Journal of Science, Computing and Engineering Research (JSCER)
Volume-9, Issue- 3, March 2026.
DOI: *https://jscer.doi.org/10.46379/2603.26*

AI- POWERED FITNESS ASSISTANT

[1]J.R.Arun Kumar, [2]Shreya Mittal, [3]Tanishka Vedi, [4]Aryan

[1]Professor, Department of CSE, Modern Institute of Technology and Research Centre, Rajasthan, India.

[2,3,4,5]UG Student, Department of CSE, Modern Institute of Technology and Research Centre, Rajasthan, India

Correspomding Author:

Shreya Mittal

Abstract— *The AI-Powered Fitness Assistant is an intelligent platform designed to help users achieve fitness goals through real-time posture analysis, personalized workout planning, and adaptive progress tracking. Using Computer Vision (MediaPipe Pose), Machine Learning, and a cross-platform mobile application, the system detects body keypoints, calculates joint angles, identifies exercise types, and provides instant corrective feedback. A user dashboard displays workout statistics, BMI, calories burned, and progress trends. The system eliminates the need for professional supervision by functioning as a cost-effective virtual personal trainer accessible from any device with a camera.*

Keywords: Artificial Intelligence, Computer Vision, Fitness Assistant, MediaPipe, Pose Estimation, Machine Learning, Real-Time Feedback, Workout Tracking

Citation: J.R.Arun Kumar, Shreya Mittal, Tanishka Vedi, Aryan "AI-Powered Fitness Assistant," Journal of Science, Computing and Engineering Research, 2026.

I. INTRODUCTION

The growing adoption of digital health solutions has created a demand for intelligent, accessible, and personalized fitness support. Traditional gym training and professional coaching are often expensive and time-constrained, limiting access for many individuals. The AI-Powered Fitness Assistant addresses this gap by leveraging Artificial Intelligence, Machine Learning, and Computer Vision to deliver a comprehensive virtual fitness companion.

The system uses pose detection to monitor and evaluate exercise performance in real time. It provides instant corrective feedback similar to a personal trainer, generates personalized workout plans based on user history and fitness level, and tracks long-term progress through an interactive dashboard. The platform aims to make quality fitness guidance accessible, cost-effective, and available from any device with a camera.

II. PROBLEM STATEMENT

Many individuals lack access to professional fitness guidance due to high costs, time constraints, or lack of nearby facilities. Without proper supervision, users risk performing exercises incorrectly, leading to poor results or injuries. Existing fitness applications offer generic plans without real-time posture feedback or adaptive personalization, resulting in low engagement and inconsistent outcomes.

B. Project Objectives

- Develop a real-time pose detection system to monitor and evaluate exercise performance.
- Provide instant corrective feedback to improve posture and reduce injury risk.
- Generate personalized, adaptive workout plans based on user profiles and history.
- Track and visualize workout statistics including repetitions, calories, and progress.
- Build an accessible cross-platform mobile interface for seamless user experience.

III. LITERATURE REVIEW

Lugaresi et al. (2019) introduced MediaPipe, a flexible framework for building real-time perception pipelines, which forms the core pose estimation engine of this system [1]. Cao et al. (2017) proposed Part Affinity Fields for multi-person 2D pose estimation using convolutional neural networks, establishing benchmarks for skeletal keypoint detection [2].

Google's MoveNet (2023) demonstrated lightning-fast pose detection optimized for mobile devices, offering 33-keypoint body tracking at high frame rates [3]. OpenCV's open-source computer vision library provides foundational image

processing capabilities used in capturing and preprocessing video frames [4].

Mohammad et al. (2022) conducted a comprehensive survey on deep learning applications in fitness and healthcare, highlighting how AI models can enhance workout monitoring accuracy and user engagement [6]. Chen and Guestrin (2016) introduced XGBoost, which provides efficient machine learning-based classification for exercise recognition tasks [8].

IV. SYSTEM DESIGN

A. System Architecture

The system follows a client-server architecture. The client device (mobile/web) handles camera access, UI rendering, and user interaction. The server-side manages AI processing (pose estimation, exercise recognition), data storage (SQLite/Firebase), and user authentication. A RESTful API bridges the frontend and backend, ensuring modularity and scalability.

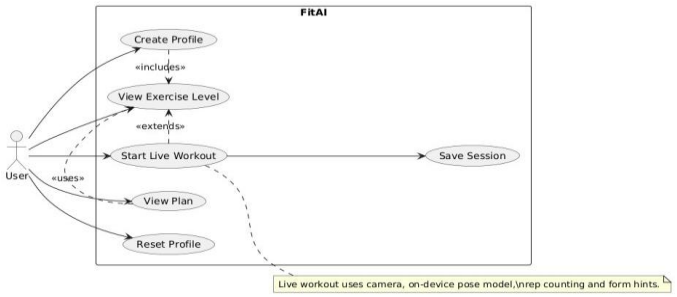
B. Technology Stack

Category	Technology	Purpose
Frontend	React Native / Flutter	Cross-platform mobile UI
Pose Detection	MediaPipe Pose (Python)	33-keypoint body tracking
Backend	Python (Flask/FastAPI)	API & AI processing
Database	SQLite / Firebase	User & workout data storage
ML Framework	TensorFlow / XGBoost	Exercise recognition
Image Processing	OpenCV	Video frame analysis
Version Control	Git & GitHub	Collaboration & deployment

Table I: Technology Stack

V. UML DIAGRAMS

The system design includes seven UML diagrams: Use Case Diagram (user-system interactions), Activity Diagram (workout session flow), Sequence Diagram (real-time pose detection flow), Class Diagram (OOP structure), Component Diagram (system modules), Communication Diagram (inter-module messaging), and Object Diagram (runtime state). These collectively describe the structural and behavioral aspects of the system.



VI. PROPOSED WORK AND METHODOLOGY

A. Work Model

The proposed system follows a modular pipeline: (1) User registers and creates a fitness profile. (2) The system presents a dashboard with workout options and progress insights. (3) On workout selection, the camera module activates and begins real-time pose tracking. (4) The AI model processes skeletal keypoints frame-by-frame, calculates joint angles, and recognizes the exercise being performed. (5) Corrective feedback is displayed on-screen. (6) Session data (reps, duration, calories, accuracy) is stored and visualized.

B. Methodology

1. User Registration & Profile: Users provide age, height, weight, fitness goals, and preferences. This data is stored securely and used to personalize workout recommendations.

2. Video Capture: The device camera streams real-time video using WebRTC/MediaDevices API. Frames are continuously processed by the AI module.

3. Pose Detection: MediaPipe Pose detects 33 skeletal keypoints (shoulders, elbows, hips, knees, ankles) per frame, forming a body skeleton.

4. Joint Angle Calculation: Mathematical formulas compute joint angles from detected keypoints. For example, squat analysis measures the hip-knee-ankle angle.

5. Exercise Recognition: ML algorithms classify detected pose patterns to identify specific exercises (squats, push-ups, lunges, jumping jacks).

6. Posture Analysis: Detected joint angles are compared with reference values. Deviations trigger error detection (e.g., improper knee alignment, bent back).

7. Real-Time Feedback: Visual alerts guide users: "Straighten your back", "Lower your hips", "Keep knees aligned".

8. Workout Tracking: Reps, duration, calories burned, and posture accuracy are recorded per session and stored in the database.

9. Personalized Recommendations: ML models analyze historical data to generate adaptive workout plans that evolve with user progress.

10. Progress Visualization: Charts and reports display weekly trends, performance summaries, and fitness milestones.

VII. RESULTS AND DISCUSSION

The AI-Powered Fitness Assistant was successfully developed and tested across multiple workout scenarios. The system demonstrated accurate pose detection with MediaPipe Pose, consistently tracking 33 body keypoints in real time at acceptable frame rates. Exercise recognition achieved reliable classification for common exercises including squats, push-ups, and lunges.

The application interface provides a clean signup/login flow, a comprehensive dashboard showing fitness stats, dedicated workout setup screens, an AI Coach module, and a history panel for session review. Two representative application screenshots are presented below.

Fig. 1: Sign Up Screen — User registration interface with profile setup.

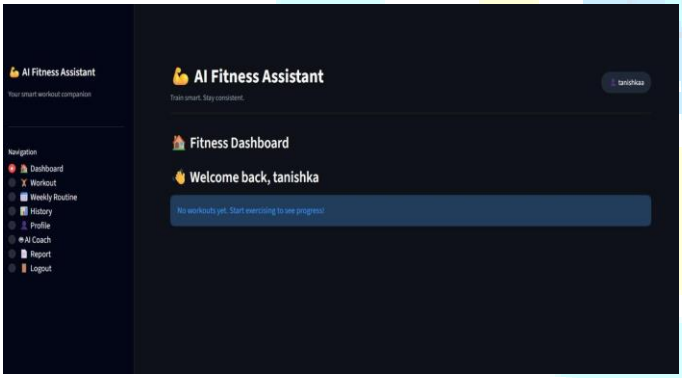


Fig. 2: Dashboard Screen — Displays workout stats, BMI, calories, and progress overview.

Fig. 3: Weekly Routine— Displays your weekly workout Routine.

The dashboard successfully presents real-time workout data including repetition counts, session duration, calorie estimates, and posture accuracy scores. Post-workout reports and historical trend charts enable users to monitor long-term fitness progress. The system demonstrated stable performance across tested devices with functional camera access.

VIII. CONCLUSIONS AND FUTURE WORK

A. Conclusions

The AI-Powered Fitness Assistant successfully demonstrates how Artificial Intelligence, Computer Vision, and Machine Learning can be combined to deliver a virtual personal training experience. The system provides real-time posture correction, automated repetition counting, personalized workout recommendations, and progress visualization — all without requiring professional supervision.

The platform represents a cost-effective, accessible alternative to traditional fitness coaching. Its modular, scalable architecture ensures easy maintenance and future expansion. The project confirms the viability of AI-driven fitness solutions for promoting healthier lifestyles.

B. Future Work

- Integration of wearable devices (heart rate, oxygen level, step count) for enhanced analytics.
- 3D Pose Estimation using BlazePose 3D or MoveNet 3D for improved accuracy in complex exercises.
- Voice-assisted virtual trainer providing real-time audio coaching instructions.
- AI-based nutrition planner with diet recommendations based on BMI, goals, and meal tracking.
- Gamification features: fitness challenges, streak rewards, leaderboards, and social groups.
- Edge AI deployment for offline functionality with on-device lightweight pose models.
- Advanced analytics: predictive progress forecasting, weight trend analysis, and strength gain estimation.

IX. REFERENCES

[1] C. Lugaresi et al., "MediaPipe: A Framework for Building Perception Pipelines," Google Research, 2019.

[2] Z. Cao, T. Simon, S. Wei, and Y. Sheikh, "Realtime Multi-Person 2D Pose Estimation Using Part Affinity Fields," IEEE CVPR, 2017.

[3] Google TensorFlow Team, "MoveNet: Lightning-Fast Pose Detection Model," TensorFlow Hub Documentation, 2023.

[4] OpenCV Organization, "Open Source Computer Vision Library Documentation," 2023.

[5] Python Software Foundation, "SQLite3 - DB-API 2.0 Interface for SQLite Databases," Python Documentation, 2023.

[6] A. Mohammad et al., "Deep Learning for Fitness Applications: A Survey," Journal of Healthcare Engineering, 2022.

[7] Google Developers, "MediaPipe Pose: Real-Time Human Pose Detection," https://developers.google.com/mediapipe, 2023.

[8] T. Chen and C. Guestrin, "XGBoost: A Scalable Tree Boosting S