AI Fitness Trainer

A Project Report

Submitted in partial fulfillment of the Requirements for the award of the Degree of

MASTERS OF SCIENCE (INFORMATION TECHNOLOGY)

By

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Under the esteemed guidance of

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2023-2024

THE APPROVAL PROJECT PROPOSAL

(Note: All entries of the proforma of approval should be filled up with appropriate and complete information. Incomplete proforma of approval in anyrespect will be summarily rejected.)

PNR **No: 2019016401988243**

1. Name of the Student	
Hardik Vaity	
2. Title of the Project	
AI fitness trainer	
3. Name of the Guide	
Mrs. Pournima P Bhangale and Mrs. Rakhee D Rane	
4. Is this your first submission?	
Yes	
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ACKNOWLEDGEMENT

I am glad to say that, I have satisfactorily reached my intentions to make this documentation.

However, it would not have been possible without the kind support and help of many individuals. I would like to extend my sincere thanks to all of them.

I am highly indebted of my guide, Mrs. Pournima P Bhangale and Mrs. Rakhee D Ranefor her guidance and constant supervision as well as for providing necessary information regarding the project.

I would also like to extend my gratitude towards **I/C Principal (Prof) Dr. Preeta Nilesh** and theHead of the Department, **Mrs. Pournima Bhangale** for providing me with all the facilities that was required.

Then I would like to thank my parents who have helped me with their valuable suggestions and guidance which has been very helpful.

Last but not the least I would like to thank my classmates who have helped me a lot. Directly or indirectly their contribution was indispensable, and will always be remembered.

This opportunity has given me a valuable experience about software development for which I shallbe thankful for the years to come.

DECLARATION

I here by declare that the project entitled, "**AI Fitness Trainer**" done at placewhere the project is done, has not been in any case duplicated to submit to any other university forthe award of any degree. To the best of my knowledge other than me, no one has submitted to anyother university. The project is done in partial fulfillment of the requirements for the award of degree of MASTERS OF SCIENCE (INFORMATION TECHNOLOGY) to be submitted as final semester project as part of our curriculum.

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Synopsis

1. Title: AI Fitness Trainer

2. Statement about the problem: The Design counted the exercise in the virtual mode using the open cv with Artificial Intelligence. The application uses computer vision techniques provided by OpenCV to track the user movements and provide the feedback on form and technique

3. Why this topic: I chose this project because I enjoy staying in shape and because everyone wants to take good care of their bodies. We occasionally run out of time to visit the gym, and working out at home can be challenging because there is not enough motivation or a conducive atmosphere. I decided to create an AI trainer because there are instances when we perform the incorrect exercise at home and are unaware of it. that is why I always try to make time for the gym. I will use an AI trainer to assist me in working out at home. The AI trainer will detect the exercise and verify that you are performing it correctly.

4. Objective and Scope: The main objective of the project is to create an AI trainer that will assist you in exercising by determining the number and quality of repetitions. The aim is to make workout easier and more enjoyable

5. Methodology: To detect and track the body movement of a person will require Body Pose Estimation model using Media pipe. And required a collection of training data to collect data for the exercise and store them in different directories.

6. Proposed Architecture:

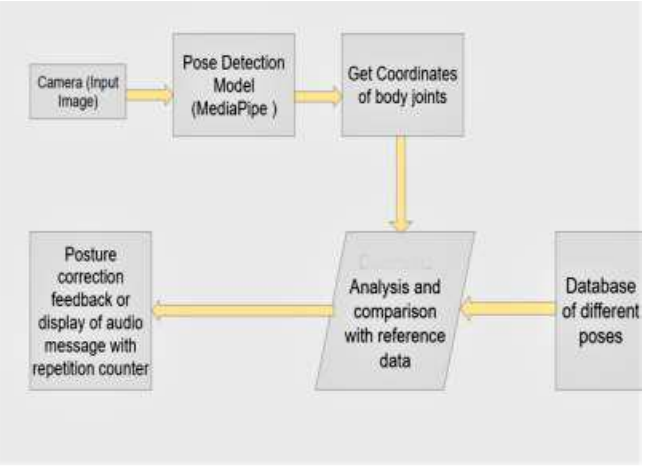


Figure: Media pipeline

From a technical standpoint, we will now explain the AI Fitness Trainer application as a pipeline system with several system stages refer to Figure. Pose training begins with the user viewing an exercise's live feed from the webcam, and it concludes with the Pose Trainer application giving detailed voice feedback on the exercise the user has selected. The user must be at least as far away from the camera as their entire body is visible, though there are no restrictions on the type of camera that can be used. The application offers the user six distinct exercises by gathering 1000 datasets for those exercises and using that data to train various models for the highest level of accuracy in those exercises. The Blaze Pose tool from Media Pipe is used by the application to first identify the landmark positions on the body in the video. Next, it transfers the points to the machine learning model, which uses them to determine the accuracy of the user's form, count the exercise repetitions, display the results, and provide feedback on the user's form.

7. Requirements:

   7.1 Software Requirement:

   - Visual Studio Code

   Python Module Require:

   - Open CV
   - Numpy
   - Mediapipe

   7.2 Hardware Requirement:

   - Processor – Dual Core
   - Hard Disk
   - Memory
   - Ram – 4GB

8. Contribution: The contribution is giving a healthy life in a society

9. Conclusion: In the conclusion this leads to numerous health problems. Our primary goal is to raise awareness among the general public of the value of fitness and good health and to assist them in achieving it.

Chapter 1: INTRODUCTION

1.1Background

A healthy lifestyle includes being fit as a key objective. Every user can be inspired by a fitness trainer to exercise regularly in order to maintain their health and fitness. Though exercise is very good for one's health, if one does it incorrectly, it can also be very dangerous and ineffective. An artificial intelligence (AI) fitness trainer is a digital platform or application that uses AI and machine learning algorithms to provide personalized fitness guidance and support to each user. The purpose of these artificial intelligence (AI) fitness trainers is to assist users in achieving their fitness goals, whether they involve maintaining an active lifestyle, building muscle, improving cardiovascular health, or losing weight. People nowadays prefer to work out at home rather than go to the gym. Many people want AI Trainer to verify that they are performing their exercises correctly. While working out in a gym, the personal trainer ensures that the person is using proper form. He ensures that the person is not injured while performing the exercise. Similarly, people want someone to guide them while working out. As a result, the AI Trainer has arrived; he examines your form and ensures that you are performing exercises correctly so that injuries do not occur. It measures your workout and keeps track of your progress. While working out, the AI fitness trainer will keep you motivated.

The potential of Artificial Intelligence (AI) to completely transform our approach to physical exercise has drawn a lot of attention to its application in the health sector in recent years. The creation of virtual trainers that can offer tailored advice and feedback while exercising is one area where AI has shown a lot of promise. In this project, we propose a real-time feedback system on exercise form and technique, powered by artificial intelligence (AI) and computer vision technology. The system records the user's movements with a camera, analyzes the data, and detects any deviations from the proper form using an AI model. The user can then improve their form and lower their risk of injury with the help of the virtual trainer's customized corrective actions. One of the most popular New Year's Resolutions is to join a gym. January, the month immediately following New Year's, has the highest rate of gym memberships. Eighty percent of people who joined a gym in January 2012 left after five months. But gym members do not always give up because they are lazy. Roughly 46% of ex-gym members stated that the primary cause of their membership cancellation was cost. Thus, even in the absence of the expense of employing a personal trainer, it is evident that cost plays a significant role in choosing whether to subscribe to the gym. Personal trainers may be available as an additional service at professional gyms and health clubs

1.2 Objective

- The primary goal of the project is to create an AI trainer that will assist you in exercising by determining the number and quality of repetitions. This is accomplished by CPU-based posture estimation.

- This initiative aims to make working out easier and more enjoyable. There will be a non-distortive user interface.
- Provide users access to a wide range of fundamental exercises.
- Provide precise and up-to-date workout evaluations Permit fitness facilities to offer virtual personal trainers to their patrons as an extra service
- While exercising, give users real-time statistics and images.
- Make sure the user experience is seamless and enhanced overall.

1.3 Purpose, Scope, and Applicability

Purpose: The system's goal is to make people healthier and stronger. When we go to the hospital, we must pay the higher-than-expected bill. Whatever you save goes toward the hospital bill.

Scope: The project's parameters are:

- Fans of exercise who would like to work out properly at any time or place
- The scope of the AI virtual trainer using computer vision project is quite vast and promising.
- The system can be utilized by individuals looking to improve their fitness and exercise routines.
- It can also be implemented in gyms, fitness centers, and other related establishments to provide personalized feedback and guidance to their clients
- People who wish to lower the risks while engaging in physical activity
- Remote trainers Fitness or treatment facilities looking to offer services online and locally-the time

1.4 Achievement

- Up to 40% more money coming in for fitness facilities
- Up to 75% decrease in the likelihood of injury
- benefits of a workout that are twice as good and faster when proper posture and techniques are used
- Enhanced contentment among clients
- AI-driven real-time feedback
- Quick pose recognition and final correction
- Freedom to work out anywhere you want

Chapter 2: Review of Technology

There are various different technology and models which can be used in AI fitness trainer. An AI fitness trainer that uses Mediapipe and OpenCV can provide several benefits to users. This type of fitness trainer uses advanced machine learning algorithms and computer vision techniques to track a person's movements during exercise routines and provide real-time feedback on their form and technique.

- Open pose

  OpenPose is a popular computer vision framework for human pose estimation, which can detect the key points or joints of a human body from an image or video in real-time. It uses a deep learning-based approach that combines convolutional neural networks (CNNs) and graph-based models to estimate the body key points.

  Here's a simplified overview of how OpenPose works:

  1. The input image or video frame is first fed into a CNN, which extracts features from the image.
  2. The output of the CNN is then fed into two branches: one branch predicts the key points or joints of the body, while the other predicts the connections or limbs between the joints.
  3. To predict the body key points, the model generates a heatmap for each key point, which represents the probability of the key point being present at each pixel location in the image.
  4. To predict the connections between the key points, the model generates Part Affinity Fields (PAFs), which represent the affinity or likelihood of a limb connecting two key points.

- Media Pipe: Media pipe provide a framework for cross-platform, customizable machine learning solution for live and streaming media to deliver live ML anywhere. The powerful tool is suitable for creating computer vision pipeline and complex. MediaPipe emphasizes real-time performance, making it suitable for applications that require low-latency processing. This is essential for tasks such as augmented reality, live video processing, and interactive applications.MediaPipe provides a collection of pre-trained machine learning models for various tasks. These models can be used to jump-start development and reduce the need for extensive training and data collection. Developers can customize and fine-tune pre-trained models or create their own models using MediaPipe. This flexibility is valuable for tailoring solutions to specific application requirements. MediaPipe offers a wide range of solutions, including face detection, pose estimation, hand tracking, object recognition, and more. These capabilities are essential for applications in fields like augmented reality, virtual reality, and computer vision. MediaPipe is well-suited for a range of applications, including AR/VR experiences, gesture-based interfaces, real-time object tracking, body and face recognition, and more. Its versatility makes it valuable in multiple industries, including gaming, healthcare, and retail.

Chapter 3: Requirement analysis

3.1 Problem Definition

The problem we aim to address is the lack of accurate and real-time monitoring of bicep exercises during fitness training sessions. Many individuals struggle to perform bicep exercises with proper form and technique, which can lead to suboptimal results and increased risk of injury. Traditional methods of monitoring form and providing feedback, such as relying on mirrors or occasional guidance from trainers, are often insufficient and inconsistent.

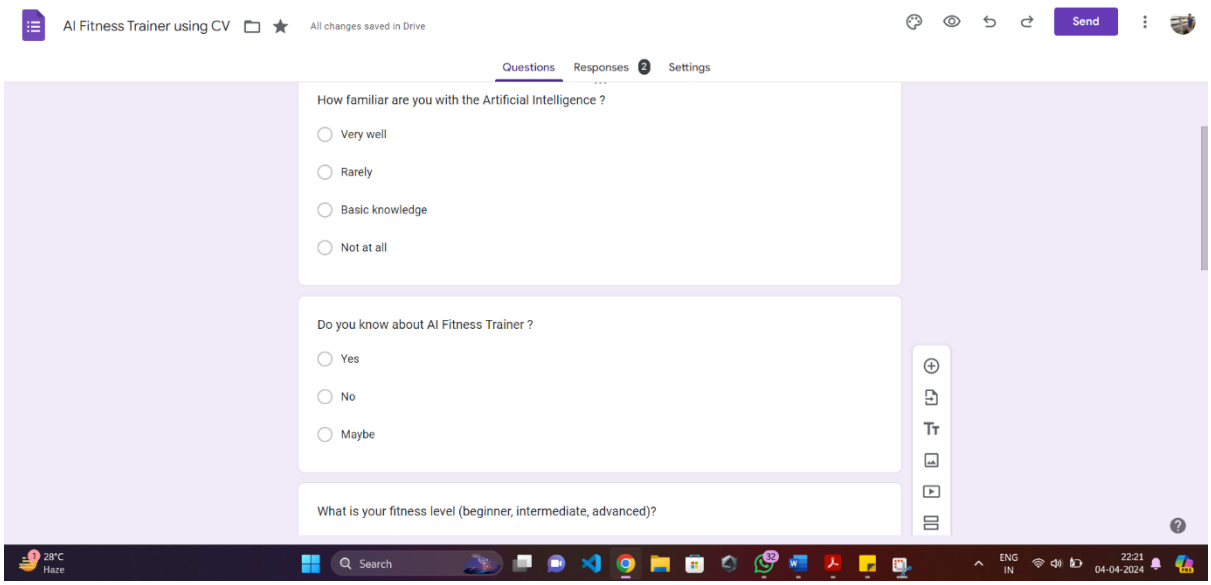
To tackle this problem, we propose the development of an AI fitness trainer with bicep detection capabilities. This system will leverage computer vision and artificial intelligence techniques to accurately track and analyze the user's bicep movements during exercises in real-time, providing personalized feedback and guidance to optimize performance and reduce the risk of injury.

3.2 Requirement Specification

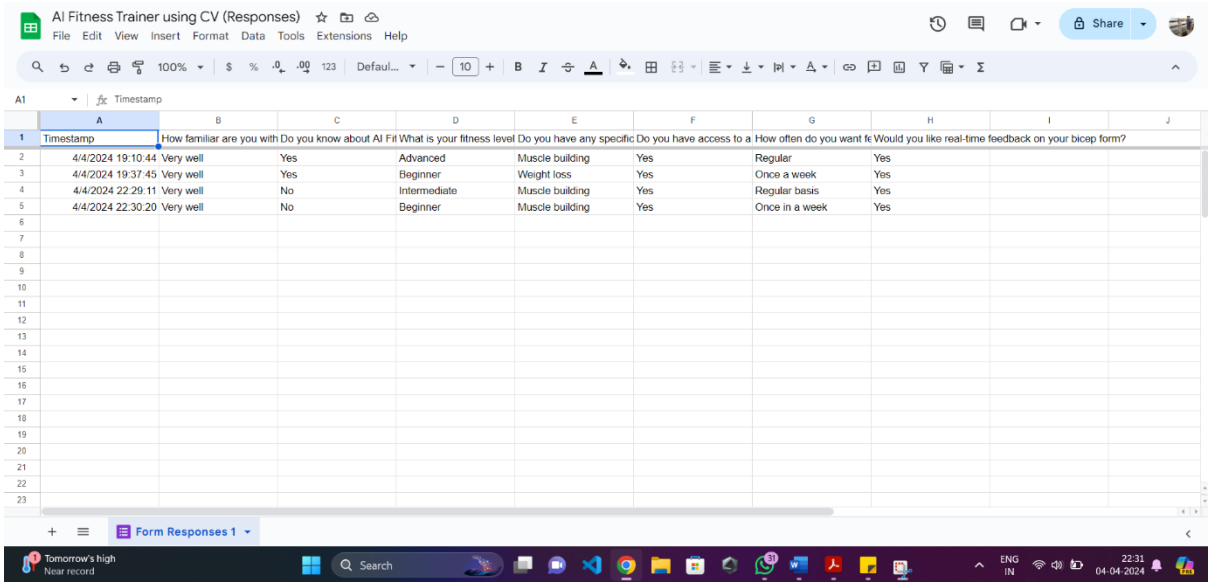
3.2.1 Requirement Gathering

The requirement gathering was performed by asking different questions related to AI fitness trainer that affecting their emotional state and the personal experience of different peoples by conducting the surveys and some personal interviews. The questions that were generally asked were:

- How familiar are you with the Artificial Intelligence ?
- Do you know about AI Fitness Trainer ?
- What is your fitness level (beginner, intermediate, advanced)?
- Do you have any specific fitness goals (e.g., muscle building, weight loss, general fitness)?
- Do you have access to a camera for capturing workout videos?
- How often do you want feedback during your workouts?
- Would you like real-time feedback on your bicep form?
- Aside from surveys & interviews the requirement can be gathered using online forums such as google scholars(https://scholar.google.com) & ResearchGate (https://researchgate.net). & As well as Google Form



3.1 Requirement Gathering: Google form



3.2 Requirement Gathering: Response Sheet

3.2.2 Requirement Analysis:

3.2.2.1 Functional Requirements:

- **Bicep Pose Detection:**

The AI Fitness Trainer must accurately detect bicep-related poses during exercises. It should identify key landmarks such as shoulder, elbow, and wrist positions to assess bicep form

- **Form Assessment:**
  The system evaluates the user's bicep exercise form in real-time. It checks for correct alignment, angles, and joint positions.

- **Repetition Counting:**
  The AI Trainer keeps track of bicep exercise repetitions. It provides visual to indicate completed reps.

- **Safety Measures:**
  The system ensures safe exercise practices.

- **Integration with Webcam or Camera:**
  The AI Trainer accesses the user's webcam or camera for real-time pose detection.
  It captures video frames and processes them using the bicep detection model.

3.2.2.2 Non- Functional Requirements:

- **Accuracy**
  The bicep detection algorithm should provide accurate and precise results. It must correctly identify bicep positions and movements during exercises.

- **Usability**
  Provide clear instructions for correct exercise form and bicep positioning.

- **Adaptability**:
  The system should adapt to different exercise types (e.g., curls, hammer curls,) and user skill levels (beginner, intermediate, advanced).

- **Feedback Mechanism**:
  Provide real-time feedback on bicep form, angle, and movement.

3.2.3 System Requirements:

- **Mediapipe Pose**

MediaPipe Pose is an ML solution that tracks body pose by inferring 33 3D landmarks and background segmentation masks from RGB video frames. It provides precise landmark positions, including those relevant to bicep detection. These views help analyze exercises such as overhead presses, side planks, crunches, curls, etc. by considering the object (person) from different angles

- **Numpy**

  NumPy arrays can represent the pose landmarks (such as bicep joint positions) detected by the MediaPipe Pose solution. It given the keypoints representing the shoulder, elbow, and wrist, NumPy can compute the angle formed by the bicep. Utilize NumPy's trigonometric functions (e.g., np.arccos, np.degrees) to calculate angles. Set angle thresholds to determine whether the bicep form is correct during exercises.

3.3 Table Task

Task no.	**Task Name**	**Starting Date**	**Ending date**	**Actual Starting Date**	**Actual Ending Date**
T1	Requirement Gathering	10-May-2023	15-June-2023	20-May-2023	22-June-2023
T2	Architecture & Detailed Design	23-July-2023	30-July-2023	27-July-2024	15-Aug-2023
T3	Coding & Testing	30-July-2023	13-Aug-2023	16-Aug-2023	2-Sept-2023
T4	Integration & Testing	13-Aug-2023	20-Aug-2023	2-Sept-2023	22-Oct-2023
T5	Operation & Maintenance	03-Sep-2023	25-Sep-2023	22-Oct-2023	11-Nov-2023

Table 3.1

3.4 Gantt Chart

	May	June	July	August	September	October	November	December
T1	Requirement Gathering							
T2			Architecture & Detailed Design					
T3				Coding & Testing				
T4					Integration & Testing			
T5						Operation & Maintenance		

Table 3.2

Chapter 4 System Design

4.1. Review of literature

Physical exercise is a crucial part of maintaining a healthy mind and body. It is a form of discipline that keeps us active and sharp, and there are various ways in which people can engage in exercise. Some prefer to go for a morning walk or hit the gym, while others invest in equipment to exercise at home. Regular exercise is essential to prevent muscle weakness, poor cardiovascular activity, and mental distress, which can ultimately lead to a poor quality of life. Specifically, according to the National Safety Council (NSC), there were 468,000 injuries in 2019 related to exercise. The importance of physical exercise has been recognized globally, as people spend more time indoors, it becomes even more important to find ways to exercise regularly.

The research paper "Vyayam: Artificial Intelligence based Bicep Curl Workout Tracking System" presents a novel system that uses artificial intelligence to track and analyze bicep curl workouts. s system aims to provide a more accurate and efficient way of monitoring bicep curl exercises, compared to traditional methods. General technologies involved are Human Pose Estimation, AI Trainer, Virtual Skeleton, OpenCV, Mediapipe The paper starts by discussing the importance of tracking workouts, which helps to measure progress, set goals, and avoid injury. However, traditional tracking methods, such as manual record-keeping or video analysis, can be time- consuming and prone to human error. This is where the Vyayam system comes in, as it uses machine learning algorithms to automatically detect and analyze the movement patterns of the bicep curl exercises. The authors of the paper conducted a study to evaluate the accuracy and effectiveness of the Vyayam system. The study participants performed bicep curl exercises using this smart fitness model, and the results were compared to manual records. The results showed that the Vyayam system was able to accurately detect and analyze the bicep curl exercises, with a high level of accuracy. The study participants also reported that the real-time feedback provided by the system was helpful in improving their form and performance. In conclusion, the "Vyayam: Artificial Intelligence based Bicep Curl Workout Tracking System" presents a promising solution for tracking bicep curl workouts. The system's use of artificial intelligence to accurately detect and analyze the movement patterns of the exercises provides a more efficient and accurate way of monitoring progress compared to traditional methods. The study results also suggest that the system can help users improve their form and performance

4.2. Data set description

- **Perspective Detection**

  For certain exercises, we resolve the ambiguity in camera perspective. For example, the bicep curl exercise is recorded from the side of the body, and could be performed with either the left or right

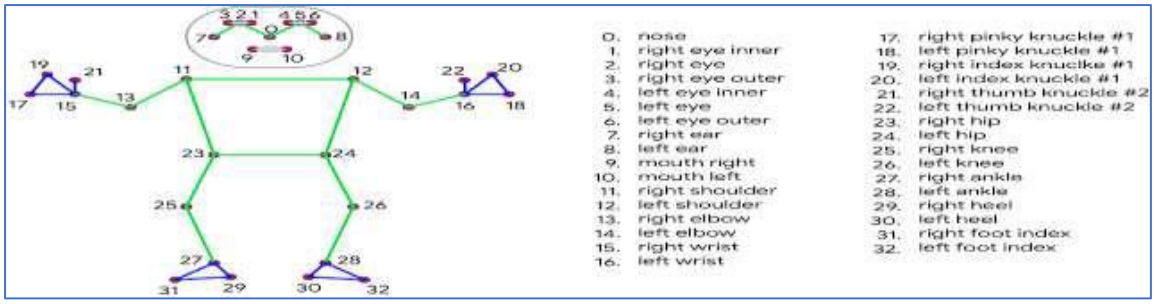
arm. We identify which arm is performing the exercise in the video by measuring which keypoints are most visible (left or right side keypoints) throughout all frames of the exercise. This accurately detects perspective all of our input videos

- **Geometry Evaluation**

  Next, we compute body vectors from keypoints of interest, and use personal training guidelines and our own recorded videos to design geometric heuristics, evaluating on the body vectors.

4.3. Algorithm

- **Mediapipe**



4.1 Mediapipe diagram

- **Pose Estimation**

  The first step is to estimate the human pose in real-time. This is achieved using MediaPipe's Pose pipeline, which infers 33 3D landmarks on the whole body from RGB video frames. The pipeline consists of a two-step detection-tracking pipeline. Using a detector, the pipeline first locates the person/pose region-of-interest (ROI) within the frame. The tracker subsequently predicts the pose landmarks within the ROI using the ROI-cropped frame as input.

- **Bicep Detection and Analysis**

  Once the pose is estimated, the landmarks corresponding to the shoulder, elbow, and wrist are identified. The angle between the shoulder-elbow and elbow-wrist lines can be calculated to determine the flexion of the bicep.

4.4. Use case

A use case diagram for an AI fitness trainer utilizing bicep detection might include the following actors, use cases, and their relationships:

Actors:

User: Engages with the AI fitness trainer application.

System: The system itself, incorporating AI algorithms for fitness guidance and bicep detection

Use Cases:

Detect Biceps:

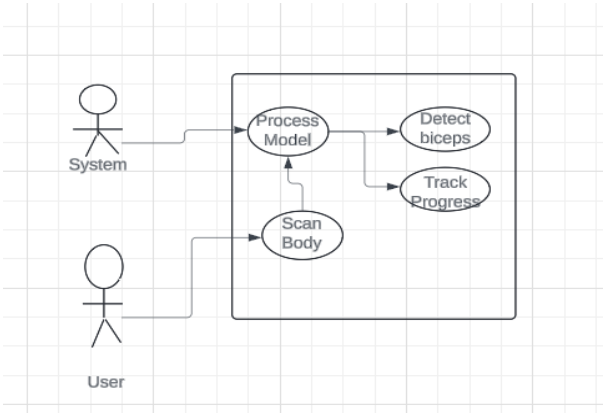
Description: Utilizes AI algorithms to detect and analyze the user's biceps.

Actors: User, AI Fitness Trainer System

Track Progress:

Description: Monitors the user's progress in bicep exercise and count the reps.

Actors: User, AI Fitness Trainer System



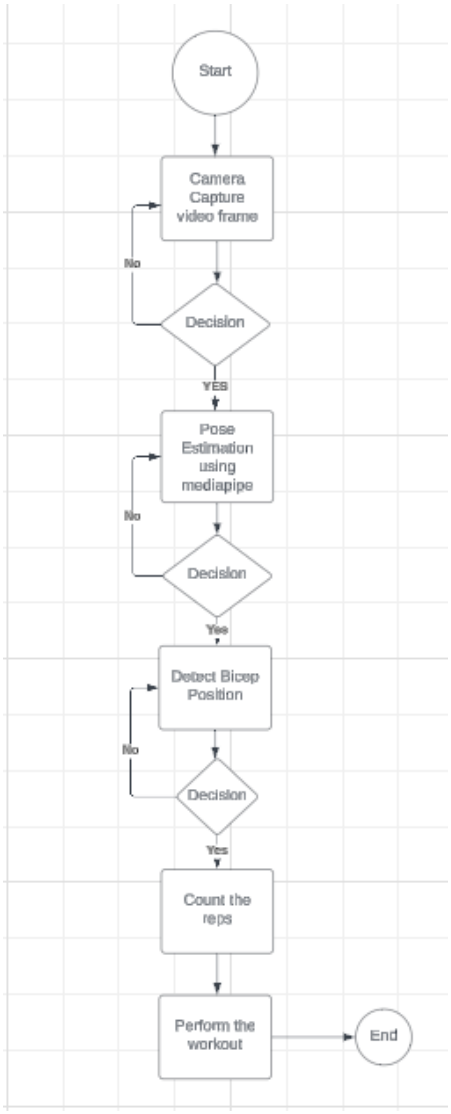
4.2 Use case diagram

4.5. Activity diagram

The activity diagram for an AI Fitness Trainer with a focus on bicep detection. This diagram will illustrate the sequence of action and interactions involved in bicep exercises using AI.

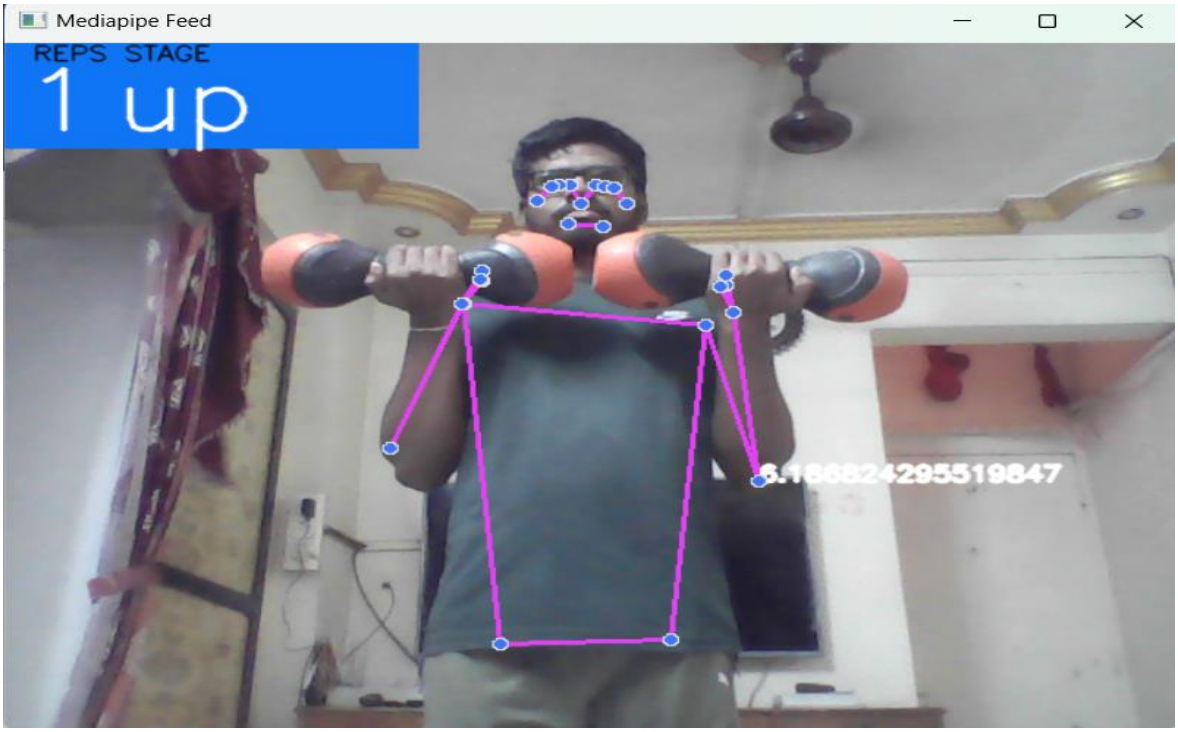
- **User Initiates Bicep Exercise:**
  - The user starts a bicep exercise (example, bicep curls, bicep hammer).
  - The AI Fitness Trainer system prepares to analyze the exercise.
- **Camera Captures Video Frames:**
  - The System accesses real-time video frames from the camera
  - These frames contain the user performing the bicep exercise.
- **Pose Estimation Using Mediapipe:**
  - The AI Fitness Trainer employs Mediapipe’s Pose Estimation.
  - It detects 33 key points on the user’s bicep form is correct or incorrect.
  - The system analyzes the video frames to infer the user’s pose.
- **Detect Bicep Position Analysis:**

- The system calculates angles and slopes related to the bicep position.
- It accesses whether the user's bicep form is correct or incorrect.



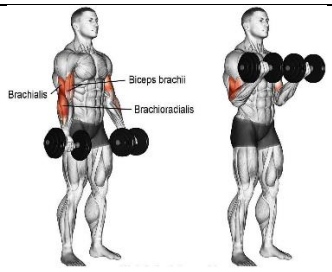
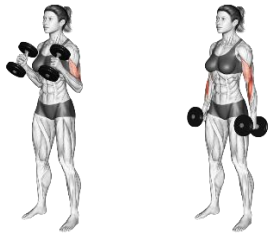
4.3 Flowchart Diagram

4.6 User Interface Design



4.4 User Interface Design

4.7 Test cases

No.	Input	Expected Output	Actual Output	Remark
1				
2				

4.1 Table

Chapter 5: Implementation and Testing

5.1 Coding detail and Efficiency:

```
import cv2
import mediapipe as mp
import numpy as np
mp_drawing = mp.solutions.drawing_utils
mp_pose = mp.solutions.pose


def calculate_angle(a,b,c):
    a = np.array(a) # First
    b = np.array(b) # Mid
    c = np.array(c) # End


    radians = np.arctan2(c[1]-b[1], c[0]-b[0]) - np.arctan2(a[1]-b[1], a[0]-b[0])
    angle = np.abs(radians*180.0/np.pi)


    if angle >180.0:
        angle = 360-angle


    return angle
cap = cv2.VideoCapture(0)


# Curl counter variables
counter = 0
stage = None
```

```
## Setup mediapipe instance
with mp_pose.Pose(min_detection_confidence=0.5, min_tracking_confidence=0.5) as pose:
    while cap.isOpened():
        ret, frame = cap.read()

        # Recolor image to RGB
        image = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
        image.flags.writeable = False

        # Make detection
        results = pose.process(image)

        # Recolor back to BGR
        image.flags.writeable = True
        image = cv2.cvtColor(image, cv2.COLOR_RGB2BGR)

        # Extract landmarks
        try:
            landmarks = results.pose_landmarks.landmark

            # Get coordinates
            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_W
RIST.value].y]


            # Calculate angle
            angle = calculate_angle(shoulder, elbow, wrist)


            # Visualize angle
            cv2.putText(image, str(angle),
                        tuple(np.multiply(elbow, [640, 480]).astype(int)),
                        cv2.FONT_HERSHEY_SIMPLEX, 0.5, (255, 255, 255), 2, cv2.LINE_AA
                            )


            # Curl counter logic
            if angle > 160:
                stage = "down"
            if angle < 30 and stage =='down':
                stage="up"
                counter +=1
                print(counter)


        except:
            pass


        # Render curl counter
        # Setup status box
        cv2.rectangle(image, (0,0), (225,73), (245,117,16), -1)
```

```
# Rep data
cv2.putText(image, 'REPS', (15,12),
        cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0,0,0), 1, cv2.LINE_AA)
cv2.putText(image, str(counter),
        (10,60),
        cv2.FONT_HERSHEY_SIMPLEX, 2, (255,255,255), 2, cv2.LINE_AA)

# Stage data
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)


# Render detections
mp_drawing.draw_landmarks(image, results.pose_landmarks, mp_pose.POSE_CONNECTIONS,
                mp_drawing.DrawingSpec(color=(245,117,66), thickness=2, circle_radius=2),
                mp_drawing.DrawingSpec(color=(245,66,230), thickness=2, circle_radius=2)
                 )

cv2.imshow('Mediapipe Feed', image)



if cv2.waitKey(10) & 0xFF == ord('q'):
```

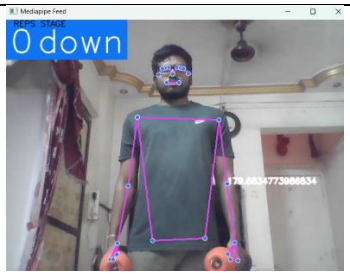
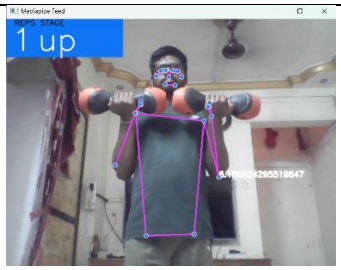
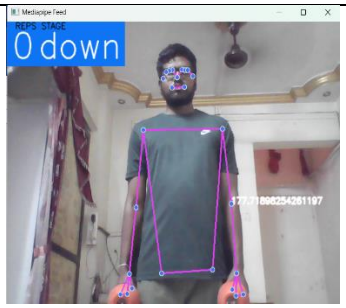
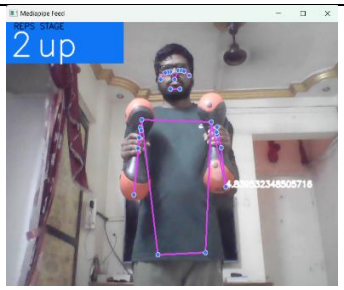
```
        break


cap.release()

cv2.destroyAllWindows()
```

5.2 Testing Approaches

For the testing, I have chosen User Acceptance Testing (UAT) as the primary test approach. UAT is pivotal as it involves real users interacting directly with the system, providing valuable feedback on its functionality, usability, and overall performance. This approach aligns with our project's focus on real-world user interactions and the complexity of the system. By involving real users in the testing process, we aim to ensure that the system meets their needs and expectation, delivering a satisfactory user experience.

No.	Input	Expected output	Actual Output	Remark
1.		Bicep Curl		Pass
2.		Hammer Curl		Pass

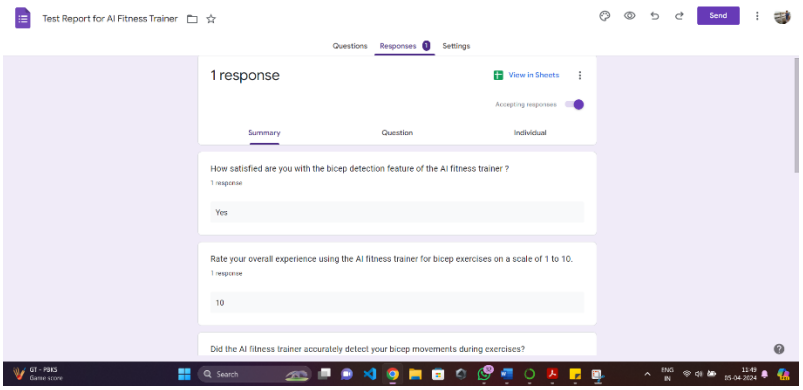
5.1 Table

Chapter 6: Implementation and Testing

6.1 Test Report

Physical exercise is a crucial part of maintaining a healthy mind and body. It is a form of discipline that keeps us active and sharp, and there are various ways in which people can engage in exercise.

As I have taken the Feedback from the user based on that, I am giving the rating of my project.



6.1 Feedback Form

- User Satisfaction: 9.7
- User Engagement: 9.2
- System Usability: 9.0
- Effectiveness: 10
- Accuracy: 10

6.2 User Documentation

- **Getting Started**
  - **Select Bicep Exercise:** Choose a bicep exercise from the available options. Common exercises include bicep curls, hammer curls, and concentration curls.
  - **Position Yourself:** Position yourself in front of the camera or device, ensuring that your entire upper body is visible.
  - **Start the Bicep Detection:** Once you are ready, start the bicep detection feature by selecting the appropriate option on the screen.

- **Using Bicep Detection**
  - **Real-Time Feedback:** As you perform the bicep exercise, the AI Fitness Trainer will provide real-time feedback on your form and technique.

    - **Visual Guidance:** Visual cues will be overlaid on the screen to indicate the movement of your biceps. Follow these cues to ensure proper execution of the exercise.
- **Tips for Better Results**
    - **Clear Visibility:** Ensure that the camera or device has a clear view of your upper body, with sufficient lighting to aid in accurate bicep detection.

- **Troubleshooting**
    - **Poor Detection:** If you experience issues with bicep detection, ensure proper positioning and lighting. Restart the detection process if necessary.

Chapter 7: Conclusion

7.1 Conclusion

Our proposed model is user-friendly, easy to use, and provides precise results. The AI workout trainer takes the user's live video as input, generates landmarks on the human body, and provides feedback on posture

7.2Limitations

- **Limited Exercise Coverage:** Bicep detection may primarily focus on specific set of exercises targeting the biceps, such as curls and extensions. Our proposed model is user-friendly, easy to use, and provides precise results. The AI workout trainer takes the user's live video as input, generates landmarks on the human body, and provides feedback on posture
- **Limited joint detection:** Mediapipe's pose estimation only detects certain joints like the elbows, wrists, and knees, which may not be sufficient for certain exercises that require the detection of other joints or body parts such as the hips or ankles.
- **Applicability limitations:** Mediapipe's pose estimation was primarily trained on data from people of certain age, gender, and body types, making it less effective for people outside of these parameters, such as children, the elderly, or individuals with disabilities

7.3Future Scope

- **Real-Time Feedback and Form Correction:** AI trainers will provide instant feedback during exercises. They will analyze your movements, posture, and form, helping you optimize each rep.
- **Personalization and Customization**: AI-driven personalization will be a game-changer. These trainers will analyze user data, preferences, and goals to create tailored workout plans. Whether it’s adjusting exercises, intensity, or rest periods, AI will adapt routines to individual needs