries**
  - OpenCV: A potent computer vision library for tasks involving image and video processing.
- **Pose estimation libraries:**
  - For joint detection, you might use OpenPose or PoseNet, depending on your preference.
- **Data Preprocessing Tools:**
  - Pandas and NumPy for cleaning, filtering, and transforming raw travel data into structured formats.

3.6 Experiment and Results for Validation and Verification

Fig 3. 4 : Implementation of Bicep Curl:

Right Form:



Wrong Form:

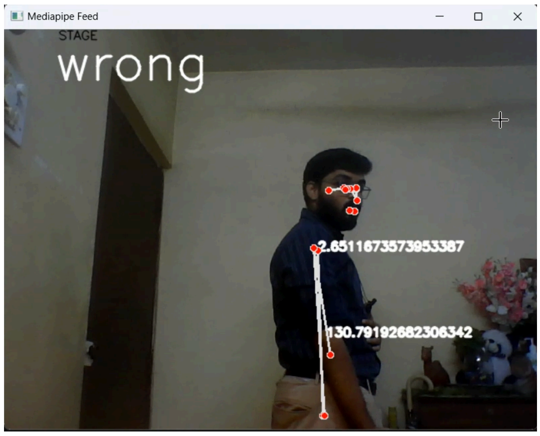
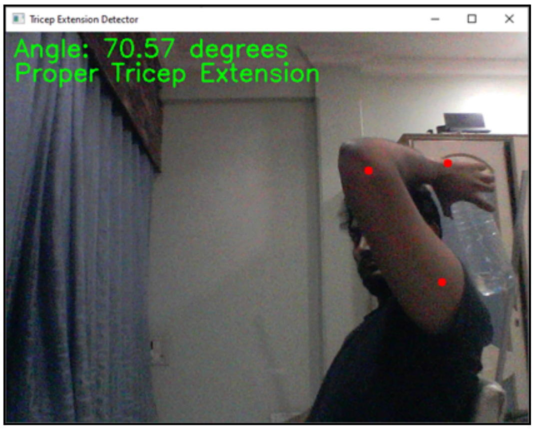
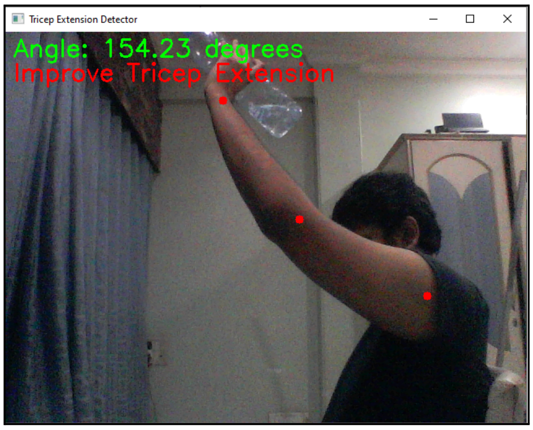


Fig 3. 5 : Implementation of Tricep Extension:

Right Form:



Wrong Form:



Logic for Bicep Curl:

```
try:
    landmarks=results.pose_landmarks.landmark

    shoulder = [landmarks[mp_pose.PoseLandmark.LEFT_SHOULDER.value].x,landmarks[mp_pose.PoseLandmark.LEFT_SHOULDER.value].y]
    elbow = [landmarks[mp_pose.PoseLandmark.LEFT_ELBOW.value].x,landmarks[mp_pose.PoseLandmark.LEFT_ELBOW.value].y]
    wrist = [landmarks[mp_pose.PoseLandmark.LEFT_WRIST.value].x,landmarks[mp_pose.PoseLandmark.LEFT_WRIST.value].y]
    Hip= [landmarks[mp_pose.PoseLandmark.LEFT_HIP.value].x,landmarks[mp_pose.PoseLandmark.LEFT_HIP.value].y]
    EL=calculate_angle(shoulder,elbow,wrist)
    Sh=calculate_angle(elbow,shoulder ,Hip)
    #puttext
    cv2.putText(image, str(EL),
                tuple(np.multiply(elbow, [640, 480]).astype(int)),
                cv2.FONT_HERSHEY_SIMPLEX, 0.5, (255, 255, 255), 2, cv2.LINE_AA
                     )

    cv2.putText(image, str(Sh),
                tuple(np.multiply(shoulder, [640, 480]).astype(int)),
                cv2.FONT_HERSHEY_SIMPLEX, 0.5, (255, 255, 255), 2, cv2.LINE_AA
                     )
    cv2.putText(image, 'STAGE', (65,12),
            cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0,0,0), 1, cv2.LINE_AA)
    cv2.putText(image, stage,
            (60,60),
            cv2.FONT_HERSHEY_SIMPLEX, 2, (255,255,255), 2, cv2.LINE_AA)


    if (EL > 160 and Sh<25) or (EL < 40 and stage  and Sh<25) :
        stage = "right"

    else:
        stage="wrong"
```

Logic for Tricep Extension:

```
    if results.pose_landmarks:
        landmarks = results.pose_landmarks.landmark
        right_shoulder = landmarks[right_shoulder_keypoint]
        right_elbow = landmarks[right_elbow_keypoint]
        right_wrist = landmarks[right_wrist_keypoint]

        # Calculate the angle between shoulder, elbow, and wrist
        if right_shoulder and right_elbow and right_wrist:
            angle = calculate_angle(right_shoulder, right_elbow, right_wrist)

            # Draw key points
            for landmark in [right_shoulder, right_elbow, right_wrist]:
                x, y = int(landmark.x * frame.shape[1]), int(landmark.y * frame.shape[0])
                cv2.circle(frame, (x, y), 5, (0, 0, 255), -1)

            # Annotate the angle value
            cv2.putText(frame, f"Angle: {angle:.2f} degrees", (10, 30), cv2.FONT_HERSHEY_SIMPLEX, 1, (0, 255, 0), 2)

            # You can set a threshold for what is considered a proper tricep extension
            upper_threshold = 150
            lower_threshold = 40

# Determine if the exercise is being performed properly
            if angle > lower_threshold and  angle < upper_threshold:
                cv2.putText(frame, "Proper Tricep Extension", (10, 60), cv2.FONT_HERSHEY_SIMPLEX, 1, (0, 255, 0), 2)
            else:
                cv2.putText(frame, "Improve Tricep Extension", (10, 60), cv2.FONT_HERSHEY_SIMPLEX, 1, (0, 0, 255), 2)

    cv2.imshow("Tricep Extension Detector", frame)
```

3.7 Result Analysis and Discussion

Fig 3.7 : Home Page:

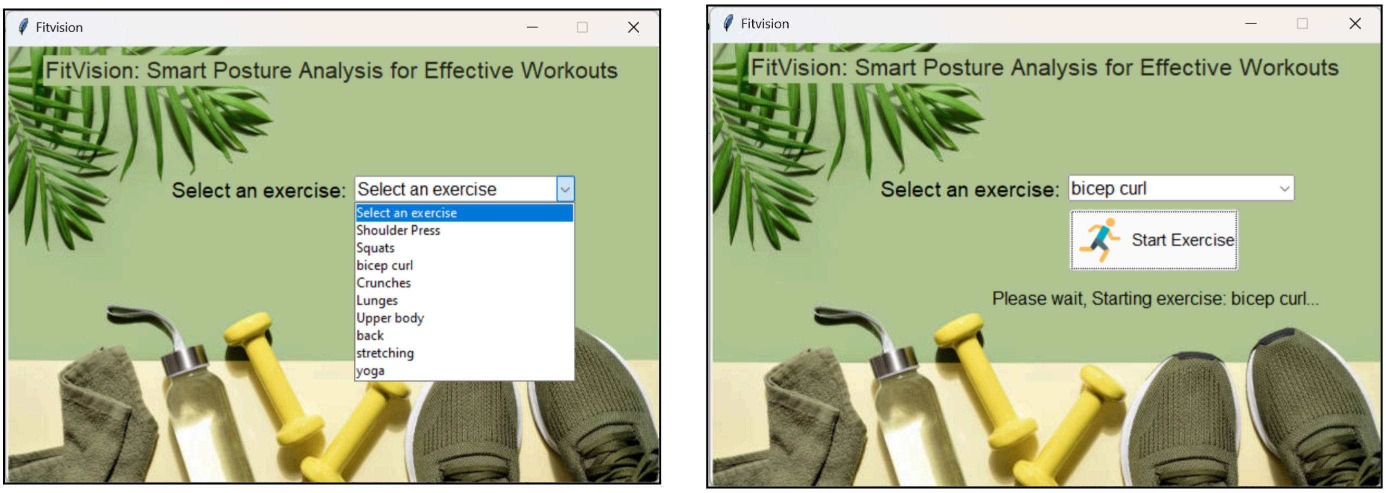
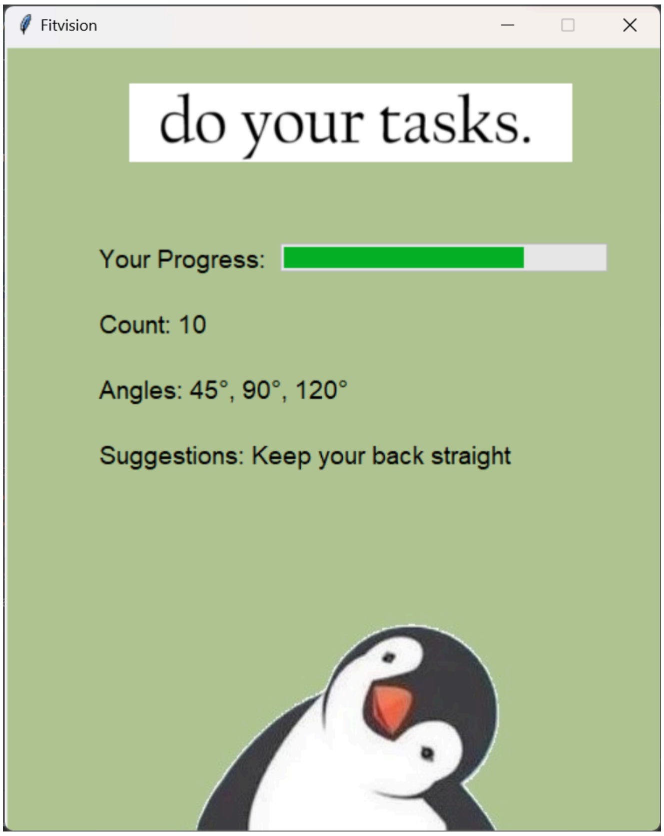


Fig 3.8 : Exercise Analysis Page:



3.8 Conclusion and Future work.

Conclusion

In the development of Fitvision, a real-time virtual fitness trainer website, we have successfully integrated cutting-edge technologies into the fitness industry. Our algorithm and process design have enabled us to create a robust platform that delivers personalized feedback and real-time analysis to users, revolutionizing the way people engage with fitness.

Throughout the project, we emphasized the significance of algorithm design, ensuring that our models provide accurate pose detection, exercise analysis, and personalized feedback. We considered key characteristics like correctness, efficiency, clarity, and generality to ensure that Fitvision offers a high-quality user experience.

Future Work

As Fitvision continues to evolve and grow, there are several avenues for future development and enhancement:

1. Expanded Exercise Database: Continuously update and expand the exercise database to cover a wider range of exercises, including specialized workouts for different fitness goals and preferences.

2. Mobile Application Integration: Develop a mobile application to complement the web platform, allowing users to access Fitvision on various devices and engage in workouts on the go.

3. Wearable Technology Integration: Integrate with wearable fitness technology, allowing users to sync their data and receive real-time feedback during workouts, taking personalization to the next level.

4. Multi-Language Support: Extend Fitvision's reach by providing support for multiple languages, making it accessible to a global audience.

5. Community Building: Foster a Fitvision community where users can connect, share their progress, and compete in fitness challenges, creating a more engaging and motivating environment.

6. Machine Learning Recommendations: Implement machine learning algorithms to provide tailored workout plans and exercise recommendations based on users' progress and preferences.

7. Data Analytics and Reporting: Enhance the analytics and reporting capabilities, allowing users to track their fitness journey comprehensively and share progress reports with fitness professionals.

8. Business Expansion: Consider partnerships with fitness influencers, gyms, and wellness organizations to expand Fitvision's reach and offer premium features.

9. Security and Privacy Enhancements: Stay updated with evolving data protection regulations and continuously improve security measures to safeguard user data and privacy.

By focusing on these future work areas, Fitvision can continue to be a pioneering virtual fitness trainer, adapting to user needs and technological advancements while promoting a healthier and more connected fitness community. This journey to combine algorithm and process design with the fitness industry will shape the future of personalized fitness training.

4. Annexure

[1] Literature Survey in depth
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