

AN INTERNSHIP PROJECT REPORT

On

AI FITNESS TRAINEE

Submitted in partial fulfillment of the requirements for the award of the degree of

Bachelor of Technology

In

Computer Science and Engineering

By

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES

ONGOLE CAMPUS

2024-2025

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIS-AP.
ONGOLE CAMPUS



CERTIFICATE

This is to certify that the project entitled “**AI FITNESS TRAINEE**” being submitted by **BELLAMKONDA PUSHPA SHREE (O190867)** in partial fulfillment of the requirements for the award of the degree of the Bachelor of Technology in Computer Science and Engineering to **Rajiv Gandhi University of knowledge Technologies-A.P. Ongole Campus**, is a record of Bonafide work carried out by them under my guidance and supervision.

The results presented in this project have been verified and found to be satisfactory. The results embodied in this project report have not been submitted to any other University for the award of any other degree.

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DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

BELLAMKONDA PUSHPA SHREE-O190867

Date:

Place:

APPROVAL SHEET

This project entitled “**AI FITNESS TRAINEE**” by **BELLAMKONDA PUSHPA SHREE-(O190867)** approved for the degree of the Bachelor of Technology in Computer Science and Engineering.

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Supervisor(s)

Chairman

Date:_____

Place:_____

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It is my privilege to express a profound sense of respect, gratitude and indebtedness to our guide **Mrs. B Shireesha, Assistant Professor**, Department of Computer Science and Engineering, Rajiv Gandhi University of Knowledge Technologies-A.P., Ongole Campus, for her indefatigable inspiration, guidance, cogent discussion, constructive criticisms and encouragement throughout the dissertation work.

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With Sincere Regards,

BELLAMKONDA PUSHPA SHREE-O190867



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who has successfully completed the

INDUSTRIAL TRAINING AND INTERNSHIP
on

PYTHON DEVELOPMENT (PROJECT BASED)
and developed the project titled

AI FITNESS TRAINEE

by following all the necessary criteria of the company with grade "A++".



Director
Technical

Issue Date: April 18, 2025

Certificate ID: ASD/CLO/RAJ/CON/60848

Grading Legend

A++: 90% and above, A+: 75% to 89%, A: 65% to 74%, B: 55% to 64%



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ABSTRACT

Recently lot of people facing many health issues due to the lack of physical activity. Not getting enough physical activity can lead to heart disease, even for people who have no other risk factors. It can also increase the likelihood of developing other heart disease risk factors including obesity, high blood pressure, high blood cholesterol. Many people refrain from physical activities like workouts or yoga for various reasons like driving out to gym, trainer fees, social anxiety and hectic schedule.

Our objective is develop a solution which can guide the user on how to properly perform a particular exercise or a yoga asana. With the help of OpenCV library and Media pipe framework, we can develop an application that detects the user's exercise pose and provides personalized, detailed recommendations on how the user can improve their form.

The project aim is to validate and be able to quantify the physical movements of the end user. Mediapipe approach provides human pose tracking by employing machine learning (ML) to infer 33, 2D landmarks of a body from a single frame. With the help of this data, we can evaluate whether the user is performing task in a proper form and notice the monthier shortcoming The practical application would require a webcam pointed towards the person in such a way that the face and the portion of the body associated with the task is clearly visible and can be marked with Mediapipe landmarks and later the data can be processed to guide them.

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CHAPTER 1

INTRODUCTION

Exercising is essential for maintaining good health and fitness and plays a vital role in every aspect of life. We have evolved from nomadic ancestors who were constantly on the move in search of food and shelter, often covering long distances each day. Our bodies are naturally designed for regular movement and physical activity. However, in today's modern lifestyle, many people spend hours sitting at desks or in front of screens, drastically reducing their daily activity. This sedentary behavior can lead to various health issues over time. Exercise, which includes any physical activity aimed at improving or maintaining fitness and health, offers numerous benefits. It helps control body weight, reduces the risk of heart disease, manages blood sugar and insulin levels, improves mental health and mood, strengthens bones and muscles, lowers the risk of certain cancers, and promotes better sleep. According to a survey conducted by *India News*, about 60% of people do not exercise regularly, often due to time constraints related to work, family, and other commitments. Despite these challenges, it is important to recognize how crucial exercise is for a healthy lifestyle. Exercising with proper form is essential to prevent injuries and achieve better results, and keeping track of repetitions and sets can help maintain consistency and motivation in one's fitness journey.

1.1 MOTIVATION

AI-powered personal training is an exciting innovation that combines the best of artificial intelligence and fitness. With AI trainee technology, a program can provide individualized feedback and guidance for every exercise and activity.

1.2 PROBLEM DEFINITION

Artificial Intelligence (AI) is the ability of machines to learn and perform tasks. It has the potential to automate and supplement traditional fitness regimes, providing data-driven insights and adaptive personal training experiences. This technology has already been employed for both commercial purposes, such as with fitness centres or at home for personal use. As AI continues to evolve, so will its application in the fitness industry, changing how people train and move towards improved health.

1.3 OBJECTIVE OF THE PROJECT

This technology has already been employed for both commercial purposes, such as with fitness centres or at home for personal use. As AI continues to evolve, so will its application in the fitness industry, changing how people train and move towards improved health. AI can be used to track one's performance, lifestyle, and diet; this information can then be used to give tailored advice and guidance on diet, sleep, exercise regimen, energy level, and more. AI is quietly revolutionizing the way people approach their health and well-being by providing real-time feedback systems designed to help habit formation.

CHAPTER 2

LITERATURE SURVEY

With growing awareness about health, many researchers are exploring ways to use technology to promote fitness. Computer vision and AI are increasingly being used to guide physical activity and correct posture during workouts

Human Pose Estimation has evolved from expensive, marker-based systems to real-time, markerless methods using standard cameras. OpenPose, PoseNet, and MediaPipe are well-known tools in this space. These tools estimate body landmarks and track movement with good accuracy.

MediaPipe Pose, developed by Google, uses the BlazePose model to detect 33 body landmarks from a single image. It works in real time and can identify small posture errors. This data can be used to assess whether exercises are being performed correctly.

Fitness Applications now use pose estimation to monitor activities like squats, yoga, and lunges. Some systems even give real-time corrections to help users maintain proper form, reducing the risk of injury and improving results.

Current Challenges in such systems include varying lighting, cluttered backgrounds, occlusion, and the need to adapt to different body types. Also, many people avoid physical activity due to gym costs, trainer fees, or social anxiety.

The proposed **AI-Fitness Trainee** aims to solve these issues by offering real-time pose correction using a webcam and open-source tools like OpenCV and MediaPipe. It's designed to be accessible, affordable, and usable at home, helping users maintain consistent and proper exercise routines.

CHAPTER 3

ANALYSIS

3.1. EXISTED SYSTEM

There are numerous applications available in the market which guide the user about the exercises to be performed. All of the applications and services of fitness available to the public on play store and app store are focusing on describing the exercise routine to be followed and the number of repetitions for which it should be performed and the time duration in which you need to complete.

3.2 PROPOSED SYSTEM

This project aims to develop an AI-based personal fitness trainer that helps users exercise correctly at home using real-time pose estimation. With the help of OpenCV and MediaPipe, the system uses a webcam to detect and analyze the user's body posture during workouts. It tracks key points on the body, calculates joint angles, and validates whether each exercise repetition is performed correctly. The system counts reps, checks form, and provides real-time feedback through voice alerts to help users improve performance and avoid injury. It's a convenient, cost-effective solution for people who prefer home workouts but still want guidance similar to a personal trainer.

ADVANTAGES OF PROPOSED SYSTEM

The main novelty of this project is that it can challenge the traditional approach and provide an entirely new alternative to people through pose detection. This kind of application could enable safer and more inspirational home workout routines, while also increasing the accessibility and decreasing the costs associated with professional physical trainers. This can also be an example of how we can use pose detection modules in the field of fitness industry to improve their mobility and efficiency. Our project overcomes the limitations of the existing fitness apps by utilizing the technology of computer vision and pose detection.

3.3.SOFTWARE REQUIREMENT SPECIFICATION:

Software Requirements

1. Python 3.8
2. PyCharms IDE
3. OpenCV Library
4. Mediapipe Frameworks

Hardware Requirements

System: OS Windows 10 or higher versions or ubuntu with webcam

Processor (CPU): i5 Processor and above

Memory: Minimum 8GB RAM

3.3.1.PURPOSE:

The purpose of this project is to create an AI-powered fitness trainer that helps users perform exercises correctly from the comfort of their homes. It aims to provide real-time posture correction, repetition counting, and performance feedback using computer vision and machine learning techniques. This system is designed to minimize the risk of injury, improve workout efficiency, and eliminate the need for a physical trainer, making fitness more accessible and affordable.

3.3.2.SCOPE:

This project focuses on building a real-time exercise monitoring system using a webcam, OpenCV, and MediaPipe. It will support common workout routines and yoga asanas, detect body landmarks, and evaluate posture using pose estimation. The system will include features such as live rep counting, form validation, voice-based feedback, and a visual display of workout status. It is intended for personal use and does not require specialized hardware, making it ideal for home environments.

3.3.3.OVERALL DESCRIPTION:

The AI-based fitness trainer works by capturing live video through a webcam and analyzing the user's movements using MediaPipe's pose estimation. It identifies key body points and calculates joint angles to determine whether the user is performing an exercise correctly. Each exercise has a custom validation function that checks form and counts repetitions. The system provides real-time feedback via voice prompts and on-screen displays to guide the user and enhance their performance. It is a user-friendly and efficient solution for people who want to stay fit without going to the gym or hiring a personal trainer.

CHAPTER 4

DESIGN

1.1 UML DIAGRAM

Unified Modeling Language (UML) is a general-purpose modelling language. The main aim of UML is to define a standard way to visualize the way system has been designed. It is quite similar to blueprints used in other fields of engineering. UML is not a programming language it is rather a visual language. We use UML diagrams to portray the behavior and structure of a system.

STRUCTURAL UML DIAGRAMS:

Structural diagrams depict a static view of a structure of a system. It is widely used in the Documentation of software architecture. The Structural UML Diagrams involves 7 diagrams They are:

- Class Diagram
- Object Diagram
- Component Diagram
- Composite Structure Diagram
- Deployment Diagram
- Package Diagram

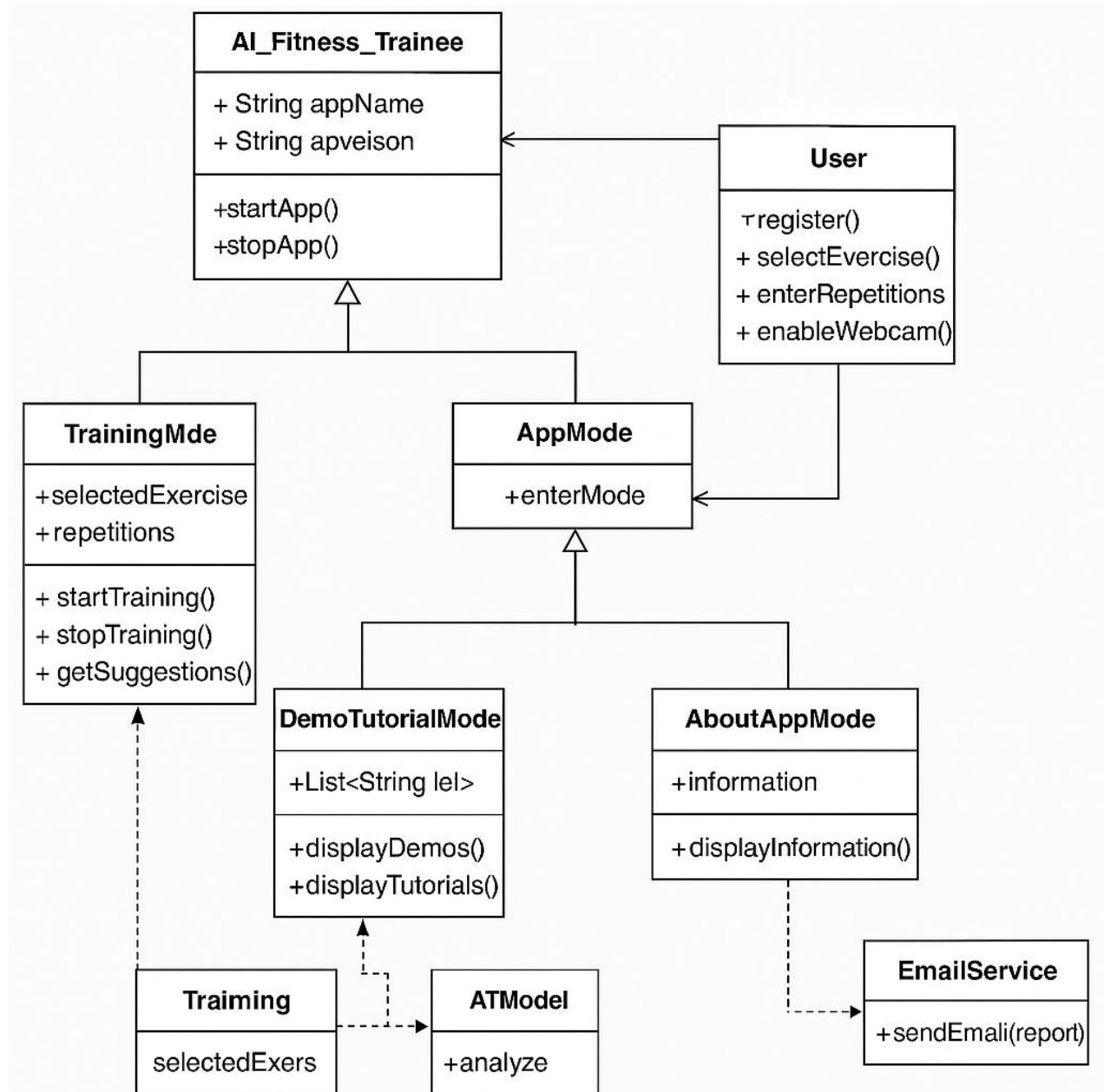
BEHAVIORAL UML DIAGRAMS:

Behavioral diagrams portray a dynamic view of a system or the behavior of a system which describes the functioning of the system. It involves 7 diagrams They are:

- Use case Diagram
- Sequence Diagram
- Activity Diagram
- Interaction Overview Diagram
- Communication Diagram
- Timing Diagram

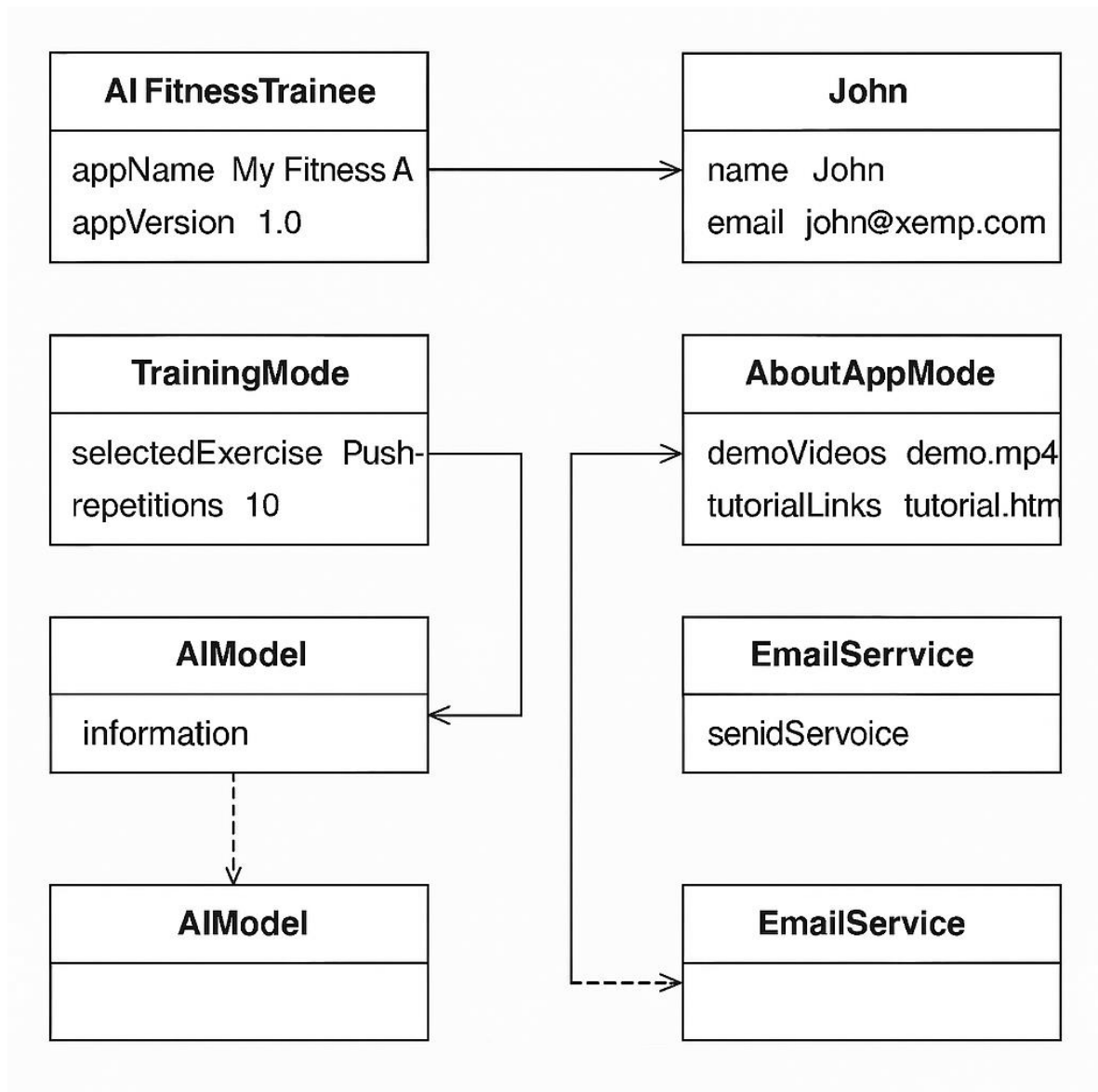
CLASS DIAGRAM

The class diagram is the main building block of object-oriented modeling. It is used for general conceptual modeling of the structure of the application and for detailed modeling, translating the models into programming code. Class diagrams can also be used for data modelling.



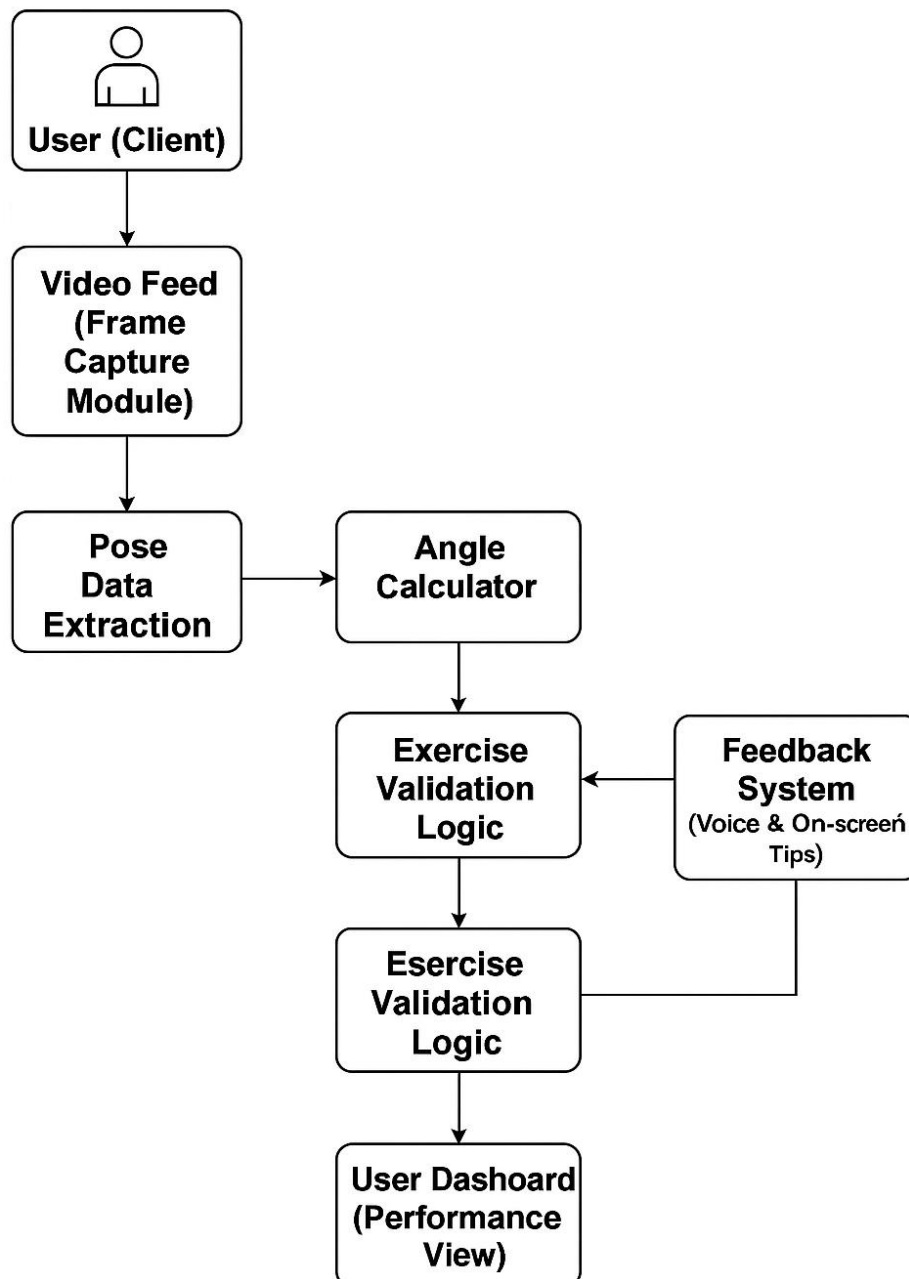
OBJECT DIAGRAM

It describes the static structure of a system at a particular point in time. It can be used to test the accuracy of class diagrams. It represents distinct instances of classes and the relationship between them at a time.



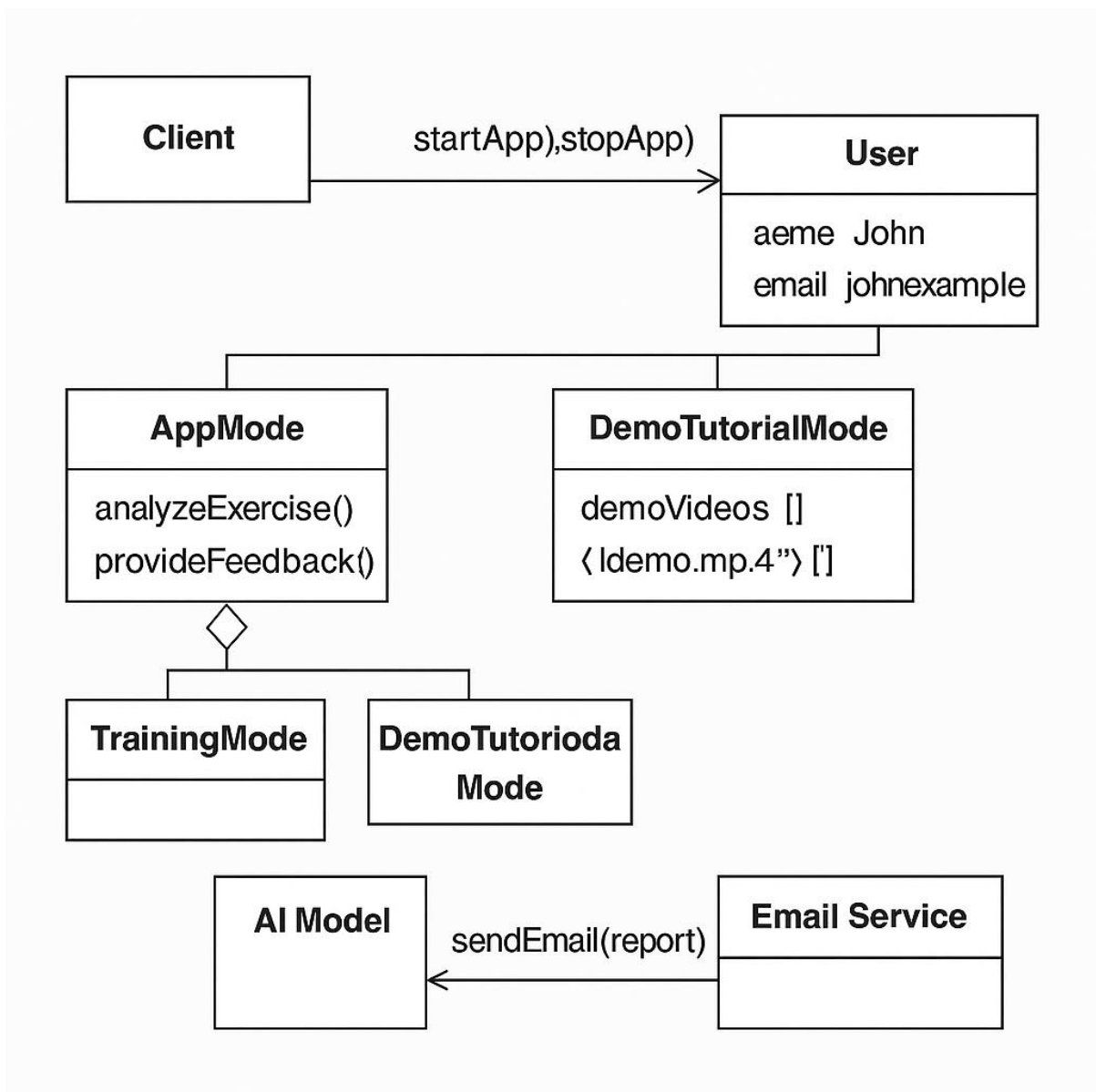
COMPONENT DIAGRAM

Component diagrams are used in modeling the physical aspects of object-oriented systems that are used for visualizing, specifying, and documenting component-based systems and also for constructing executable systems through forward and reverse engineering. Component diagrams are essentially class diagrams that focus on a system's components that often used to model the static view of diagram.



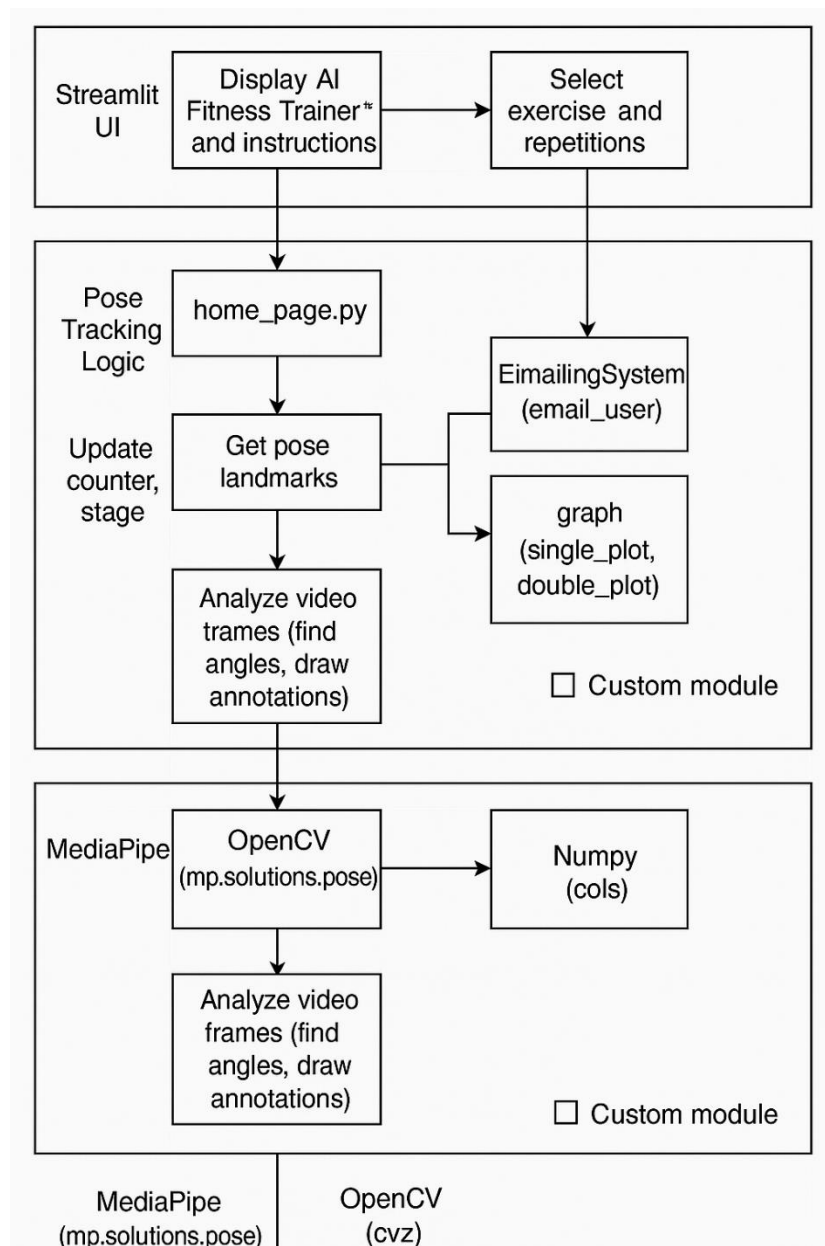
COMPOSITE STRUCTURE DIAGRAM

Composite Structure Diagram is one of the new artifacts added to UML 2.0. A composite structure diagram is a UML structural diagram that contains classes, interfaces, packages, and their relationships, and that provides a logical view of all, or part of a software system. It shows the internal structure (including parts and connectors) of a structured classifier or collaboration.



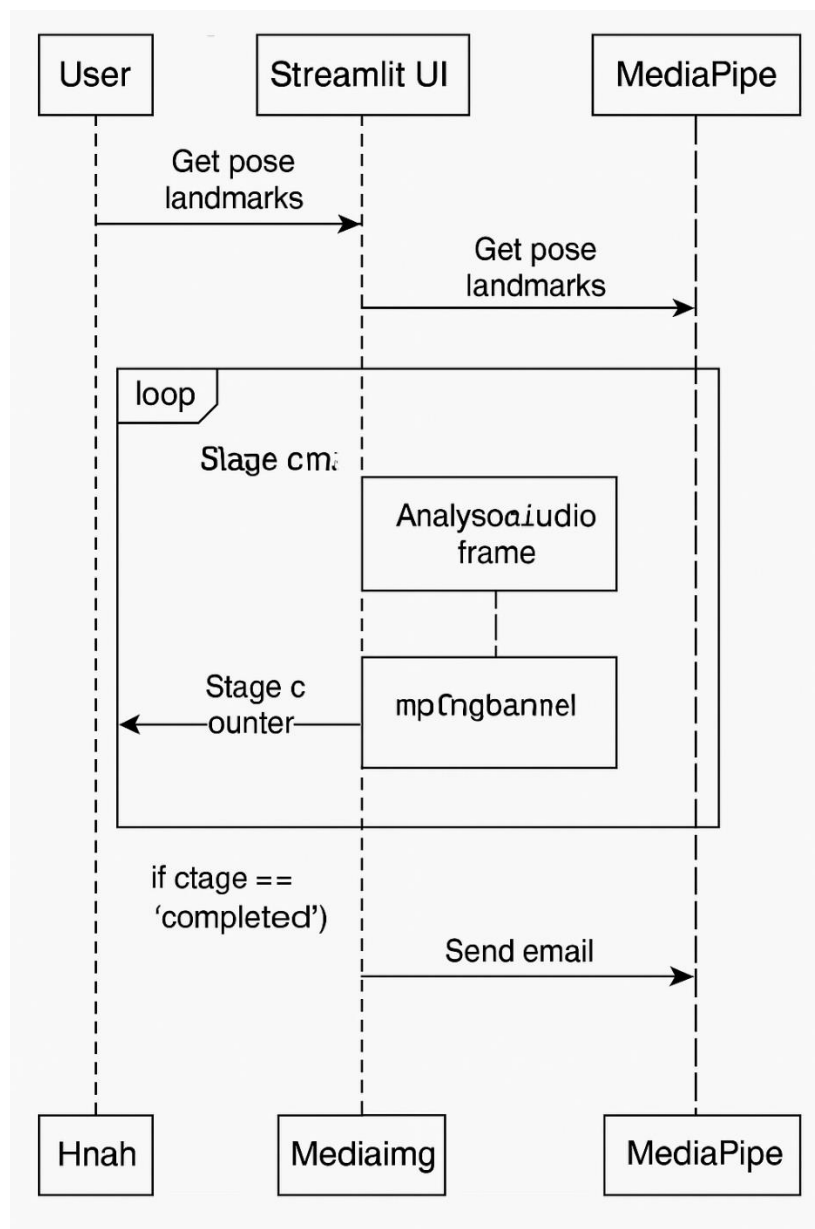
PACKAGE DIAGRAM

Package diagrams are used in part to depict import and access dependencies between packages, classes, components, and other named elements within your system. Each dependency is rendered as a connecting line with an arrow representing the type of relationship between the two or more elements



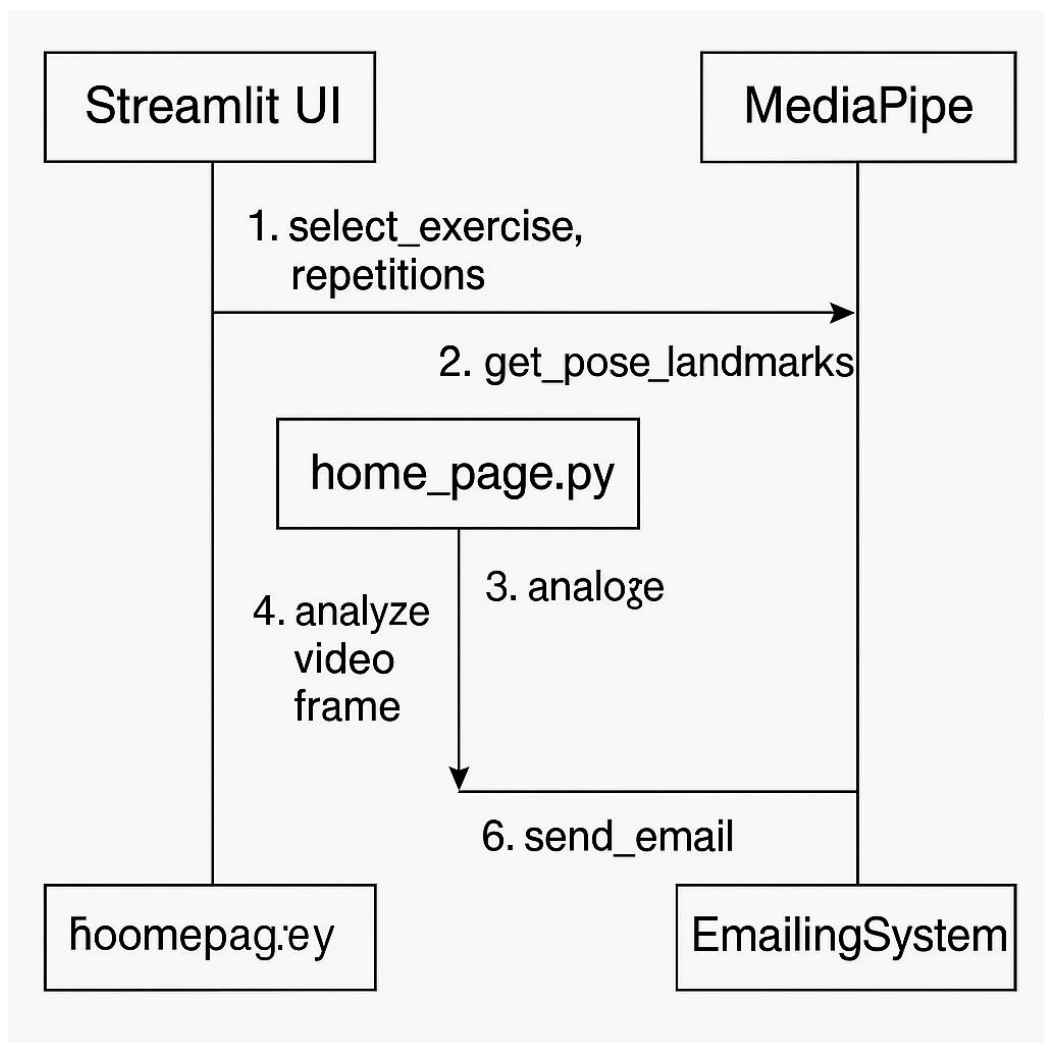
SEQUENCE DIAGRAM

A sequence diagram consists of a group of objects that are represented by lifelines and the messages that they exchange over time during the interaction. A sequence diagram shows the sequence of messages passed between objects. Sequence diagrams can also show the control structures between objects.



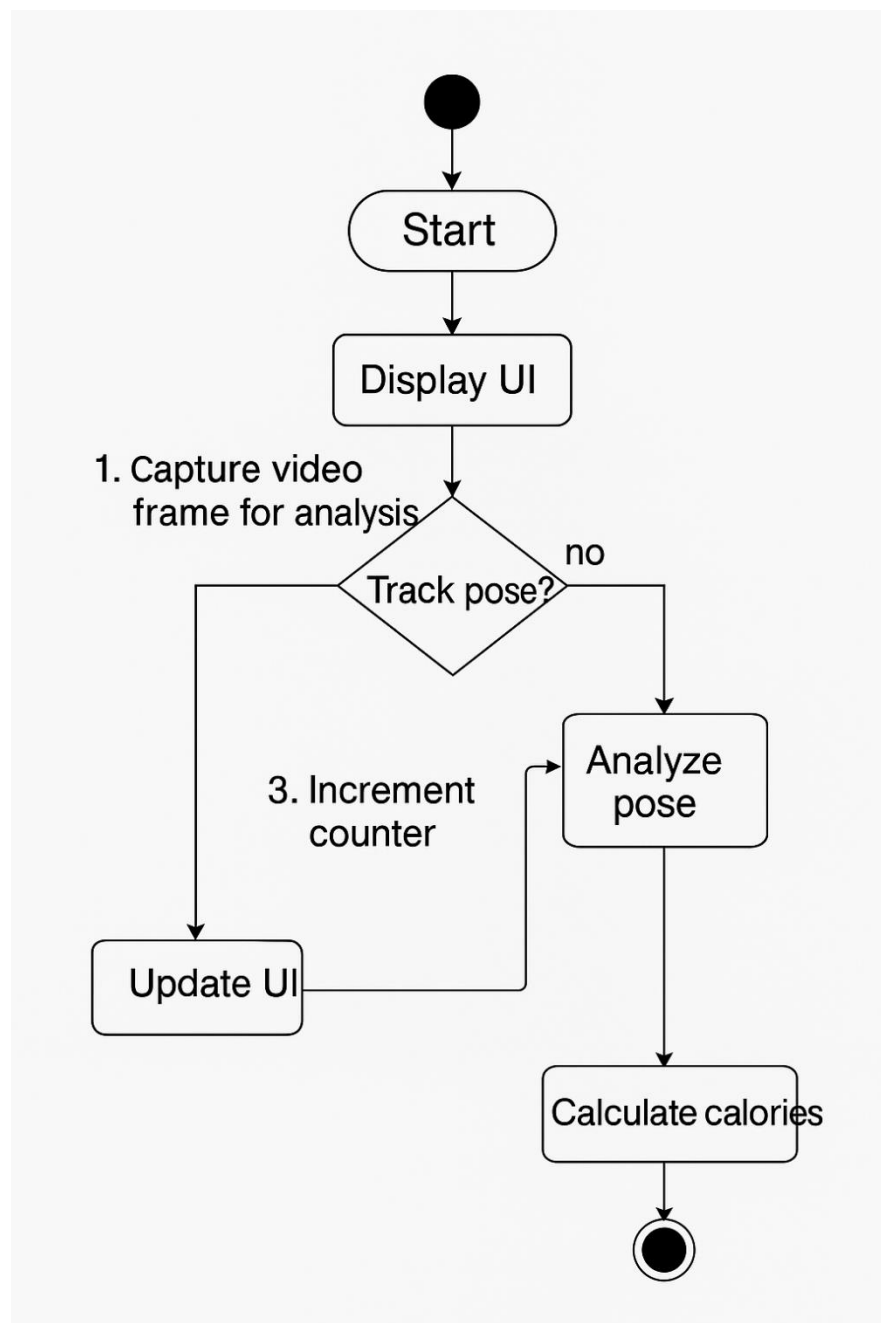
COMMUNICATION DIAGRAM

A Communication diagram models the interactions between objects or parts in terms of sequenced messages. Communication diagrams represent a combination of information taken from Class, Sequence and Use Case Diagrams describing both the static structure and dynamic behavior of a system.



ACTIVITY DIAGRAM

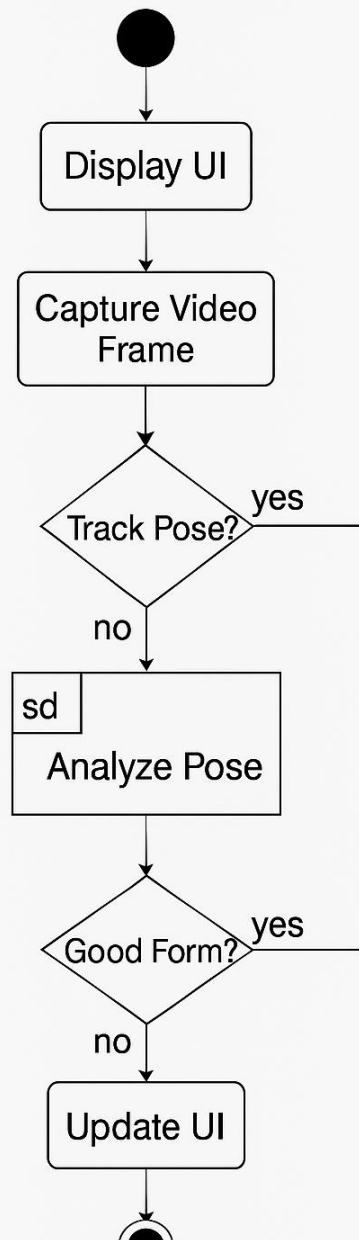
An activity diagram visually presents a series of actions or flow of control in a system similar to a flowchart or a data flow diagram. Activity diagrams are often used in business process modeling. They can also describe the steps in a use case diagram. Activities modeled can be sequential and concurrent .



INTERACTION OVERVIEW DIAGRAM

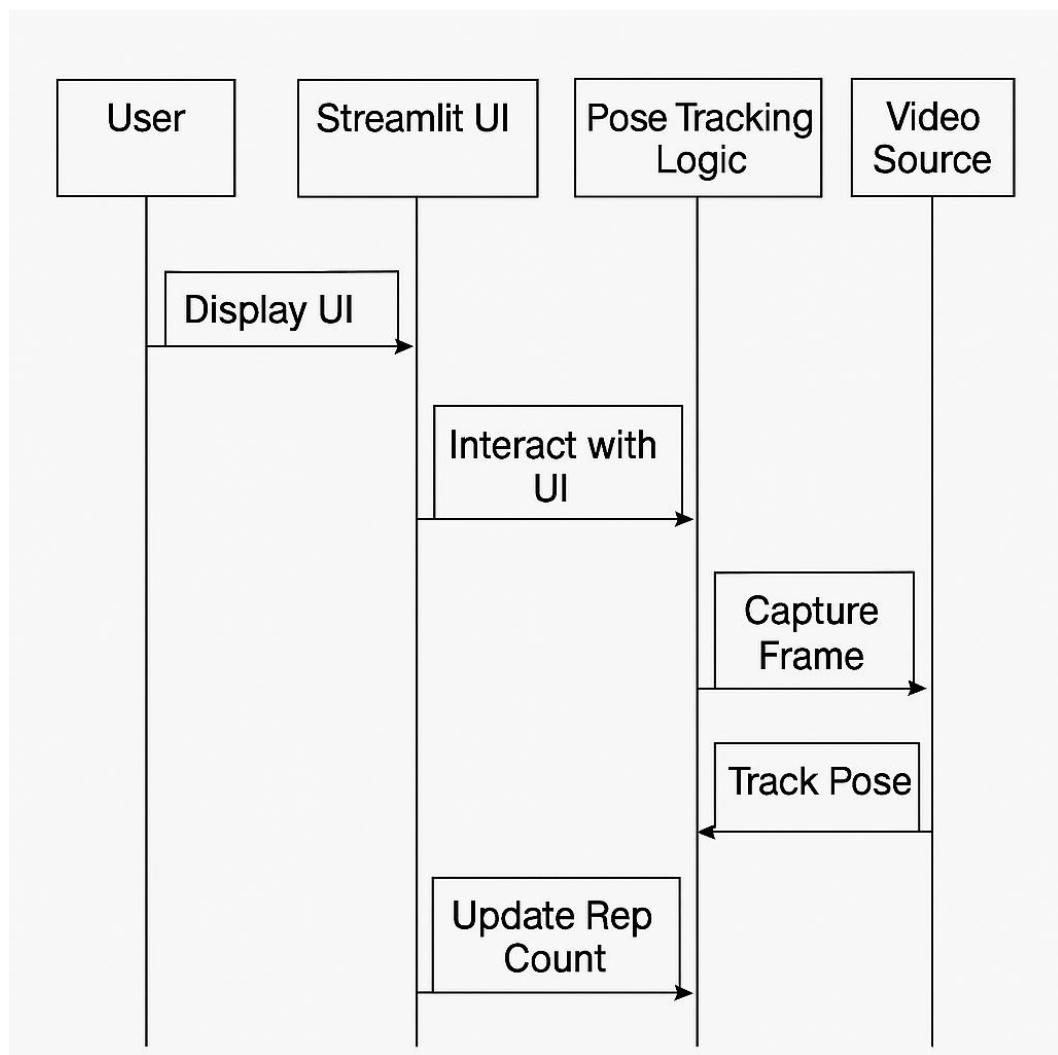
An interaction diagram is a type of UML diagram that's used to capture the interactive behavior of a system. Interaction diagrams focus on describing the flow of messages within a system, providing context for one or more lifelines

Interaction Overview Diagram



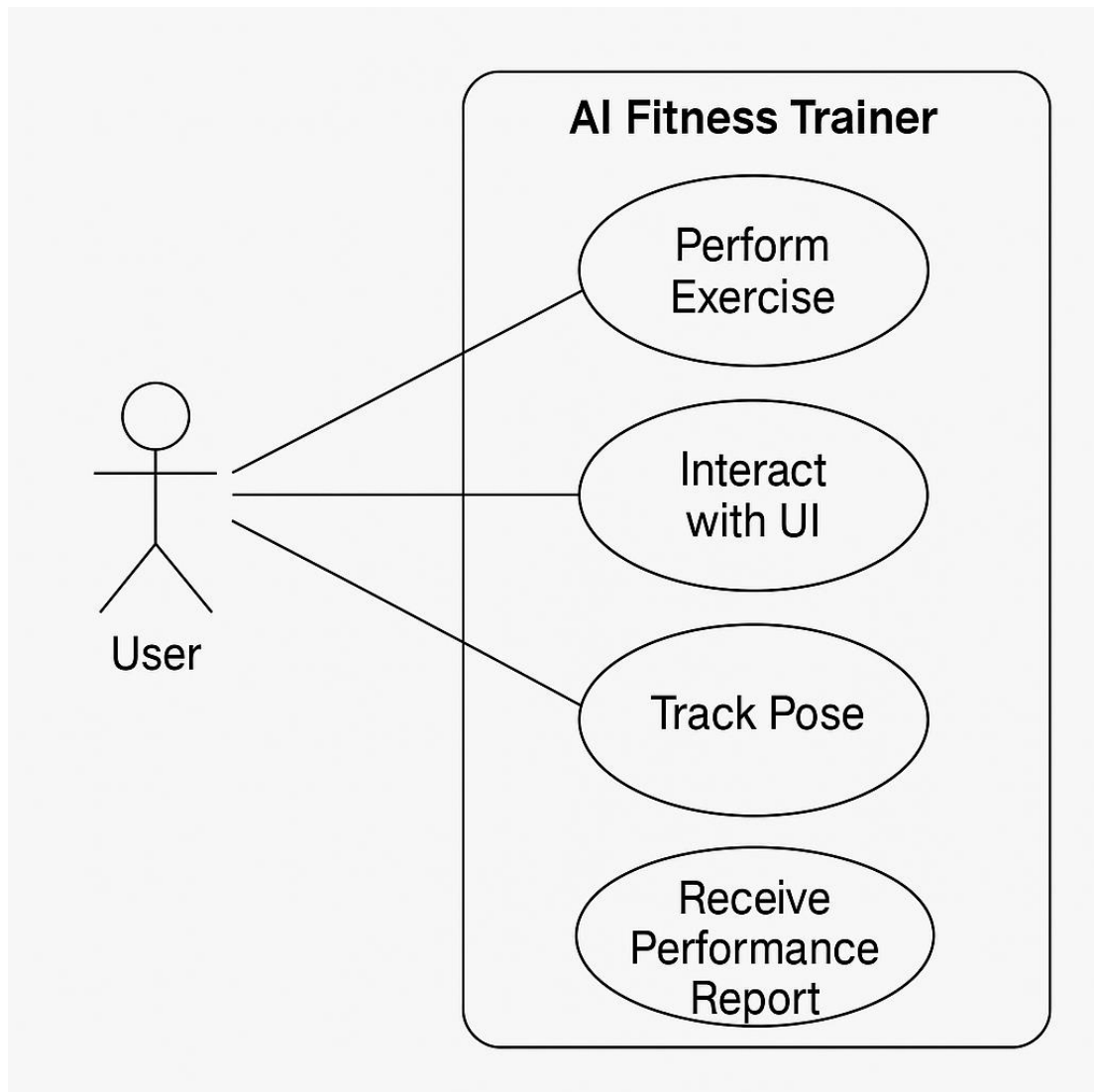
TIMING DIAGRAM

A timing diagram includes timing data for at least one horizontal lifeline with vertical messages exchanged between states. Timing diagrams represent timing data for individual classifiers and interactions of classifiers. You can use this diagram to provide a snapshot of timing data for a particular part of a system.



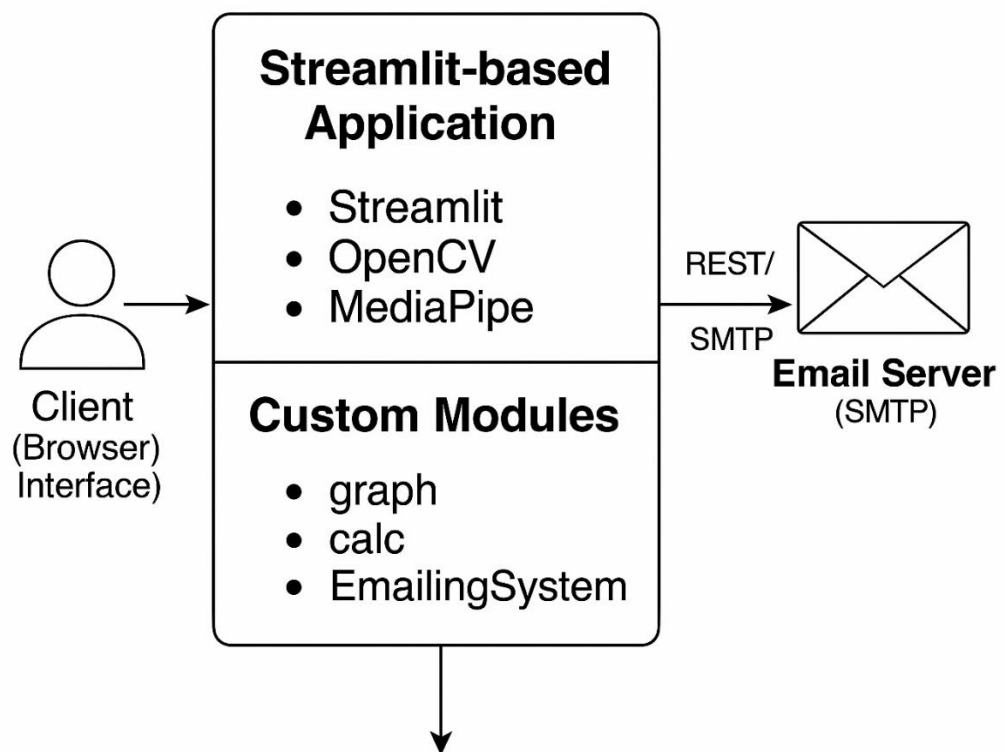
USE CASE DIAGRAM

Use case diagrams describe the high-level functions and scope of a system. These diagrams also identify the interactions between the system and its actors. The use cases and actors in use-case diagrams describe what the system does and how the actors use it, but not how the system operates internally.



DEPLOYMENT DIAGRAM

A deployment diagram is a UML diagram type that shows the execution architecture of a system including nodes such as hardware or software execution environments, and the middleware connecting them. Deployment diagrams are typically used to visualize the physical hardware and software of a system.



CHAPTER 5

IMPLEMENTATION

5.1. MODULES

- 1 Main Streamlit Application with Webcam and UI
- 2 Module for Plotting Performance Graphs
- 3 Estimates Calories Burned Based on Exercise
- 4 Sends Email Summaries to Users

5.2 MODULE DESCRIPTION

1. Main Streamlit Application with Webcam and UI

Description:

This is the **core application module** that builds the interactive web interface using Streamlit. It manages real-time webcam input, pose detection, exercise recognition, and user interaction.

Functionality:

- Displays exercise selection, user input, and tutorials
- Captures video and analyzes user pose in real-time
- Tracks exercise progress and counts repetitions
- Provides live feedback and posture correction tips
- Triggers calorie calculations, performance plotting and email reporting

Key Technologies:

- **Streamlit** – Web interface and UI components
- **OpenCV** – Capturing and processing video frames
- **MediaPipe** – Real-time body landmark detection
- **NumPy** – Mathematical computations (angles)

2. Module for Plotting Performance Graphs

Description:

This module is responsible for **visualizing exercise data**—specifically the variation of joint angles over time—through line plots. These plots help users analyze their posture consistency.

Functionality:

- `single_plot()`: Plots left-side (or single-limb) movement
- `double_plot()`: Plots left and right sides for bilateral exercises
- Annotates target angle ranges to visualize correct posture

Key Technologies:

- **Matplotlib** – For generating angle-over-time plots

3. Estimates Calories Burned Based on Exercise

Description:

A **calorie estimator module** that returns an estimated number of calories burned based on the selected exercise and number of repetitions.

Functionality:

- Maps each exercise type to a calorie multiplier
- Multiplies that by the number of repetitions to return total calories
- Simple, fast, and easily extendable with more exercises or accuracy layers

Key Technologies:

- Python logic only

4. Sends Email Summaries to Users

Description:

A dedicated email module that sends **personalized performance summaries** to users at the end of their workout session.

Functionality:

Sends emails containing:

- Exercise performed
- Repetition count
- Calories burnt

Key Technologies:

- **SMTP** – for email delivery

5.3. INTRODUCTION OF TECHNOLOGIES USED

NumPy

NumPy (Numerical Python) is a scientific computing library for Python that provides support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays. NumPy is a fundamental library for scientific computing with Python and is widely used in various fields, including physics, engineering, data science, and machine learning. NumPy provides various tools for working with arrays, such as indexing, reshaping, slicing, and broadcasting. It also includes functions for linear algebra, Fourier analysis, random number generation, and more..

Pandas

Pandas is a popular Python library for data manipulation and analysis. It provides powerful tools for working with structured data, such as data frames and series, making it a valuable tool for a wide range of applications. It provides efficient tools for data cleaning, filtering, merging, and reshaping, making it easy to work with messy or complex data.

Streamlit

A Python library for creating web applications with Python. It makes it easy to create webbased user interfaces with widgets, charts, tables, and more.

Mediapipe

It is an open-source framework developed by Google for building multimodal machine learning pipelines, particularly for processing perceptual data such as video and audio. It provides a set of reusable building blocks that can be combined to create complex pipelines for tasks such as object detection, hand tracking, facial recognition, and pose estimation. The framework consists of a set of pre- built models and algorithms for common computer vision and machine learning tasks, as well as a set of customizable components that can be used to build more complex pipelines. It includes tools for processing video and audio streams in real-time, as well as tools for annotating and visualizing data. Mediapipe is designed to be flexible and modular, allowing developers to easily plug in their own models and algorithms or modify existing ones. It also supports a variety of hardware platforms, including CPUs, GPUs, and specialized accelerators such as Google's Edge TPU. Mediapipe has been used in a variety of applications, including virtual try-on, augmented reality, and interactive installations. It is available as a Python package and can also be used through a web API or on mobile devices through the TensorFlow Lite runtime.

CV2

CV2 is a Python library for computer vision tasks. It is a wrapper around the OpenCV (Open Source Computer Vision) C++ library and provides a simple and intuitive Python interface for performing common computer vision operations such as image processing, object detection, and video analysis.

Matplotlib

This is a plotting library for Python. It provides a wide range of functions for creating different types of plots and visualizations, and is often used for data visualization and exploration.

smtplib Library

The smtplib library in Python provides a simple and efficient way to send emails using the SMTP protocol. It allows Python applications to connect to an SMTP server, authenticate with credentials, and send email messages.

Key Features and Concepts:

1. SMTP Client Session (smtplib.SMTP):

- smtplib.SMTP represents an SMTP client session that can be used to send emails.
- It connects to the SMTP server specified by its hostname and port number
- (e.g., smtp.gmail.com on port 587 for Gmail's SMTP server).

2. Secure Communication:

- starttls(): Method used to upgrade an unencrypted connection to a secure one using Transport Layer Security (TLS). This is essential for securing email transmission over the internet.

3. Authentication:

- login(username, password): Method to authenticate the client session with the SMTP server using the provided username (usually the email address) and password.
- Alternatively, some SMTP servers support OAuth tokens or application specific passwords for authentication.

4. Sending Email:

- sendmail(from_addr, to_addrs, msg): Method to send an email message. It takes the sender's address (from_addr), recipient addresses (to_addrs), and the complete email message (msg) as arguments.
- The message (msg) should be formatted according to RFC 2822 standards, which includes headers like From, To, Subject, and the email body.

5. Email Components:

- MIME (Multipurpose Internet Mail Extensions) Support: The library supports
- MIME format for email messages.
- You can use email.mime modules (MIMEMultipart, MIMEText, etc.) to construct complex email structures with attachments and HTML content.

6. Error Handling:

- Use try-except blocks to handle exceptions that may occur during SMTP operations, such as network errors, authentication failures, or SMTP server issues.

7. Closing the Connection:

- Always close the SMTP connection gracefully using quit() after sending emails. This ensures that resources are released properly and the connection is terminated with the server.

5.4.SAMPLE CODE

```
import streamlit as st
import mediapipe as mp
import numpy as np
import time
import math
import cv2
from EmailingSystem import email_user
from graph import single_plot,double_plot
from calc import calcs
flag=1
mp_pose = mp.solutions.pose
mp_drawing = mp.solutions.drawing_utils

# user position
stage = None
message=""
# count of correct movement
counter = 0
l_angles=[]
r_angles=[]
frames=[]
frame_count=0

@st.cache_resource()
def image_resize(image, width=None, height=None, inter=cv2.INTER_AREA):
    dim = None
    (h, w) = image.shape[:2]

    if width is None and height is None:
        return image

    if width is None:
        r = height / float(h)
        dim = (int(w * r), height)

    else:
```



```

    r = width / float(w)
    dim = (width, int(h * r))

    resized = cv2.resize(image, dim, interpolation=inter)

    return resized

def calculate_angle(a, b, c):
    a = np.array(a)
    b = np.array(b)
    c = np.array(c)

    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

def get_pos(img, results):
    landmarks = []
    for id, lm in enumerate(results.pose_landmarks.landmark):
        h, w, c = img.shape
        cx, cy = int(lm.x * w), int(lm.y * h)
        landmarks.append([id, cx, cy])
    return landmarks

def drawOn(img, p1, p2, p3, angle, lmList):
    x1, y1 = lmList[p1][1:]
    x2, y2 = lmList[p2][1:]
    x3, y3 = lmList[p3][1:]

```

```

cv2.line(img, (x1, y1), (x2, y2), (0, 255, 0), 1)
cv2.line(img, (x3, y3), (x2, y2), (0, 255, 0), 1)
cv2.circle(img, (x1, y1), 5, (255, 0, 0), cv2.FILLED)
cv2.circle(img, (x2, y2), 5, (255, 0, 0), cv2.FILLED)
cv2.circle(img, (x3, y3), 5, (255, 0, 0), cv2.FILLED)
cv2.putText(img, str(int(angle)), (x2 - 50, y2 + 50),
             cv2.FONT_HERSHEY_PLAIN, 2, (0, 0, 255), 2)

```

```

st.markdown(
    """
    <style>
    [data-testid="stSidebar"][aria-expanded="true"] > div:first-child {
        width: 350px;
    }
    [data-testid="stSidebar"][aria-expanded="false"] > div:first-child {
        width: 350px;
        margin-left: -350px;
    }
    </style>
    """,
    unsafe_allow_html=True,
)

```

```

st.sidebar.title('AI Fitness Trainer\n using MediaPipe and OpenCV')
app_mode = st.sidebar.selectbox(' ', ['Training', 'About App', 'Demos and
Tutorials'])
if app_mode == 'About App':
    st.title('AI FITNESS TRAINEE')
    st.markdown(
        'In this application we are using Mediapipe for detecting exercise
gestures and opencv for webcam reading and StreamLit for creating the Web

```

Graphical User Interface (GUI')

```
st.markdown(
    """
    <style>
    [data-testid="stSidebar"] [aria-expanded="true"] > div:first-child {
        width: 350px;
    }
    [data-testid="stSidebar"] [aria-expanded="false"] > div:first-child {
        width: 350px;
        margin-left: -350px;
    }
    </style>
    """,
    unsafe_allow_html=True,
)
text_html = '<h3 style="background-color: rgb(0, 128, 131); color: #fff;
text-decoration:none; padding: 5px;">INSTRUCTIONS TO USE</h3>'
st.markdown(text_html, unsafe_allow_html=True)
st.markdown('step-1: Choose training mode to start your fitness today')
st.markdown('step-2: If you are not aware of what you are intended to
do,be comfortable to go our demos and tutorial section')
st.markdown('step-3: Now,it is the time to start your exercise,please
provide Name and email')
st.markdown('step-4: Select exercise fom dropdown')
st.markdown('step-4: Select how many time you want to repeat the
exercise')
st.markdown('step-5: Tick on the start')
st.markdown('step-6: Now,our trainee can be able to capture your pose')
st.markdown('step-7: start doing exercise')
st.markdown('step-8: count will be displayed on screen how many times
you repeated')
st.markdown('step-9: Finish those repetitions you mentioned,our trainee
will count for you')
st.markdown('step-10: Check your given mail inbox to see your
performance report')
text_html = '<h3 style="background-color: rgb(0, 128, 131); color: #fff;
```

```

text-decoration:none; padding: 5px;">BE AWARE...</h3>'
    st.markdown(text_html, unsafe_allow_html=True)
    st.markdown('Make sure that you have proper Lighting')
    st.markdown('Ensure that your camera is working properly ')
elif app_mode == 'Demos and Tutorials':
    #HIGH KNESS
    st.title("HIGH KNEES")
    link_html = '<a
href="https://youtu.be/oDdkytliOqE?si=Mferh8hYmi14Rh7m"
style="background-color: rgb(0, 128, 131); color: #fff; text-decoration:none;
padding: 5px;">Video tutorial &rarr;</a>'
    st.markdown(link_html, unsafe_allow_html=True)
    hk_video_url =
"https://www.shutterstock.com/shutterstock/videos/1060403879/preview/stock
-footage-athletic-woman-doing-high-knee-exercise-at-home-home-training-
workout-home-fitness-there-is-some.webm"
    st.video(hk_video_url)

    #SQUATS
    st.title("SQUATS")
    link_html = '<a href="https://youtu.be/4KmY44Xsg2w?si=eh8-
DmSgjZptopSs" style="background-color: rgb(0, 128, 131); color: #fff; text-
decoration:none; padding: 5px;">Video tutorial &rarr;</a>'
    st.markdown(link_html, unsafe_allow_html=True)
    s_video_url =
"https://www.shutterstock.com/shutterstock/videos/1102020407/preview/stock
-footage-female-butt-workout-squats-at-home-athletic-asian-woman-squats-
workout-in-living-room-female.webm"
    st.video(s_video_url)

    #SHOULDER PRESS
    st.title("SHOULDER PRESS")
    link_html = '<a

```

CHAPTER 6

TESTING

5.1 Introduction

Software Testing is a method is to check whether the actual software product matches expected requirements and to ensure that software product is Defect free. It involves execution of software system components using manual or automated toolsto evaluate one or more properties of interest. The purpose of software testing is toidentify errors, gaps, or missing requirements in contrast to actual requirements.

Some prefer saying Software testing definition as a White Box and Black BoxTesting. In simple terms, Software Testing means the Verification of ApplicationUnder Test (AUT). This is Software Testing course introduces testing software to theaudience and justifies the importance of software testing.

Software Testing is Important because if there are any bugs or errors in the software, it can be identified early and can be solved before delivery of the software product. Properly tested software product ensures reliability, security and high performance which further results in time saving, cost effectiveness and customersatisfaction. Software bugs could be expensive or even dangerous. Software bugs can potentially cause monetary and human loss, and history is full of such examples.

5.1.1 Black Box Testing and White Box Testing

5.1.1.1 Black Box testing

The primary source of black-box testing is a specification of requirements that are stated by the customer. It is another type of manual testing. It is a software testing technique that examines the functionality of the software without knowing its internal structure or coding. It does not require programming knowledge of the software. All test cases are designed by considering the input and output of a particular function. In this testing, the test engineer analyses the software against requirements, identifies the defects or bugs, and sends it back to the development team



5.1.1.2 White Box Testing

The term 'white box' is used because of the internal perspective of the system. The clear box or white box, or transparent box name denotes the ability to see through the software's outer shell into its inner workings.



It is performed by Developers, and then the software will be sent to the testing team, where they perform black-box testing. The main objective of white-box testing is to test the application's infrastructure. It is done at lower levels, as it includes unit testing and integration testing. It requires programming knowledge, as it majorly focuses on code structure, paths, conditions, and branches of a program or software. The primary goal of white-box testing is to focus on the flow of inputs and outputs through the software and strengthening the security of the software.

5.2 Types of testing

1. Unit Testing
2. Integration Testing
3. System Testing
4. Functional Testing
5. Acceptance Testing
6. Regression Testing
7. Performance Testing
8. Security Testing
9. User Acceptance Testing

1. Unit Testing

Unit testing is a method of testing individual units or components of a software application. It is typically done by developers and is used to ensure that the individual units of the software are working as intended.

2. Integration Testing

Integration testing is a method of testing how different units or components of a software application interact with each other. It is used to identify and resolve any issues that may arise when different units of the software are combined. Integration testing is done after unit testing and before functional testing, and is used to verify that the different units of the software work together

3. Regression Testing

Regression testing is a method of testing that is used to ensure that changes made to the software do not introduce new bugs or cause existing functionality to break. It is typically done after changes have been made to the code, such as bug fixes or new features, and is used to verify that the software still works as intended.

4. Alpha Testing

This is a type of validation testing. It is a type of acceptance testing which is done before the product is released to customers. It is typically done by QA people.

5. Beta Testing

The beta test is conducted at one or more customer sites by the end-user of the software. This version is released for a limited number of users for testing in a real- time environment.

6. System Testing

This software is tested such that it works fine for the different operating systems. It is covered under the black box testing technique. In this, we just focus on the required input and output without focusing on internal working.

CHAPTER 7

SAMPLE SCREENSHOTS



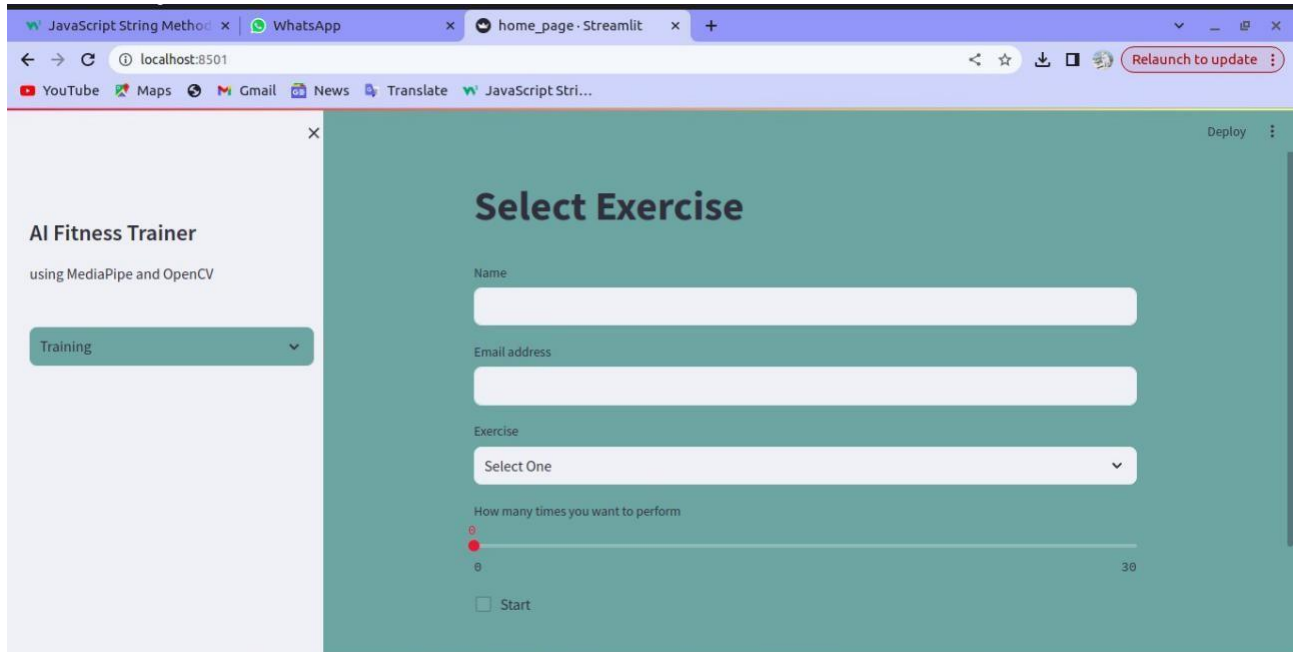
MediaPipe Pose is a computer vision system developed by Google that can detect and track human body poses in real-time using machine learning algorithms. The system uses a set of 33 key points, also known as landmarks, to identify the position and orientation of different parts of the human body.

Here's a high-level overview of how MediaPipe Pose works:

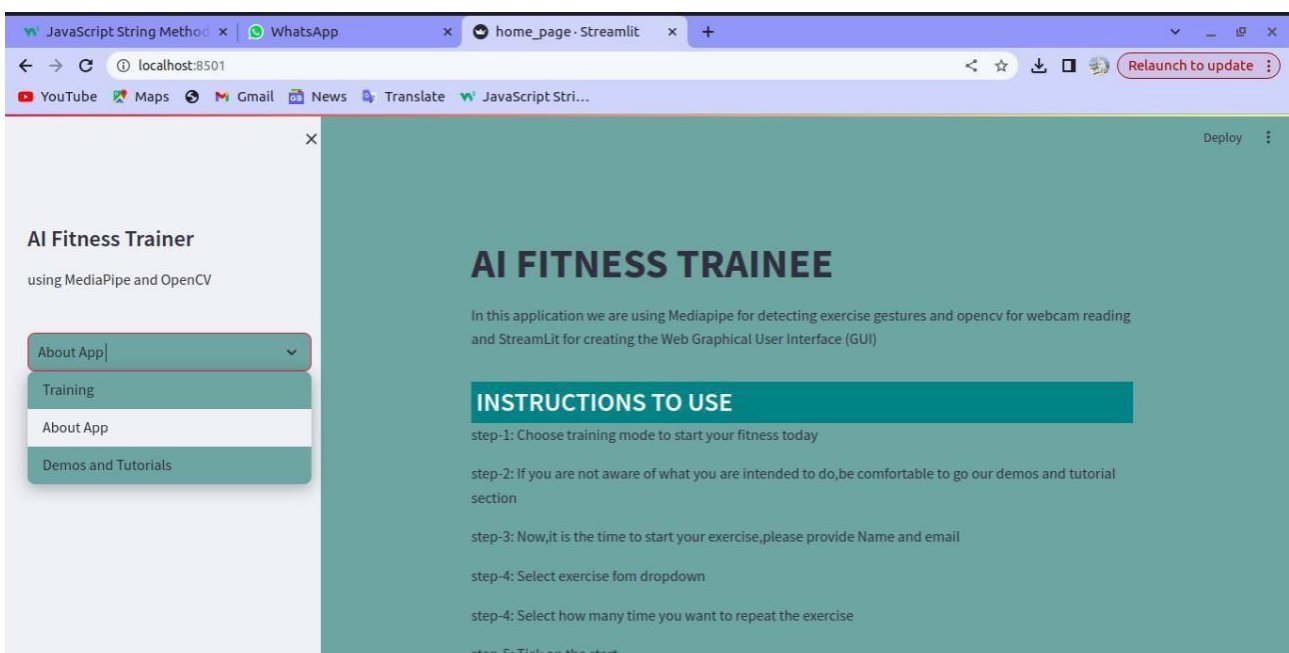
1. Input data: The system takes in a video stream or a series of images containing a human body.
2. Preprocessing: The input data is preprocessed to enhance the image quality, remove noise, and the lighting conditions.
3. Pose estimation: The system uses a deep neural network model trained on thousands of labeled images to estimate the position of the 33 key points on the human body.
4. Pose tracking: The system uses a Kalman filter to track the movements of the key points over time, reducing jitter and improving the overall accuracy of the pose estimation.
5. Output: The system outputs the estimated pose in real-time as a set of 33 key points, which can be used for various applications such as augmented reality, fitness tracking, or gesture recognition.

Project Execution Demo

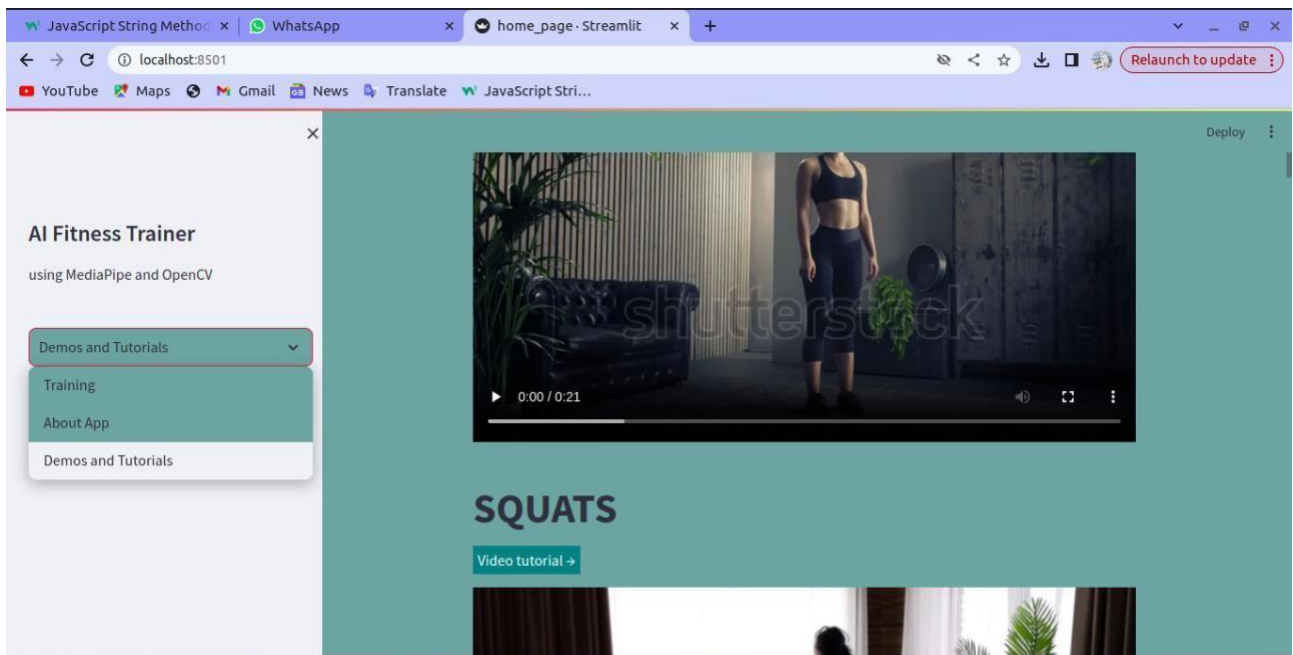
1 Interface



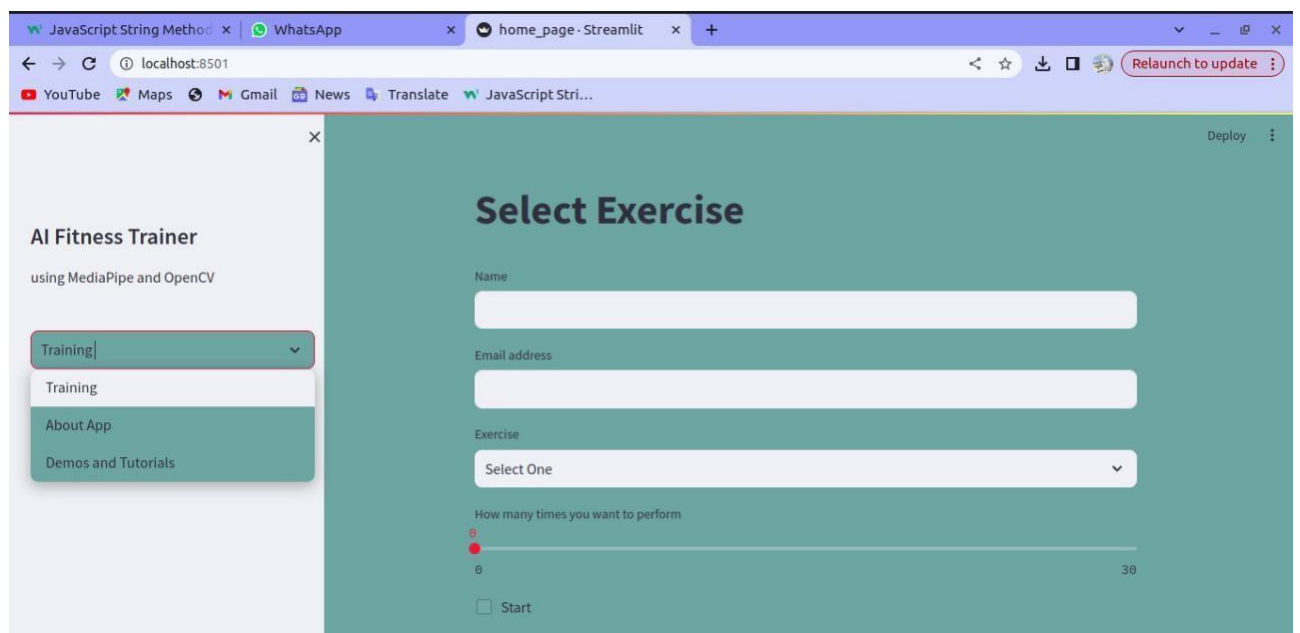
2 About app mode interface.



3 Demos and Tutorials mode interface.



4 Training mode interface.



5 Enter details: Name and email

The screenshot shows a web browser window with the URL `localhost:8501`. The page title is "AI Fitness Trainer" and it mentions "using MediaPipe and OpenCV". On the left, there is a sidebar with a "Training" dropdown menu. The main content area is titled "Select Exercise" and contains the following form elements:

- Name:** A text input field containing "Mounika".
- Email address:** A text input field containing "mounikagandra36@gmail.com".
- Exercise:** A dropdown menu currently showing "Select One".
- How many times you want to perform:** A range slider with a red dot at 0 and a green dot at 30.
- Start:** A checkbox labeled "Start".

At the top right of the page, there is a "Deploy" button and a "Relaunch to update" button.

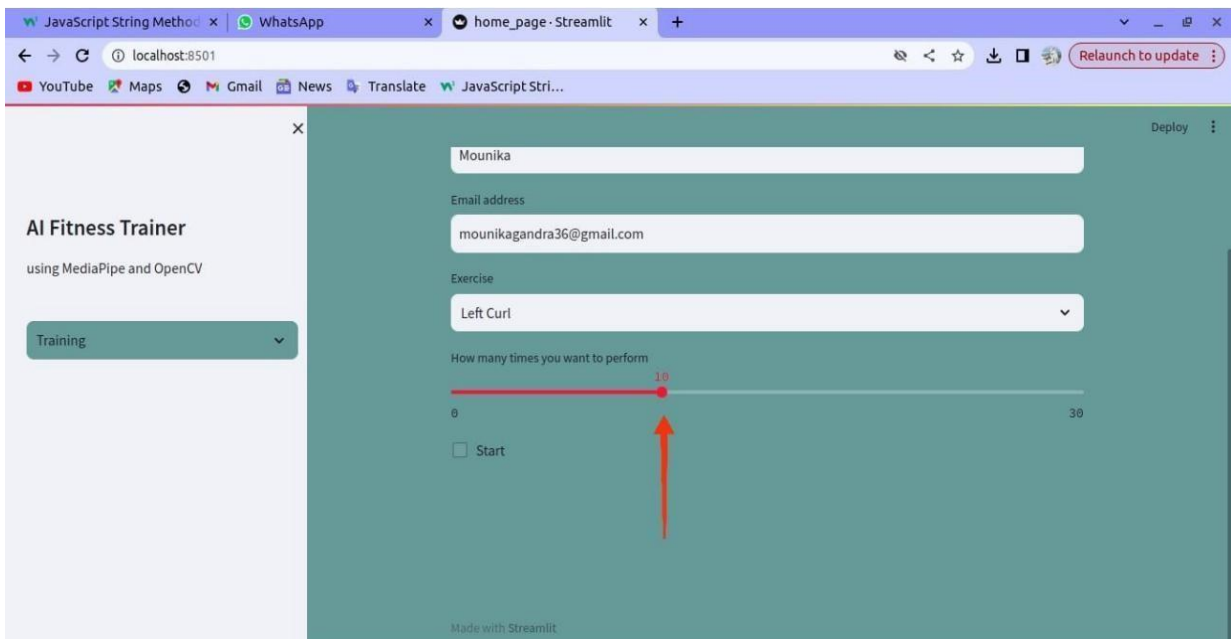
6. Select Exercise

This screenshot shows the same web application as the previous one, but with the "Exercise" dropdown menu open. The dropdown menu displays a list of exercises:

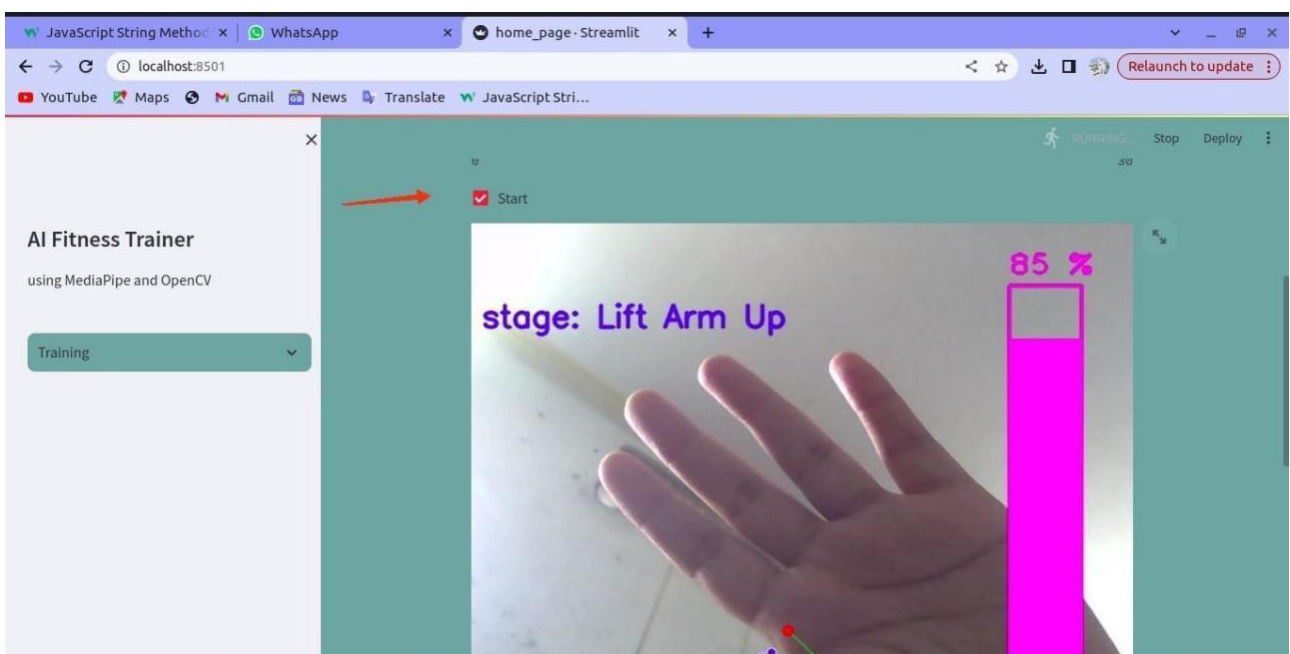
- Select One
- High Knees
- Squats
- Shoulder Press
- Lateral Curls
- Curls
- Left Curl

The "Left Curl" option is currently selected and highlighted. The rest of the form, including the "Name" and "Email address" fields, remains the same as in the previous screenshot.

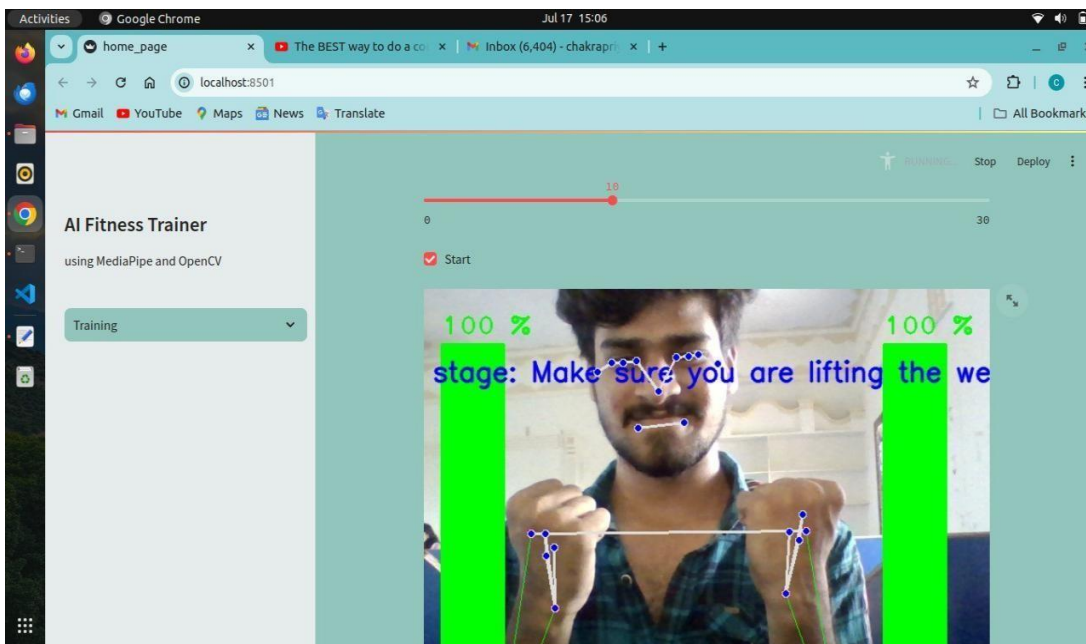
7. Select count



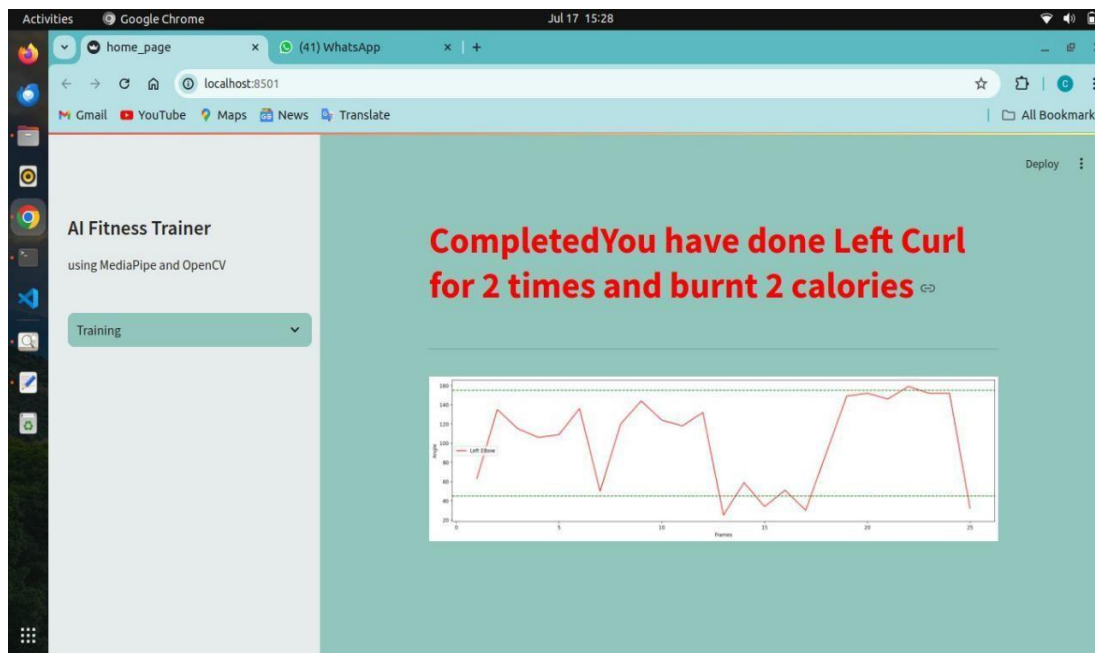
8. Check start button.



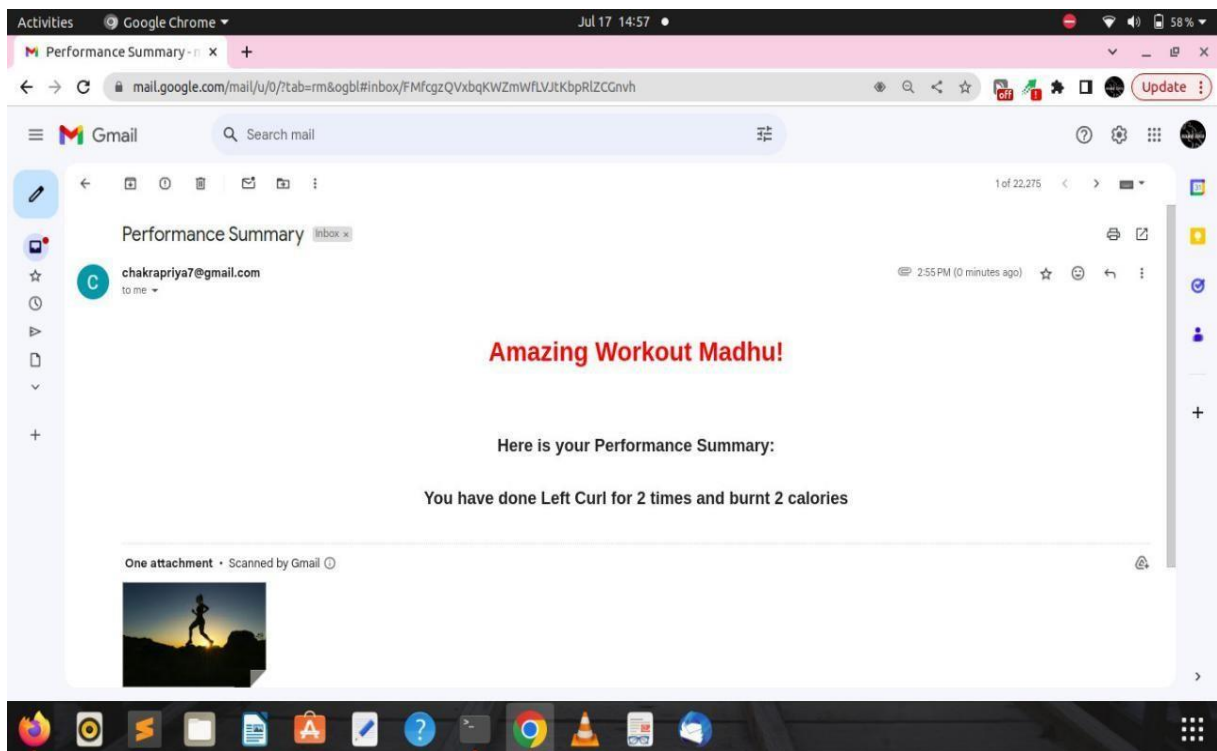
9.start doing exercise



10.Performance graph



11. Performance report to your inbox.



CHAPTER 8

CONCLUSION

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 ease our fitness journey. Individuals can use this application in their own workouts, hence making them more efficient and less error-prone. There is a lot of scope of development in this project like it can be upgraded to support more exercises. The data collected by the AI Fitness Trainer can be saved and processed for the next sessions. The trainer will suggest your 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. The application can not only be used at home but by increasing the scope can be used in gyms as smart trainers thus reducing the human intervention. Further application will also be able to provide personalized workout and diet plans. This application will offer different styles of yoga to give users an overall fitness regime.

We all know it is very important to exercise with correct form. Nowadays people prefer working out at home. It is very convenient and time saving as well. We can workout anytime we want at home. But we also know that a trainer is very important to keep a track of our exercise. This project is our effort to make an AI based trainer. An AI-powered personal trainer that works simply by pointing a camera at a person completing a workout, and having a human pose estimation model (specific poses related to a workout regimen) indicate whether or not a given exercise has been completed properly..

CHAPTER 9

FUTURE ENHANCEMENT

Real-Time Feedback and Corrections:

Implement real-time feedback during the exercises to correct the users pose. The AI could provide visual or auditory cues to guide the users into the correct position, enhancement the effectiveness of the workout.

Adaptive Workouts:

Develop an adaptive system that tailors workouts based on the users performance and progress the ai could adjust exercise difficulty ,duration ,and intensity to ensure continual improvement and prevent plateaus

Augmented Reality(AR) Integration:

Explore AR Technology to provide Users with a more immersive experience.AR could overlay exercise instruction directly onto the users environment. Making it easier for them to follow instructions maintain proper form.

AI-powered Personal Trainer Conversations:

Develop a natural language processing (NLP) system that follows users to interact with a virtual personal trainer the AI could answer questions ,provide encouragement ,and offer personality advice based on the users fitness journey In our modern, hectic lives, finding time to prioritize our health and engage in regular exercise has become increasingly challenging. This lack of focus on fitness often leads to various health issues. Our primary objective is to raise awareness about the significance of good health and fitness among the general population and assist them in achieving their wellness goals. By harnessing the power of Artificial Intelligence (AI) and Machine Learning (ML) in the realm of fitness, we can address many of these challenges. Fitness applications and devices have simplified our lives and streamlined our fitness journeys. These tools empower individuals to conveniently perform workouts at home, increasing efficiency and reducing the risk of errors. Throughout this process, we have acquired knowledge on utilizing various Python libraries and packages and have witnessed the immense benefits that machine learning can offer in improving human well-being.

CHAPTER 10

BIBLIOGRAPHY

- 1) <https://google.github.io/mediapipe/solutions/pose>
- 2) <https://learnopencv.com/introduction-to-mediapipe/>
- 3) “BlazePose: On-device Real-time Body Pose tracking.” V.Bazarevsky, I.Grishchenko, K.Raveendran, T.Zhu, F. Zhang, M.Grundmann.
- 4) F. Zhang, V. Bazarevsky, A. Vakunov, A. Tkachenka, G. Sung, C.L. Chang and M. Grundmann, “MediaPipe Hands: On#device Real-time Hand Tracking.” ArXiv, 2020
- 5) Ammar Anuar, Khairul Muzzammil Saipullah, Nurul Atiqah Ismail, Yewguan Soo “OpenCV Based Real#Time Video Processing Using Android Smartphone” , IJCTEE, Volume 1, Issue 3