Real-Time Human Posture Evaluation Using Biomechanical Modeling and Machine Learning

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Client Repository:

Server Repository:

Problem & Motivation

Problem Overview

Incorrect body posture during physical exercises is a major cause of injuries and inefficient training.

Most trainees exercise without professional supervision and receive no immediate feedback on their movement quality.

Existing solutions are often expensive, non real-time, or require special hardware.

Project Goal

The goal of BodyTrack is to provide **real-time posture correction** using only a mobile device camera.
The system analyzes body movement and delivers immediate feedback to help users improve posture and reduce injury risk.

Target Users

- Fitness trainees and gym users
- Home workout practitioners
- Individuals training without a coach

System & Architecture

System Overview

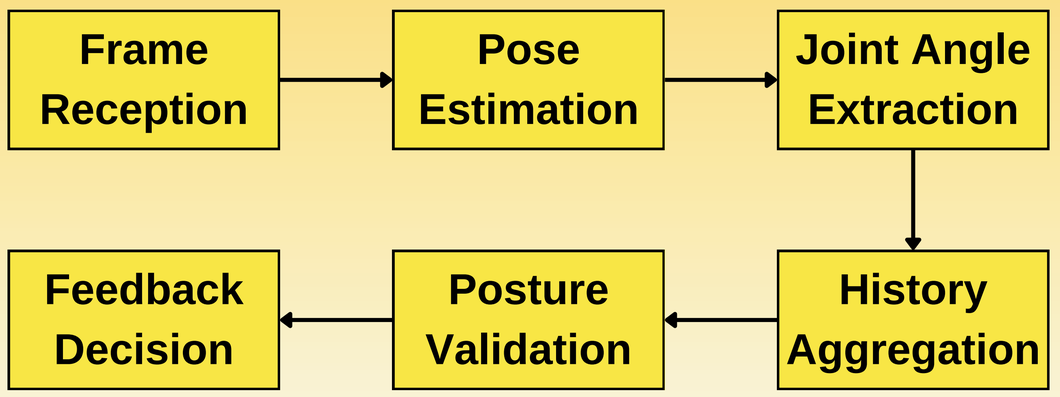
BodyTrack is a **client–server system** composed of an **Android mobile application** and a **backend server**.

The client captures live video frames and presents feedback to the user, while the server performs posture analysis, session tracking, and feedback decision logic.

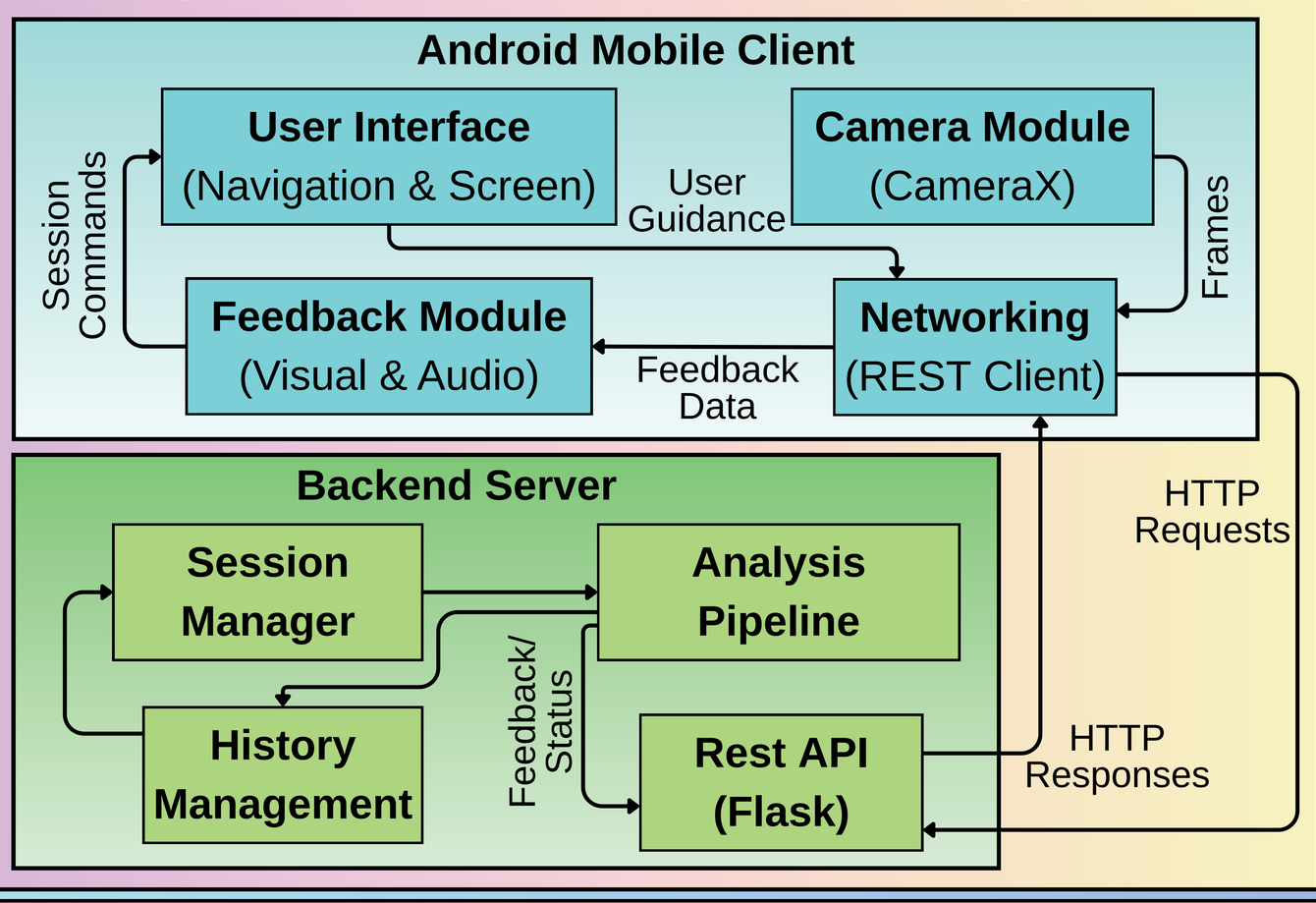
Real-Time Processing Pipeline

During an active session, the system processes video frames continuously **in real time**.
Each incoming frame is analyzed independently while also contributing to a historical context used for stable decision making.

Server Data Flow



High-level client–server architecture of the system



Key Design Decisions

- Clear separation between client and server responsibilities
- Session-based state management for temporal analysis
- History-driven validation to prevent unstable feedback
- Asynchronous processing to maintain real-time performance

Results & Insights

Evaluation and Results

The system was tested during real training sessions with gym users. Observed results include:

- Stable posture detection under normal lighting conditions
- Clear and understandable feedback
- Smooth real-time interaction during active sessions

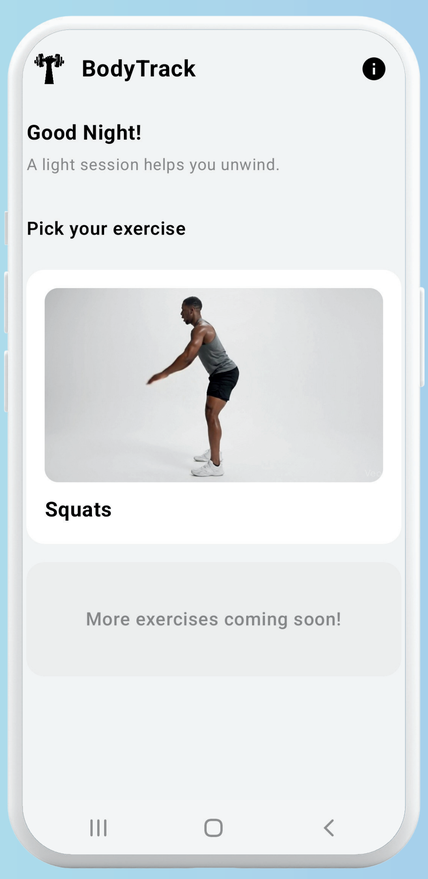
Challenges and Solutions

- **Unstable pose detection:** Solved using frame history aggregation and validation thresholds.
- **Network latency:** Handled through lightweight frame transfer and asynchronous processing.
- **Feedback overload:** Prevented by prioritization and throttling logic.

Future Work

- Support for additional exercises
- Transition to secure HTTPS communication
- Extended session analytics and summaries

Home Screen



Exercise Screen

Summary Screen