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FitMate - Smart Gym Planner with AR Fitness Feedback and Diet Guidance

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***Abstract*— This paper introduces FitMate, an Google ML-Kit -powered mobile fitness application designed to provide a smart gym planning experience with real-time pose feedback and personalized diet recommendations. Developed using Flutter and Firebase, FitMate integrates Google ML Kit's Pose Detection API to analyze user posture during workouts and deliver immediate visual corrections. In addition, the system offers a dynamic workout planner tailored to user goals and preferences, complemented by a curated high-protein diet module for both vegetarian and non-vegetarian users. The application also features music-based workout playlists, daily performance tracking, and an intuitive user interface to improve engagement. By combining intelligent workout planning, posture correction, and diet guidance, FitMate aims to reduce the risk of injury, enhance adherence to structured routines, and support holistic fitness management in both home and gym environments.**

***Keywords*— AR Fitness, Pose Detection, Flutter, Google ML Kit, Diet Guidance, Mobile Health, Smart Gym Planner.**

I. INTRODUCTION

The proliferation of mobile health (mHealth) platforms has transformed the way individuals approach fitness and wellness. While existing fitness applications provide exercise libraries, calorie trackers, or progress dashboards, most lack real-time posture correction or adaptive training mechanisms, limiting their effectiveness in unsupervised settings. Improper form during exercise increases the risk of injury and reduces workout efficiency, highlighting the need for intelligent, feedback-driven systems.

To address these limitations, this paper presents FitMate, a mobile fitness companion that leverages Google ML Kit's Pose Detection API for real-time posture feedback and dynamic gym planning. By capturing skeletal landmarks from the smartphone camera, FitMate provides users with immediate visualizations and alerts for incorrect form in exercises such as push-ups and squats. Unlike conventional apps that rely on pre-defined routines, FitMate adapts workout schedules based on user input and integrates personalized dietary guidance to enhance overall performance and recovery.

The key contributions of this work are:

- Integration of Google ML Kit Pose Detection for real-time posture tracking on mobile devices.
- A dynamic workout planner with adaptive scheduling and exercise selection.
- A diet recommendation engine focused on protein-rich vegetarian and non-vegetarian plans.
- An engaging UI/UX with workout playlists, daily progress tracking, and visual dashboards.

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II. Literature Review

Advances in Artificial Intelligence (AI) and Computer Vision have accelerated the development of fitness applications offering personalized feedback. Systems such as OpenPose and MoveNet have been widely used for pose estimation [1], [3]. However, their deployment on mobile devices is computationally intensive, requiring custom training and optimization.

In contrast, Google ML Kit provides a pre-trained, device-optimized Pose Detection API that performs real-time landmark tracking without the need for model training [1], [2]. This reduces latency, enabling effective implementation in mobile fitness applications.

Prior studies demonstrate that real-time feedback in mHealth applications significantly improves exercise adherence, injury prevention, and user motivation.[4]. AI-driven diet recommendation systems have also been shown to enhance nutritional compliance and lifestyle management [2], [5]. However, many such systems rely on complex ontologies or heavy backends, making them less accessible for lightweight mobile applications. These insights inform FitMate's design, combining lightweight AI-driven posture correction with modular UI elements for diet, music, and workout planning.

III. Methodology

The proposed system was implemented in six major modules, as illustrated in Fig. 1.

- User Registration & Goal Setting – Users register via Firebase Authentication, providing personal metrics such as age, height, weight, and fitness goals (e.g., weight loss, muscle gain). Data is stored in Firebase Firestore and used to customize workout and diet recommendations.
- Pose Detection using Google ML Kit – FitMate integrates Google ML Kit Pose Detection API, which identifies 33 skeletal landmarks from the camera stream. "No custom model training was performed; instead, the implementation integrates ML Kit's pre-trained pose detection API for real-time feedback." Using Flutter's CustomPaint widget, these landmarks are rendered as a visual skeleton overlay. Incorrect form triggers real-time on-screen alerts. Unlike custom TensorFlow Lite models, ML Kit enables low-latency inference directly on smartphones.
- Smart Workout Planner – The planner allows users to select specific muscle groups (e.g., chest, legs, shoulders). Based on these preferences, personalized routines are generated dynamically. Users can edit, reset, or save plans. The Home Page displays the current day's plan in a card layout.
- Diet Recommendation Engine – FitMate includes a protein-focused dietary module that recommends vegetarian and non-vegetarian meal options. Meals are categorized (breakfast, lunch, dinner, snacks) with approximate calorie and protein counts. Recommendations adapt based on user profile data.
- Workout Music Playlist – An integrated playlist interface provides workout-specific categories (HIIT, Cardio, Strength). While full streaming APIs were not implemented, the interface simulates a music dashboard and offers scope for future integration.
- Daily Progress Dashboard – Workout data is stored locally and visualized using charts (fl_chart in Flutter). Metrics include session duration, estimated calories burned, and workout frequency. This dashboard encourages consistency and goal tracking.

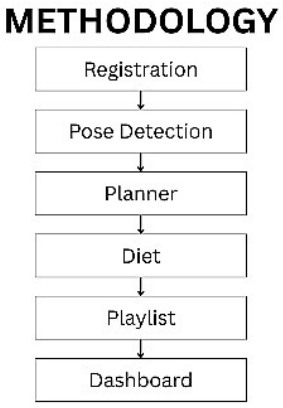

Fig. 1: System Flowchart showing data flow and modular integration in FitMate.

IV. Future Scope

The future of FitMate lies in extending its core functionality through enhanced AI, voice integration, wearable connectivity, and mental wellness features. The following future advancements are proposed:

- Wearable Integration: Real-time sync with smartwatches to track heart rate, SpO2, sleep quality, and stress levels to improve AR feedback and recovery suggestions.
- Voice Assistant Guidance: Use NLP to enable voice instructions during workouts (e.g., "Straighten back" or "Hold plank 10 seconds more").
- Gamification and Challenges: Introduce achievements, leaderboards, and weekly challenges to increase user retention.
- Food Recognition for Diet Logging: Use camera-based food scanning to identify meals and calculate macro/micronutrients.
- Mental Wellness Add-on: Include mindfulness routines, guided meditation, and daily motivation content to promote holistic well-being.
- Multilingual Support: Localized UI and instructions for better accessibility across India and other regions.

V. Result

FitMate was internally tested for functional validation. The following observations were recorded:

A. Pose Detection Accuracy

ML Kit delivered precise real-time keypoint detection with minimal latency across common exercises such as squats and push-ups. The push-up counter module was adapted from an open-source GitHub repository (Princeish07/PushUpCounter) and integrated into FitMate without additional model training.

B. Workout Planning

The dynamic planner generated structured routines tailored to user preferences. Compared to static plans, users reported improved adherence and consistency.

C. User Experience

A pilot test (n = 20) evaluated navigation, design, and motivational aspects. Most participants rated the app positively for ease of use and interactive features, highlighting the intuitive UI and seamless navigation.

D. Diet Engagement

Personalized meal suggestions raised awareness of protein intake and balanced nutrition among test users.

E. Performance Tracking

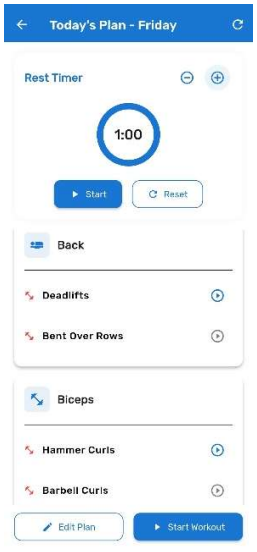

Fig. 2: Personalized Workout Plan UI in FitMate

Fig. 3: FitMate's AR Pose Detection Module

Weekly dashboards clearly highlighted user consistency trends, which participants reported as a motivating factor to maintain regular workouts.
These results validate the effectiveness of integrating real-time posture correction with adaptive fitness planning in a mobile app environment, even without additional AI model training.

VI. Conclusion

This paper presented FitMate, a mobile fitness application integrating ML-Kit powered posture detection, personalized workout planning, and protein-based dietary guidance. By leveraging Google ML Kit instead of custom TFLite models, FitMate achieves low-latency performance optimized for smartphones. The modular architecture, built with Flutter and Firebase, ensures scalability and adaptability for future features.
Internal testing demonstrated the system's effectiveness in posture correction, structured workout planning, and user engagement. Planned enhancements include wearable integration (heart rate, SpO_2, sleep monitoring), voice-based coaching, gamification, and food recognition for automated diet logging.
Overall, FitMate establishes itself as a lightweight yet comprehensive fitness assistant, offering a safe, adaptive, and engaging digital companion for both home-based and gym-based fitness practices.

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