A Pose Estimation Tracker

Project Number 16
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Learning Objectives

01
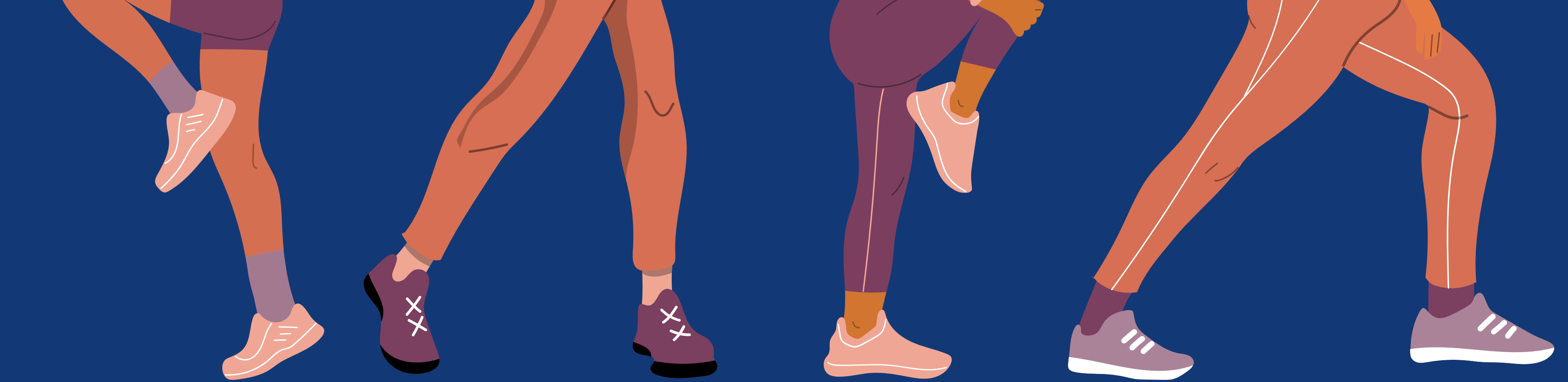
About The Project

02

Design Flow

03

Code And Functionality

04

Output

05

Business Use Cases

Project Overview

Developing a system or algorithm that can effectively perform pose estimation using either a skeleton-based approach or a 3D model-based approach. A pose detection system is an augmented reality application that takes inputs from video or image to accurately recognize and estimate various human poses across areas like dance, yoga, health & wellness etc.
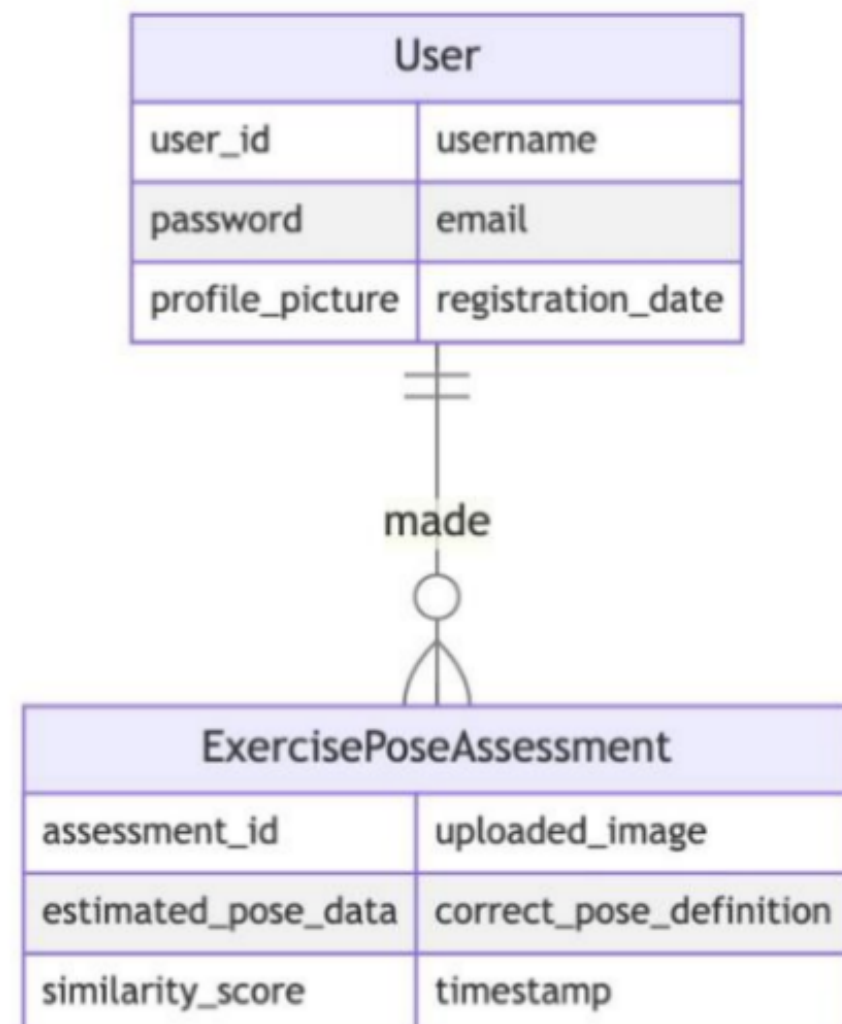
Aim

Accurately estimate the pose or position of a person or object in an image or videos.
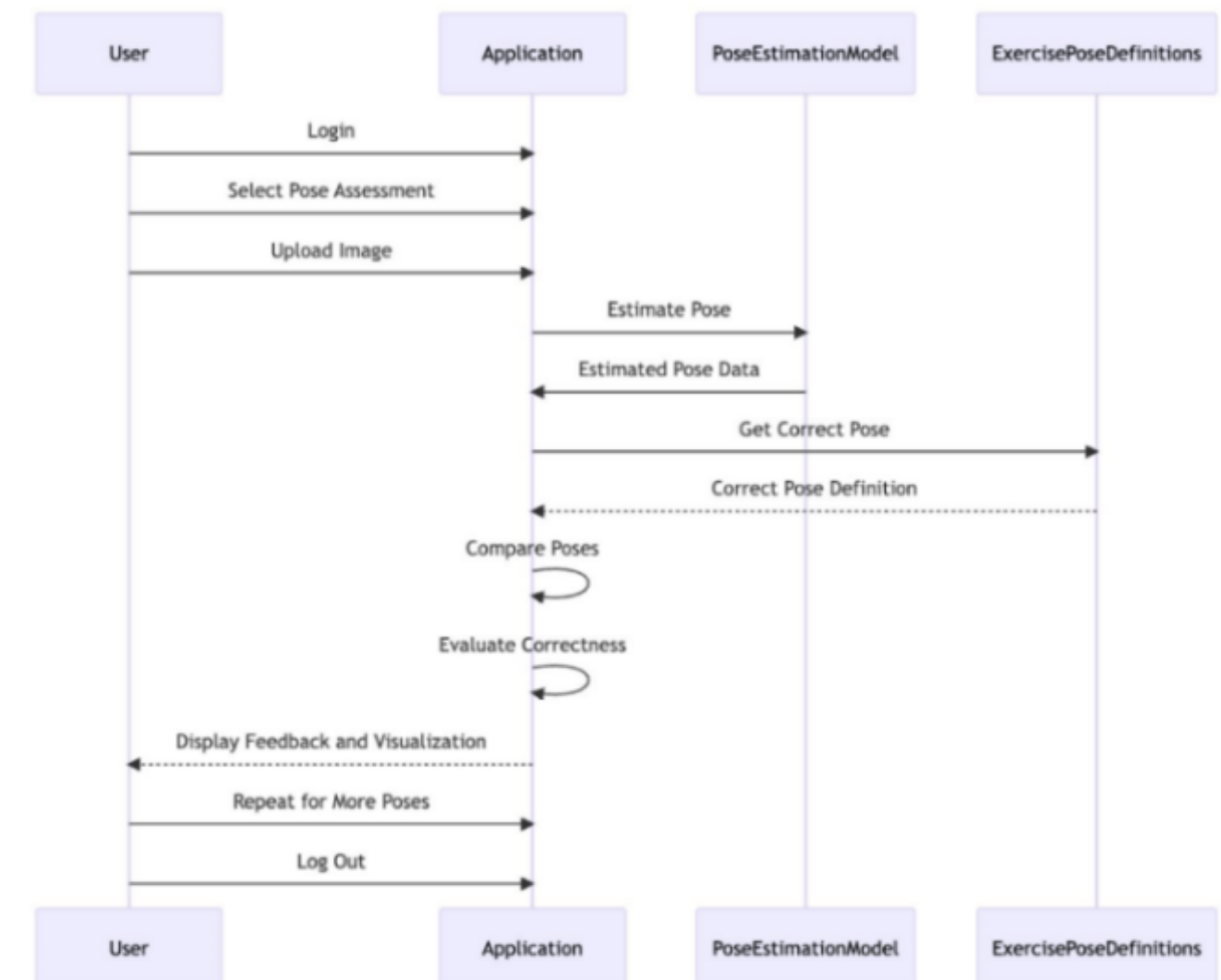
Objective

- To design a web-based application that take inputs from an image or video to estimate pose
- · To build AI/ML models to detect, estimate and predict poses accurately
- · To provide a seamless user experience for the user with intuitive UI

Design Flow And Architecture

ERD diagram (Entity-relationship) :

User	
user_id	username
password	email
profile_picture	registration_date

made

ExercisePoseAssessment	
assessment_id	uploaded_image
estimated_pose_data	correct_pose_definition
similarity_score	timestamp

Sequence diagram:

User — Application — PoseEstimationModel — ExercisePoseDefinitions

Login

Select Pose Assessment

Upload Image

Estimate Pose

Estimated Pose Data

Get Correct Pose

Correct Pose Definition

Compare Poses

Evaluate Correctness

Display Feedback and Visualization

Repeat for More Poses

Log Out

Business use cases

FITNESS TRAINING

Analyzes body postures during exercises and provide real-time feedback to ensure proper form, reducing the risk of injuries.

YOGA & THERAPIES

monitor and assess the progress of sessions during yoga exercises or therapy ensuring they are performing movements correctly.

DRIVING ASSISTANCE

used to monitor the driver's posture and alertness, providing assistance or warnings if signs of fatigue or distraction are detected

RESEARCH & STUDIES

used to interpret and recognize sign language gestures, enabling communication for individuals with hearing impairments.

Step 1 - User Authentication

- User accesses the web page.
- The web page includes a sign-in mechanism for user authentication.
- Upon successful authentication, the user gains access to the pose estimation functionality.
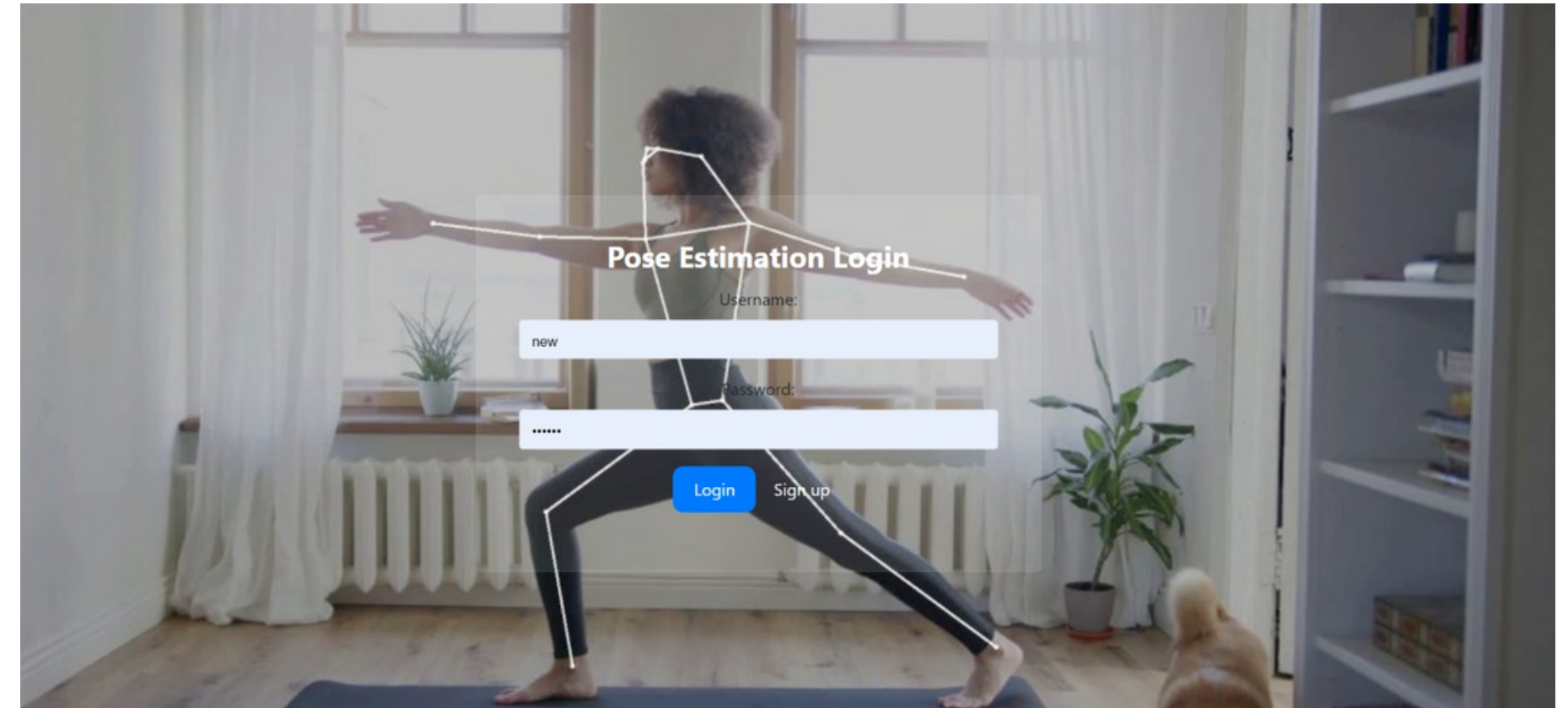
Step 2 - Pose Estimation

Authenticated users can now have two ways to estimate pose

1. Manual estimation with input from webcam

   - We are using if-else conditions on the angles between major body points to detect the pose
2. Upload a dataset containing pairs of images for pose comparison (Automatic Estimation)

We utilize the MediaPipe pose estimation library to train the model to train the model using the dataset uploaded by the user or poses detected through webcam and save the trained model for later use in pose estimation.

Step 2 - Cont...

Manual Estimation

- Select the desired exercise
- Perform it infront of webcam
- If the pose matches with selected exercise, count of repetition increases (if pose doesn't match or idle count wont be displayed)

Automatic Estimation

- Select one reference image and upload
- Upload the image to compare and click pose Estimation Request
- The uploaded images are processed using the mediapipe's trained pose estimation model.
- Extract relevant pose features or keypoints from the images.
- Compare the pose features/keypoints obtained from the two images.
- Calculate the accuracy or similarity score based on the comparison.

Step 3 - the Result

Result Display:

- Display the pose accuracy result to the user on the web page.
- Provide visualizations or metrics indicating the similarity or differences in the poses.

Data Storage in MongoDB:

- Store the pose estimation results and associated metadata in MongoDB.
- This can include history logs like user information, timestamps, and accuracy scores.
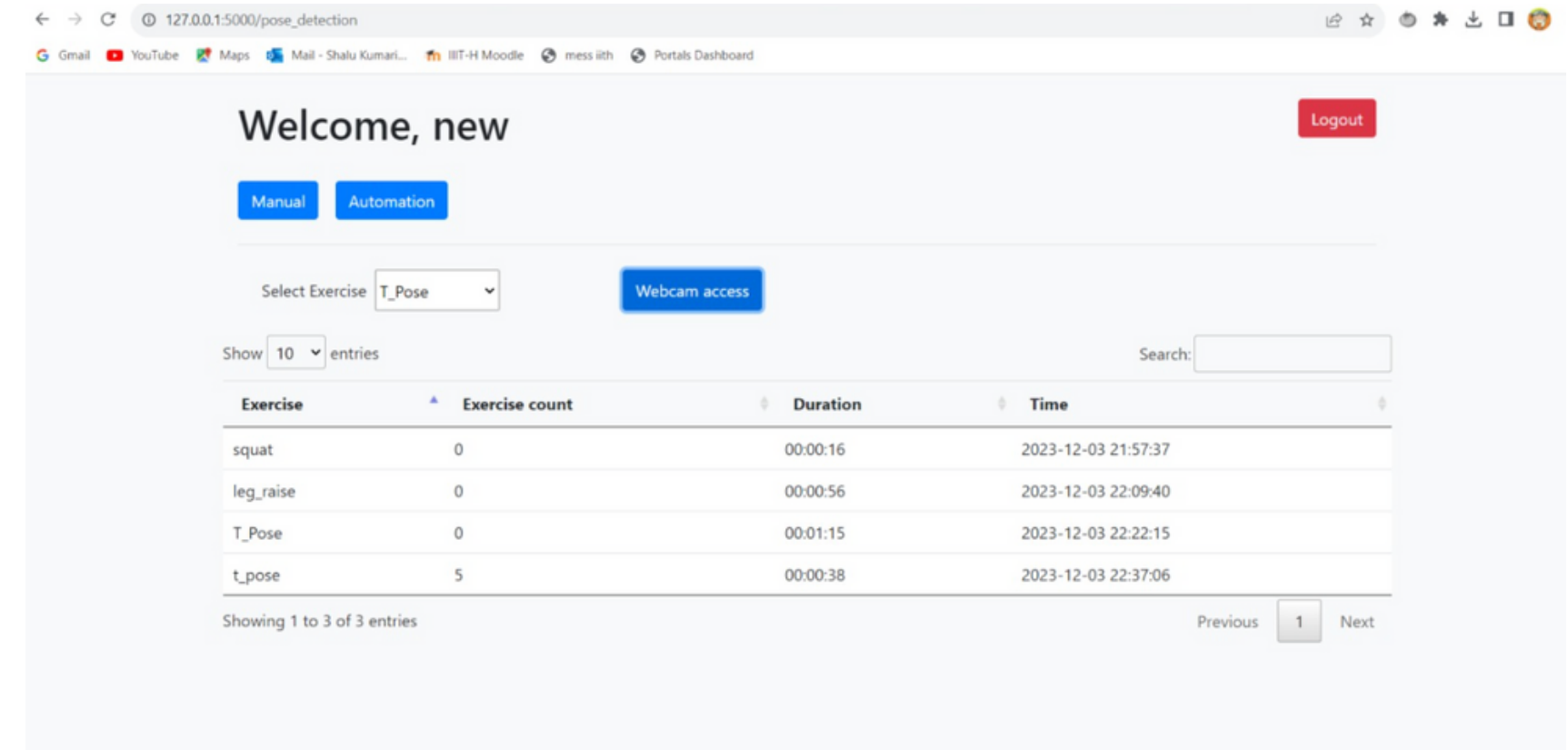
Feature Set:

Pose estimation through webcam : lets users select the desired exercise to perform interact with webcam, where it displays count if performed accurately (detects and calculates accuracy)
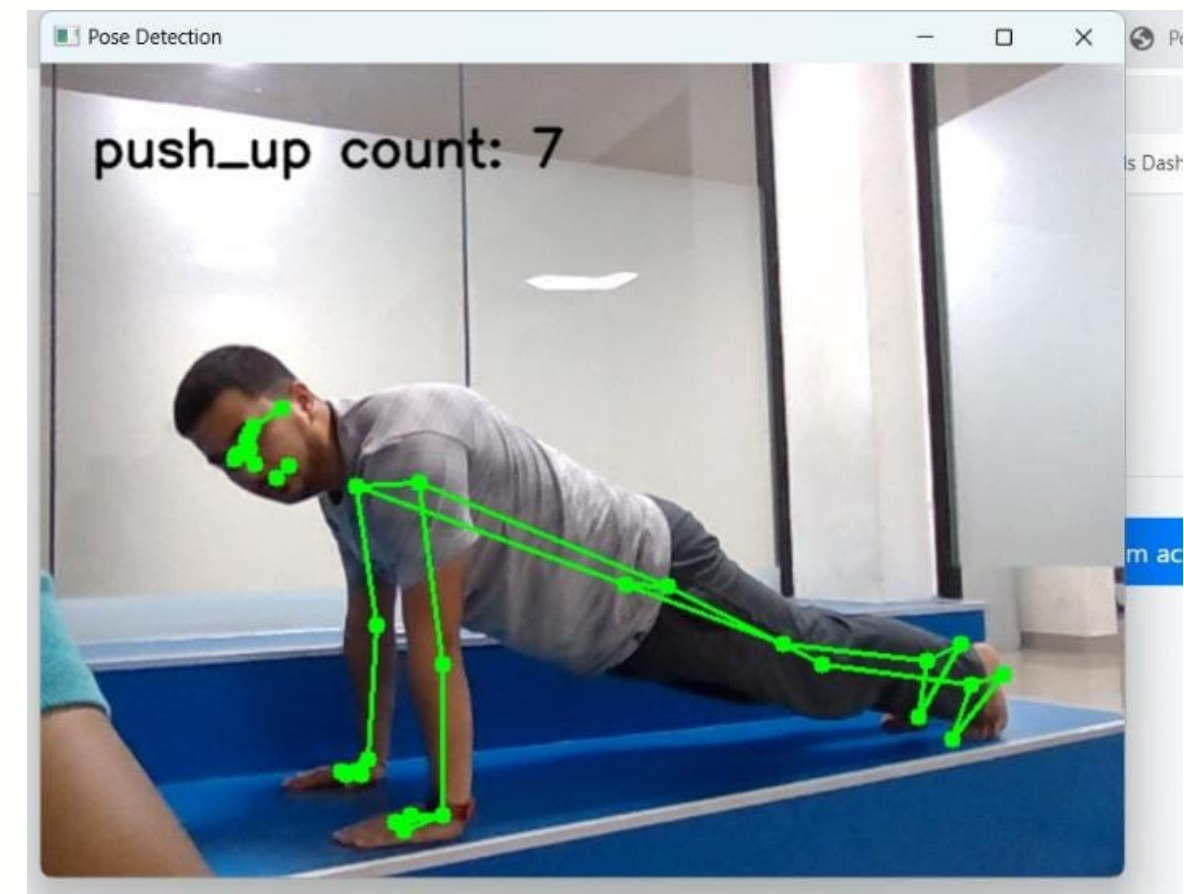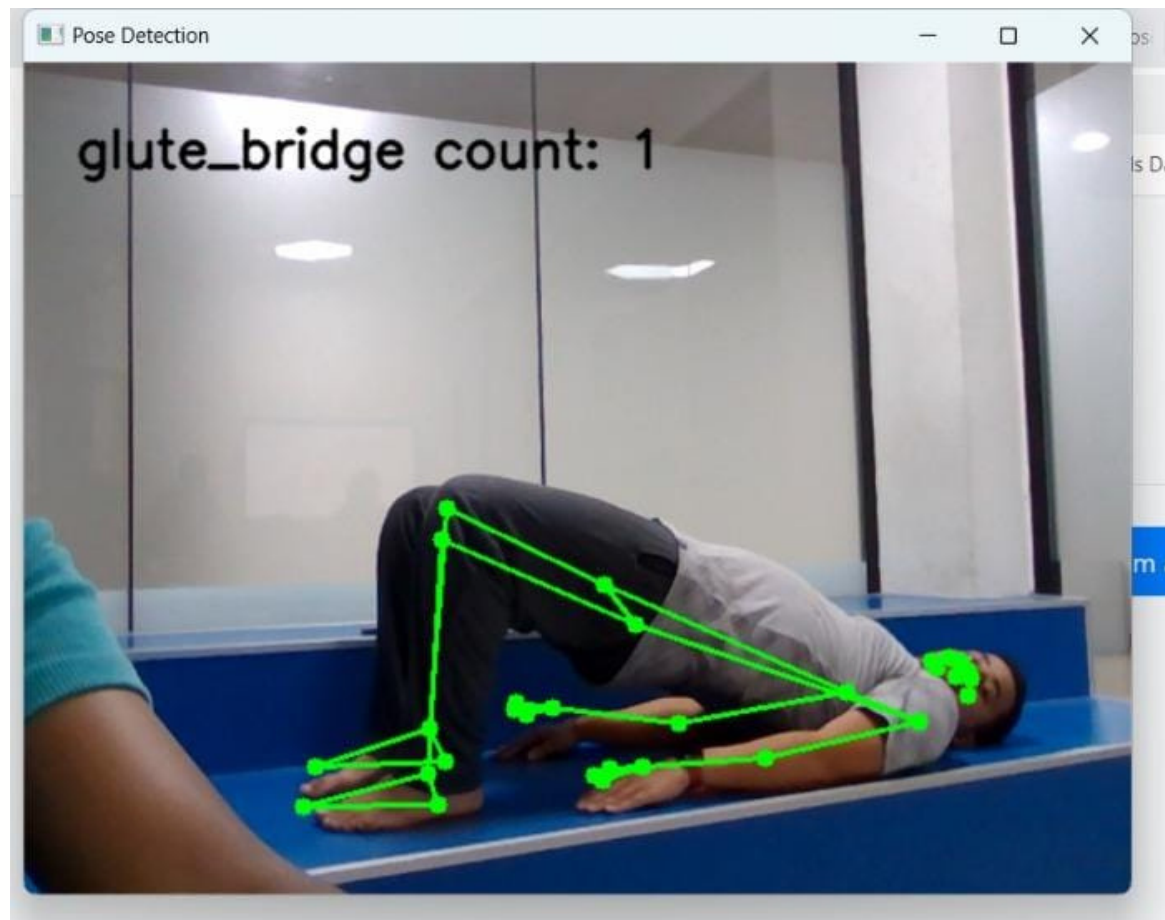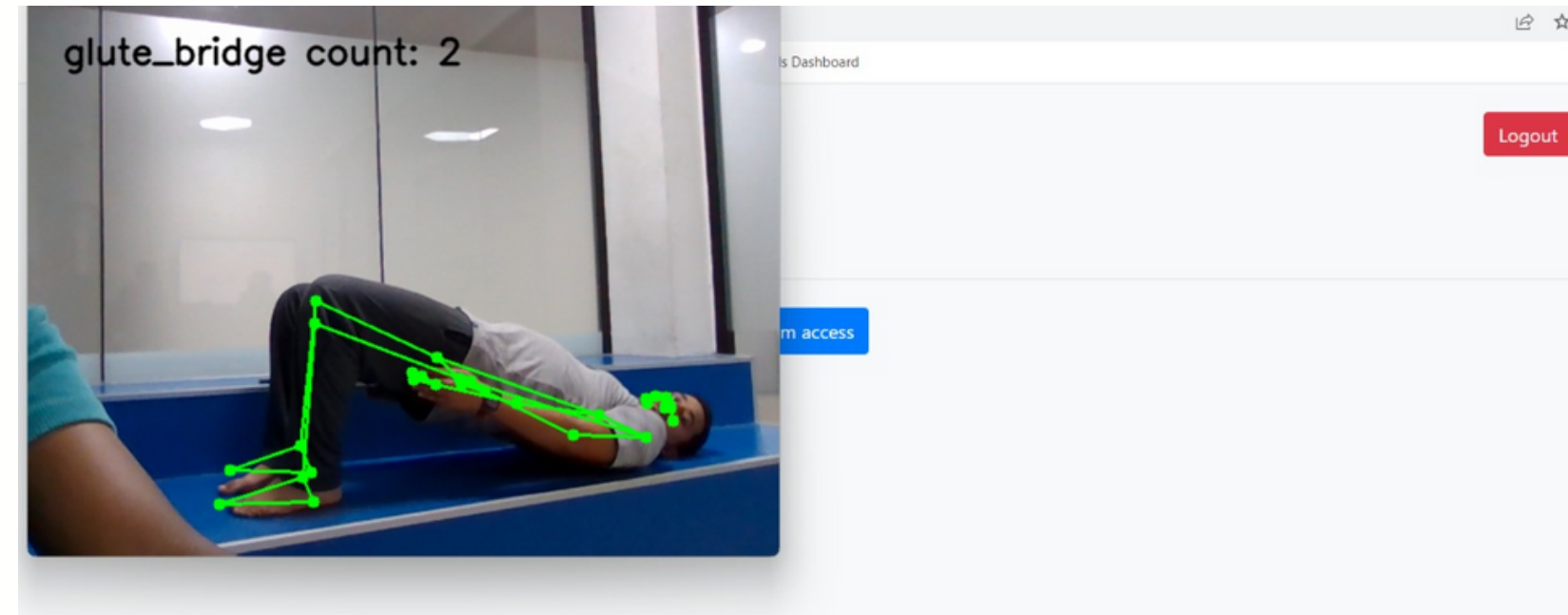
Comparison Of Images : lets users upload images to system one for reference and one for comparison to calculate similarity

Feature Set:

Pose Similarity Score : calculates score based on similarity of images to give user a visual indication of accuracy of pose implementation and degree correction

History log: Every time a user performs comparison through manual or automatic, the activities are stored in history tab for future references

Output Results

Thank you for listening!