AI-Driven Posture Anlysis and Training Management Application

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General Context

What about Yoga and Well-Being?

Yoga is known for its numerous benefits for both physical and mental health, improving strength, flexibility, and mental clarity.

What about Proper Posture?

The importance of posture is crucial to maximize benefits and prevent injuries, highlighting the need for guidance during practice.

What about the Role of Technology?

With the integration of technology, especially machine learning, yoga can be practiced safely at home with real-time feedback on posture.

Objectives

- **Personalized Yoga Practice App**: that has of a user-friendly interface.
- **Real-Time Pose Detection:** that provides real-time feedback using camera technology and machine learning.
- **Fitness Tracking:** implement comprehensive functionalities that allow users to track and visualize their performance over time.
- **Voice Instruction Integration:** that provide voice instructions to enhance the overall user experience.

Chosen Solutions

1 Pose Detection:

Utilized the MoveNet Thunder, a state-of-the-art deep learning model for real-time pose estimation, within TensorFlow.js for accurate and fast performance.

2 User Interface:

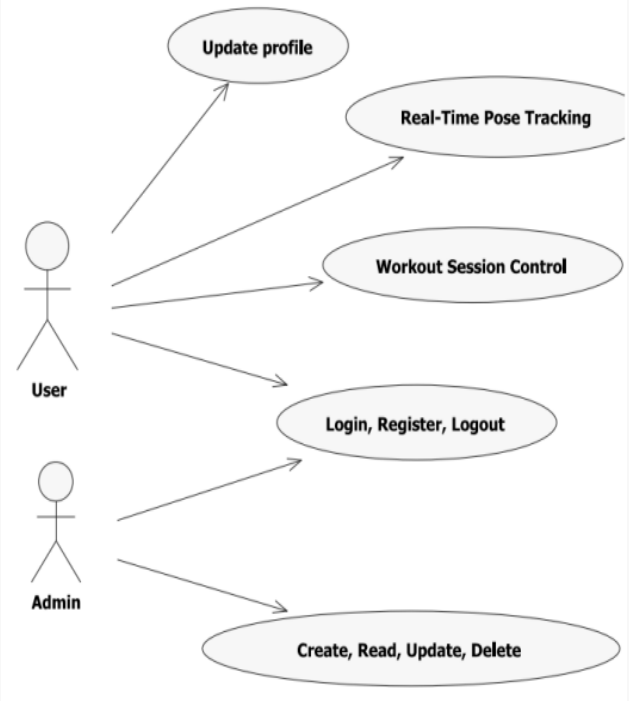
Designed a dynamic, responsive UI that provides real-time visual and audio feedback, with color-coded indicators to guide users in their practice.

3 Personalization:

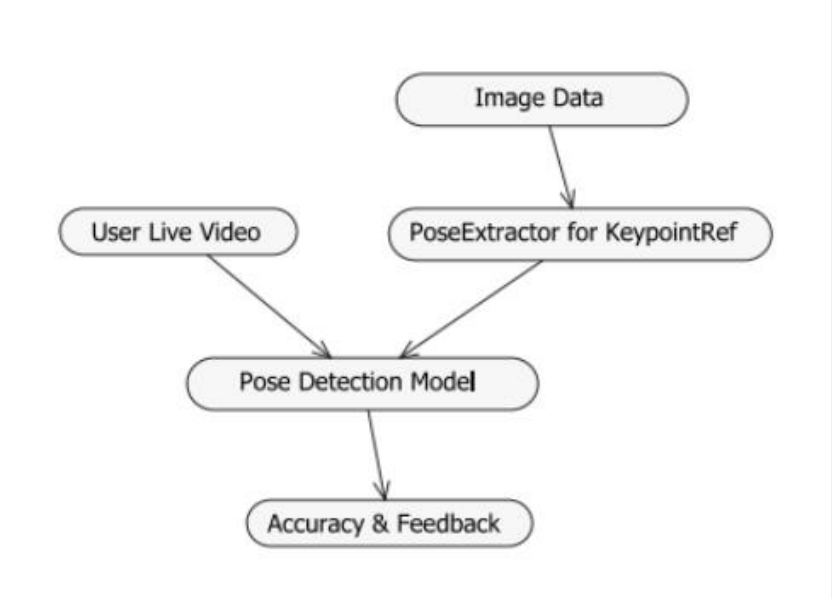
Integrated user profile management and progress tracking to tailor the experience to individual needs and monitor improvements over time.

Implementation & Design

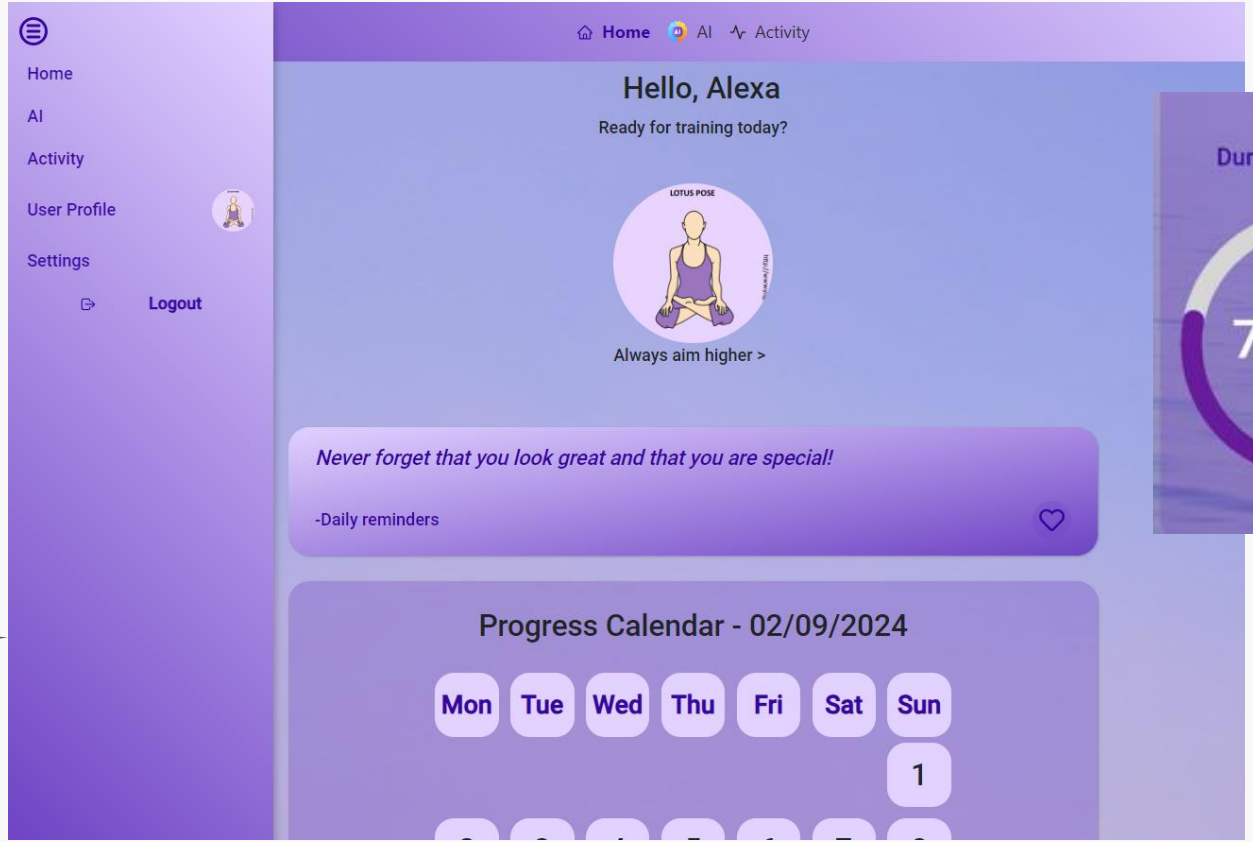
User and admin use case

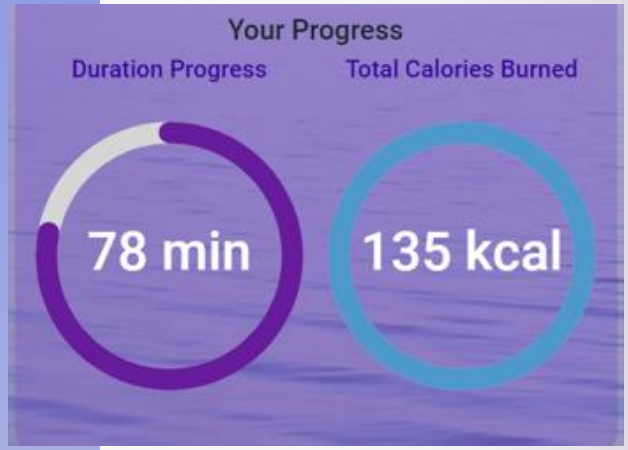


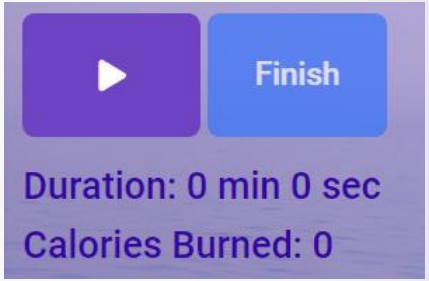
Machine Learning Integration

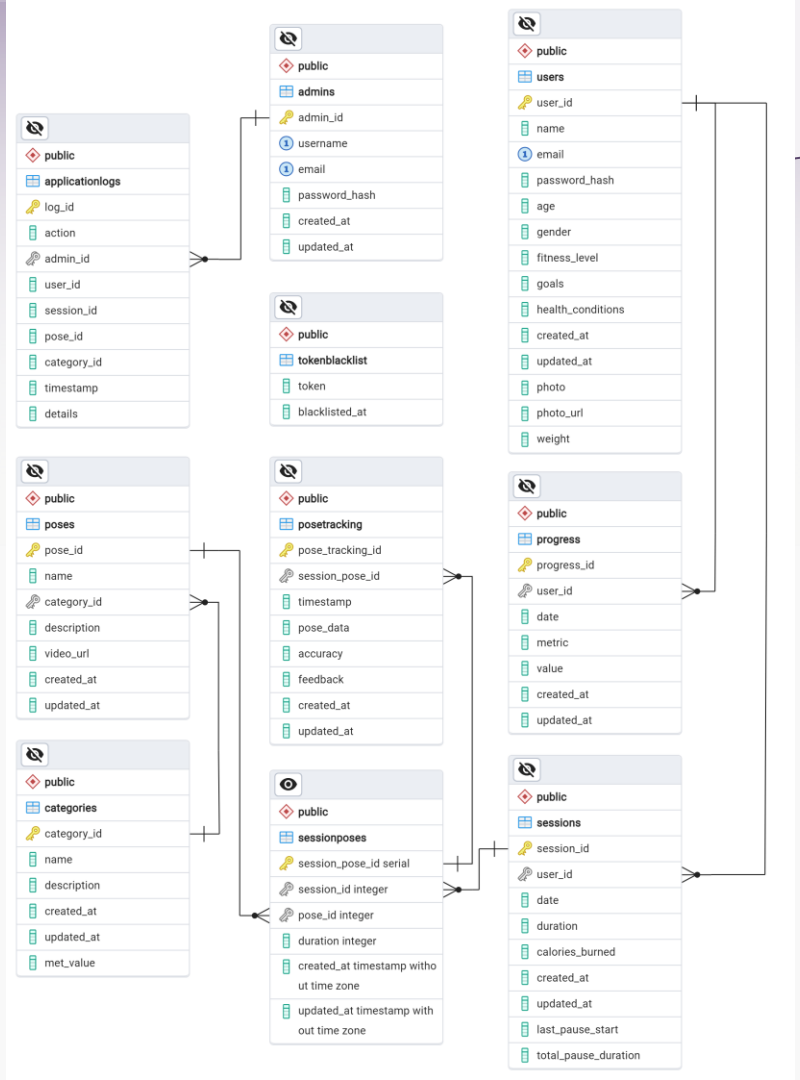


User Experience and Interface Design









DataBase design

Key Features

1

Yoga Pose Tracking

- Video Capture using browser's camera.
- Pose comparison to assess accuracy and provide feedback.
- Canvas Drawing to display keypoints and skeletons.

2

User Profile Management

Development of a system to manage user profiles, personalize sessions, and track progress and activity over time.

3

JSON Web Tokens

JWT manage user authentication, enabling secure and efficient handling of user sessions.

Test and verifications

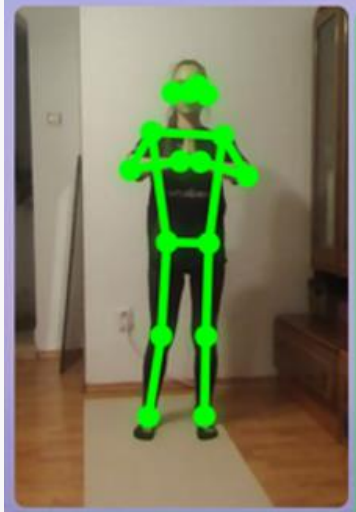
Backend Testing with Postman:

- Tested user registration, login, CRUD operations, logging, error handling, and authentication.
- Verified system functionality and security.

Pose-Tracking Feature Testing:

- Evaluated model accuracy, resolution optimization, and versatility.
- Achieved high accuracy in pose detection (>96%).
- Tested real-time feedback (text and audio).

Good Pose VS Bad Pose



Perfect Pose!

Accuracy:
96.24%

Adjust your: left_shoulder (move it up), right_shoulder (move it up), left_elbow (move it up), right_elbow (move it up), left_wrist (move it up), right_wrist (move it up), left_hip (move it up), right_hip (move it up), left_knee (move it up), right_knee (move it up), left_ankle (move it up), right_ankle (move it up)

Accuracy:
76.47%

Conclusions

- Key Results:

The application successfully enhances yoga practice through accurate pose detection, interactive feedback, and personalized user experiences.

- Innovations and Contributions:

Introduction of real-time feedback mechanisms, user progress tracking, and voice instructions set this work apart from existing solutions.

- Impact:

The thesis provides a significant contribution to the field by merging traditional yoga with modern technology, promoting health and well-being in the digital age.

Future Improvments

- **Wearable Device Integration**
- **AR/VR Enhancements**
- **Multi-Camera Support**

Thanks you for your atention!

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