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VIRTUAL FITNESS TRAINER

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Abstract—The ”Virtual Fitness Trainer” project develops an interactive health application using Python Flask, integrating deep learning for posture detection and correction, symptom- based disease prediction, and personalized fitness guidance. Objectives include high accuracy in disease prediction, real-time posture analysis, personalized video recommendations, and a user-friendly interface.

Machine learning predicts health conditions from user symp- toms, while Mediapipe enables real-time posture analysis. Users get instant feedback on posture correctness and personalized improvement suggestions.

Results show accurate disease prediction, effective posture correction, and tailored fitness recommendations, highlighting the project’s potential to enhance personalized healthcare and promote proactive health management.

Index Terms—Mediapipe, OpenCV, Python Flask, frontend, SQLite.

I. INTRODUCTION

The ”Virtual Fitness Trainer” project, using Flask, HTML, CSS, and JavaScript, combines computer vision and machine learning for real-time posture analysis, symptom-based disease prediction, and tailored health monitoring for yoga and exercise. It targets individuals seeking personalized, interactive health advice.

a) Problem Statement: Health challenges are rising due to sedentary lifestyles and inadequate personalized health- care. Issues include difficulty recognizing symptoms, incorrect exercise and yoga postures, and lack of health resources. An interactive health application is needed to address these concerns.

The application should offer:

- Symptom-Based Disease Prediction
- Accurate Exercise and Yoga Posture Detection
- Personalized Video Suggestions

b) Objectives: The primary objectives are:

1) Accuracy: High-accuracy symptom-based disease prediction models.
2) Real-Time Analysis: Real-time pose detection using MediaPipe.
3) Personalization: Personalized exercise and yoga video recommendations.
4) User-Friendly Interface: Intuitive web interface.
5) Scalability: Scalable architecture for future enhancements.

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c) Motivation: The project aims to empower proactive health management, leveraging smartphone and internet use to reach a broad audience. Key motivations include:

1) Encouraging proactive health steps with personalized information.
2) Enhancing accuracy and effectiveness in symptom prediction and posture detection.
3) Facilitating better health outcomes through timely assessments.

The project aims to make personalized health information and guidance more accessible and effective, improving users’ well-being.

II. LITERATURE SURVEY

Song et al. (2020)

- Title: AI-based virtual fitness trainer with 3D position estimation
- Methods: CNN for 3D position estimation from 2D images
- Results: Improved training efficiency and reduced injury risk (22 exercises)
- Remarks: Enhances user experience and promotes healthy habits

Chen et al. (2019)

- Title: Deep learning-based intelligent fitness assistant
- Methods: CNN and LSTM with wearable device data
- Results: Improved exercise quality and reduced
- injury risks
- Remarks: Supports healthy behaviors and enhances user experience

Bellocchio et al. (2020)

- Title: Virtual fitness coach for automated training
- Methods: Machine learning and computer vision with Microsoft Kinect
- Results: Automated personalized fitness training (5 exercises)
- Remarks: Engaging and interactive fitness experience

III. MODULE DESCRIPTION

1) User Authentication
   - Description: Handles user registration, login, and session management.
   - Features: Registration, secure login, session maintenance.
2) Symptoms-Based Disease Prediction (Random Forest)

- Description: Predicts diseases based on user symptoms.
- Features: Symptom input, disease prediction with confidence level, disease information.

3) MediaPipe-Based Exercise and Yoga Posture Detection
- Description: Detects and evaluates postures in real-time.
- Features: Real-time pose detection, posture evaluation, corrective suggestions, progress tracking.

4) Dashboard and User Profile
- Description: Provides personalized dashboard and profile management.
- Features: Health data visualization, goal setting, profile management, external device integration.

These modules form a Python Flask health application, facilitating disease prediction, posture detection, user management, and health tracking.

IV. ALGORITHMS

MediaPipe:

- Description: Multi-platform, customizable ML solutions for live and streaming media.
- Features:
  - Accelerated ML processing.
  - Deploy once, use anywhere.
  - Ready-to-use ML-based solutions.
- MediaPipe Pose: Object-based pose detection using machine learning for high-fidelity body pose detection based on 33 landmarks in RGB video frames.

BlazePose:

- Description: Lightweight convolutional neural network for real-time human body posture estimation.
- Features:
  - Designed for real-time inference.
  - Useful for fitness tracking and sign language recognition.
- Fig 6: BlazePose model consisting of 33 landmarks.

Random Forest:

- Description: Machine learning technique for regression and classification problems.
- Features:
  - Utilizes ensemble learning.
  - Consists of many decision trees.

Decision Trees:

- Description: Decision support technique forming a tree-like structure.
- Overview: Building blocks of the random forest algorithm.

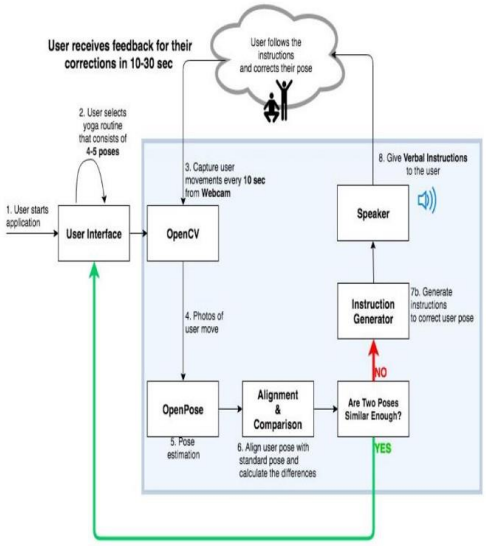

Fig. 1. System Architecture

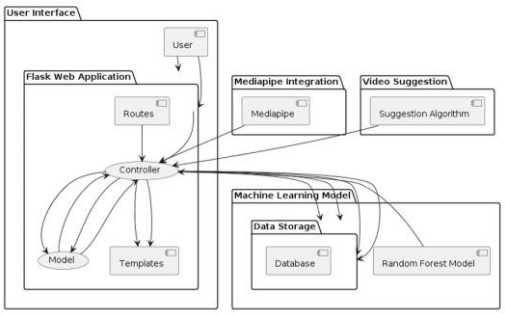

Fig. 2. Data Flow Diagram

V. ARCHITECTURE

A. System

Architecture B.

Dataflow Diagram C.

Blazepose

VI. RESULT AND DISCUSSION

Working of the Model And Results

A. Yoga Pose Detection

This module is concerned with Yoga Pose Detection. For the required application we are using Media pipe Pose

B. Exercise Monitoring

This module is concerned with various exercise detection and monitoring. Mediapipe module is made for this feature. The API is used to obtain mediapipe's 33 landmarks on the image with humans, which are connected using javascript functions. 5 unique exercises are implemented in this feature. The number of repetitions performed are counted and incremented upon the performance of the exercise.

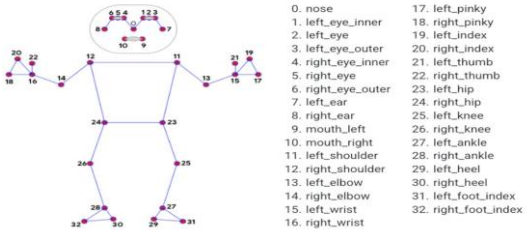

Fig. 3. Blazepose model consisting of 33 landmarks

Fig. 4. output screenshot 1

C. Symptom Based Disease Prediction

Based on the given symptoms the model predicts the accurate diseases by using ML algorithms

VII. Conclusion

Web applications merging deep learning and digital image processing offer a groundbreaking approach to enhancing overall well-being. Through early disease detection and real-time posture correction, these platforms empower users to proactively manage their health. By leveraging personalized recommendations and interactive interfaces, individuals can exercise safely and efficiently, reducing injury risks and promoting long-term engagement with fitness routines. As technology continues to evolve, these applications hold immense potential to revolutionize personal wellness, fostering a healthier and more digitally connected society.

VIII. FUTURE SCOPE

The number of exercises and yoga poses can be increased and various conditions for each can be implemented. More insightful suggestions could be provided with respect to the user's pose while performing the exercise. As an exercise monitoring feature,the number of sets could be considered to form a complete exercise routine. A separate database could be set-up to store user specific exercise data and create

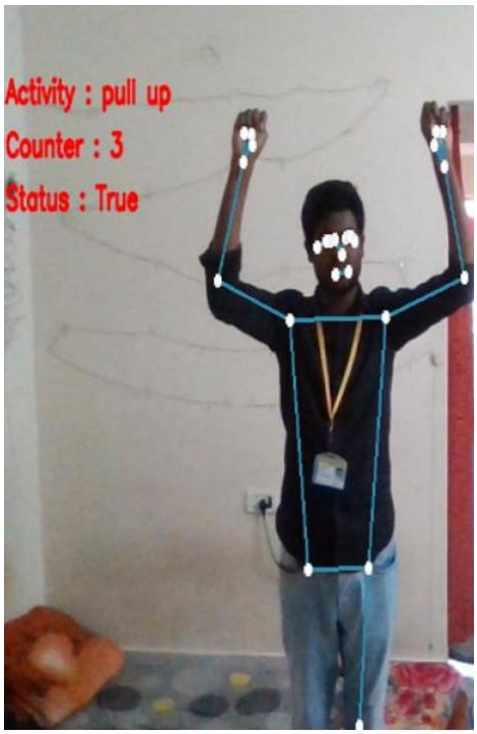

Fig. 5. output screenshot 2

necessary graphs to get better insights as a part of data analytics. Regular updates and reminders could be set-up to attract users and make them actively perform their routine.

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