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Yoga Pose Detection and Correction System

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Abstract

This project presents a real-time Yoga Pose Detection and Correction system built using HTML, CSS, and JavaScript, leveraging the PoseNet model to detect key human body points from webcam video. The system uses a K-Nearest Neighbors (KNN) classifier with ml5.js to identify the user's yoga pose by comparing detected keypoints against stored training data. For pose correction, it calculates joint angles and compares them with ideal reference angles to detect deviations, providing instant visual and audio feedback through p5.js and the Web Speech API. This interactive feedback helps users adjust their posture accurately in real time, promoting safer and more effective yoga practice. By combining computer vision, machine learning, and human-computer interaction in a web environment, this project offers an accessible and engaging tool for users to practice yoga at home with guided corrections, enhancing the overall quality and mindfulness of their sessions.

INTRODUCTION

In recent years, yoga has gained immense popularity worldwide, not only as a tool for physical well-being, but also as a powerful practice for enhancing mental health and inner balance. As more people turn to yoga for holistic health, many choose to practice at home due to its convenience and flexibility. However, lack of professional guidance often leads to incorrect postures, which can reduce the effectiveness of the practice and even lead to injuries. To bridge this gap, there is a growing need for a smart, accessible system that can analyze yoga poses in real-time, provide instant feedback, and help users achieve correct alignment. This project addresses that need by leveraging pose estimation and machine learning to offer expert-like corrections, making high-quality yoga instruction available to anyone, anywhere.

Existing System

Existing yoga pose correction systems, such as **YogaMats**, **MyYogaCoach**, and **Asana Rebel**, often lack **real-time feedback**, providing corrections only after users upload videos or images. This delay disrupts the **flow of practice**, preventing users from making **immediate improvements**. Additionally, most systems do not offer **interactive features** like **chatbots** or **personalized guidance** during sessions, leaving users without the opportunity for **real-time assistance**. While **OpenPose** and **PoseNet** provide some level of real-time pose analysis, they lack **interactivity** and can be challenging to implement or require **specialized hardware**, raising the overall cost. Furthermore, many apps are **subscription-based**, making them **unaffordable** for a significant portion of users. These limitations hinder the **accessibility** and **effectiveness** of yoga training, emphasizing the need for a more **interactive, real-time, and affordable solution.**

1.1 Proposed System

The **proposed system** is a **real-time**, **web-based** Yoga Pose **Detection** and **Correction** tool using **PoseNet** for accurate **body keypoint detection** via **webcam**. It employs **K-Nearest Neighbors (KNN)** with **ml5.js** to **classify poses** by comparing live data to **pre-trained examples**. **Joint angles** are calculated and matched against **ideal poses** to identify **deviations**, providing instant **visual** and **audio feedback** through **p5.js** and the **Web Speech API**. Built with **HTML**, **CSS**, and **JavaScript**, the system is **accessible**, **affordable**, and **easy to use**, enabling users to practice yoga at home with **expert-like guidance** and **real-time corrections**.

LITERATURE SURVEY

Polycystic Ovary Syndrome (PCOS) is a chronic and complex hormonal disorder that affects millions of women worldwide, often leading to irregular periods, infertility, weight gain, acne, and mood disturbances. Despite its widespread prevalence, effective PCOS management tools remain limited, with many existing applications focusing solely on menstrual tracking without providing actionable insights or emotional wellness support. The growing interest in personalized and AI-driven healthcare solutions has prompted researchers and developers to explore intelligent systems for women's health management.

According to a case study by **Ghosh et al. (2021)**, the integration of AI into women's healthcare applications significantly improves user engagement and health outcomes by delivering personalized insights. Their study emphasized the need for data-driven systems capable of adapting to individual hormonal profiles and cycle variations, particularly for conditions like PCOS.

In another notable work, **Goyal and Rajput (2023)** proposed an AI-powered menstrual tracker that leveraged time-series prediction models to forecast cycle dates and potential irregularities. Their system, although limited in scope, demonstrated the effectiveness of LSTM (Long Short-Term Memory) networks in predicting upcoming cycles with improved accuracy compared to traditional static models.

Kaur et al. (2022) introduced a PCOS monitoring application that collected user-reported symptoms such as weight gain, mood swings, and hair loss, and offered general health tips. However, the system lacked advanced personalization and predictive capabilities, highlighting the gap that OvaCare aims to fill with its AI-powered insights and adaptive recommendations.

Khan et al. (2020) explored emotional wellness tracking in chronic disorder management systems and found that integrating features like journaling, guided meditation, and mood analysis contributed significantly to long-term adherence and mental well-being. Their findings support the mental health features embedded in OvaCare, which aims to treat both physical and psychological aspects of PCOS.

A relevant study by **Sharma and Dey (2021)** presented the use of MongoDB and Flask in building scalable, cloud-based health tracking platforms. Their architecture enabled rapid deployment, secure storage of user data, and support for real-time data visualization—an approach that OvaCare adopts to ensure performance, portability, and security.

Furthermore, **Nanda et al. (2019)** demonstrated the application of Google OAuth in safeguarding sensitive user data in healthcare apps. Their work supports OvaCare's secure authentication system, which uses Google sign-in to maintain user trust and streamline access.

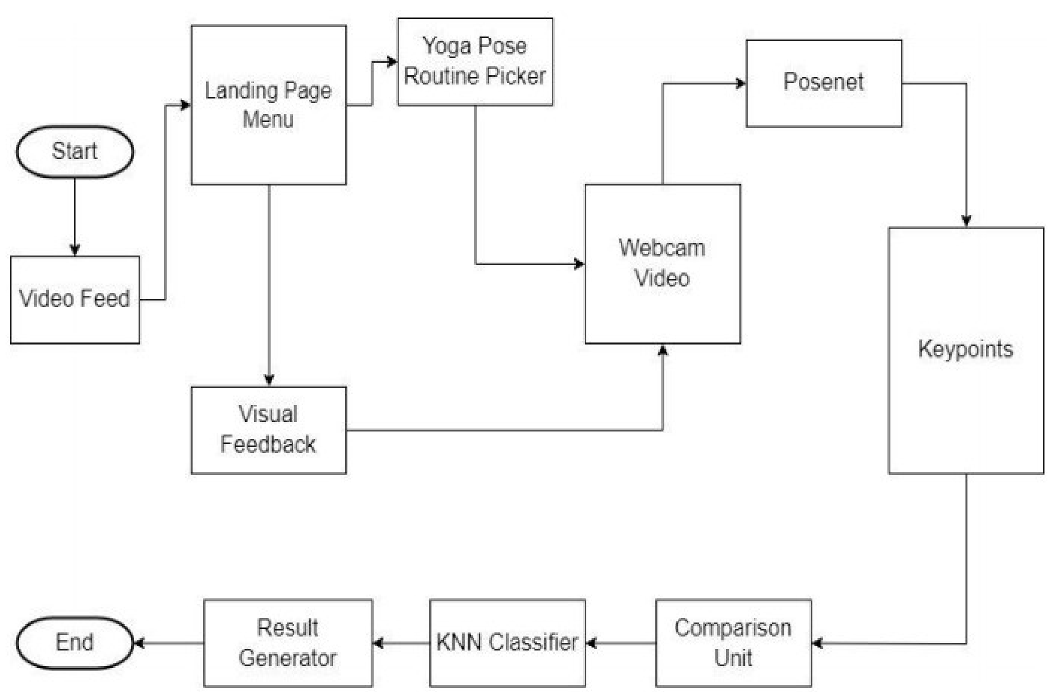
Collectively, these studies validate the viability and growing need for intelligent, web-based health tracking systems that combine AI analytics, personalized guidance, and emotional wellness features. OvaCare builds upon these foundational works by offering a unified platform for PCOS management that predicts cycle patterns using LSTM, delivers tailored lifestyle and wellness recommendations, and ensures a user-centric experience with a secure and scalable technical infrastructure.

By bridging the gap between basic tracking tools and intelligent health support, OvaCare advances the current state of PCOS management and aligns with the ongoing shift toward personalized digital healthcare solutions.

DESIGN

- Design represents the number of components we are using as a part of the project and the flow of request processing i.e., what components in processing the request and in which order.
- An architecture description is a formal description and representation of a system organized in a way that supports reasoning about the structure of the system.

System Architecture



System Architecture of Yoga Posture Detection And Correction

Implementation

Technologies

The proposed system is implemented using JavaScript-based libraries and browser-compatible models, enabling real-time yoga pose detection, classification, and correction with an interactive and user-friendly interface. Below are the key steps in the implementation along with the technologies used at each stage

1. Environment Setup

Technology Used: HTML, CSS, JavaScript, p5.js, ml5.js

Set up a client-side development environment to handle real-time webcam input, visualization, and interactive feedback.

2. Data Collection

Technology Used: JSON / Local Storage

Yoga pose data (keypoints and labels) is collected from webcam streams and stored locally or loaded from pre-trained datasets for use in classification.

3. PoseDetection

TechnologyUsed:PoseNet(viaml5.js)

Detects human body keypoints such as elbows, shoulders, and knees from the live webcam stream in real-time using a lightweight, browser-friendly model.

4. Feature Extraction

Technology Used: Custom JavaScript functions

Calculates angles between key joints (e.g., shoulder-elbow-wrist) to form numerical features representing body posture. These features are used for comparison with ideal poses.

5. **Pose Classification & Correction Technology Used:** K-Nearest Neighbors (KNN) - ml5.js Classifies the current pose by comparing features to a set of labeled poses. Identifies incorrect posture by comparing joint angles with ideal pose angles
6. **Feedback Method:** Visual overlays and voice instructions guide users to correct their alignment.
7. **Real- Time Feedback System Technology Used:** Web Speech API,p5.js Provides audio feedback through speech synthesis and visual cues (e.g., text warnings, color-coded lines) using canvas overlays.

Test Cases

Test Case ID	Test Scenario	Test Steps / Inputs	Expected Output	Actual Output	Status
TC001	Webcam Access Prompt	Load the webpage and allow webcam access	Webcam activates and displays live video stream	As expected	Pass
TC002	Webcam Denied	Deny webcam access when prompted	Display error or message: "Webcam access denied"	As expected	Pass
TC003	Pose Detection Initialization	Stand in front of the webcam in a known pose (e.g., MOUNTAIN)	PoseNet detects human keypoints on the screen	As expected	Pass
TC004	Data Collection for New Pose	Click "Add Example" for a specific label while performing pose	Pose gets added to the dataset with correct label	As expected	Pass
TC005	Pose Classification	Perform a trained pose after training KNN with multiple examples	Detected pose label displayed with confidence percentage	As expected	Pass
TC006	Misclassified Pose	Perform an unknown or untrained pose	Show "Unrecognized" or "Low confidence" output	As expected	Pass
TC007	Real-Time Pose Updates	Change from one trained pose to another (e.g., MOUNTAIN to PLANK)	Pose label updates instantly in the interface	As expected	Pass
TC008	Clear All Pose Data	Click the "Clear All" button	All stored pose data removed, reset interface	As expected	Pass
TC009	Audio Feedback (if implemented)	Perform a trained pose correctly	System speaks out pose name via Web Speech API	As expected	Pass
TC010	Audio Feedback for Incorrect Pose	Perform a wrong pose	System gives corrective audio instructions	As expected	Pass
TC011	UI Elements Visibility	Load the web app completely	Buttons like "Add Example", "Train", "Clear All" are visible	As expected	Pass
TC012	Device Compatibility	Open web app on different browsers (Chrome, Firefox, Edge)	Pose detection and classification works consistently	As expected	Pass

Result

Results Screenshots

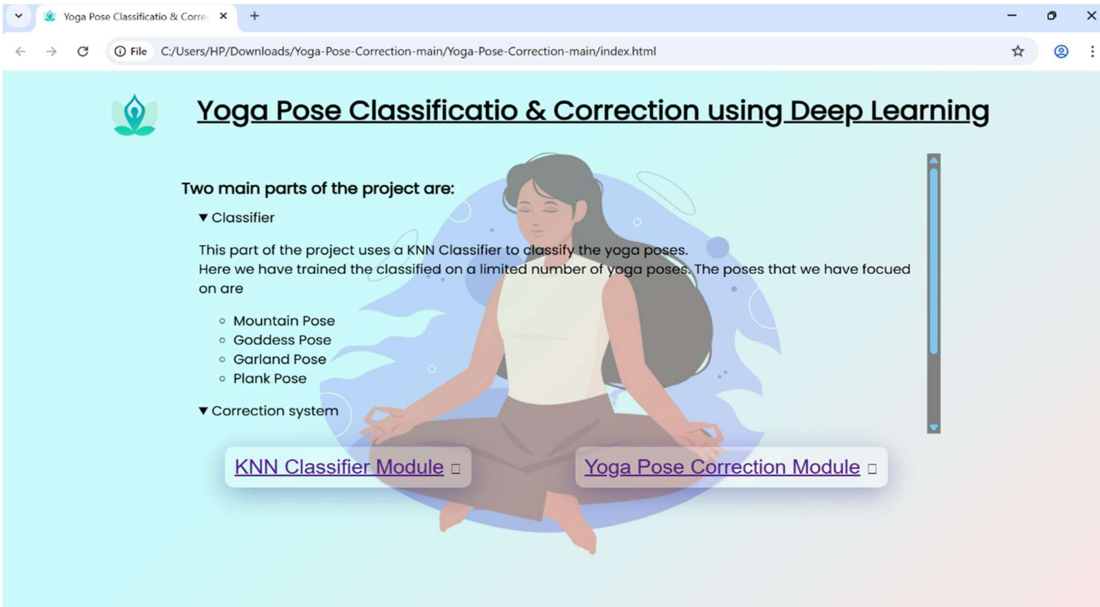


Fig 6.1 Main Page

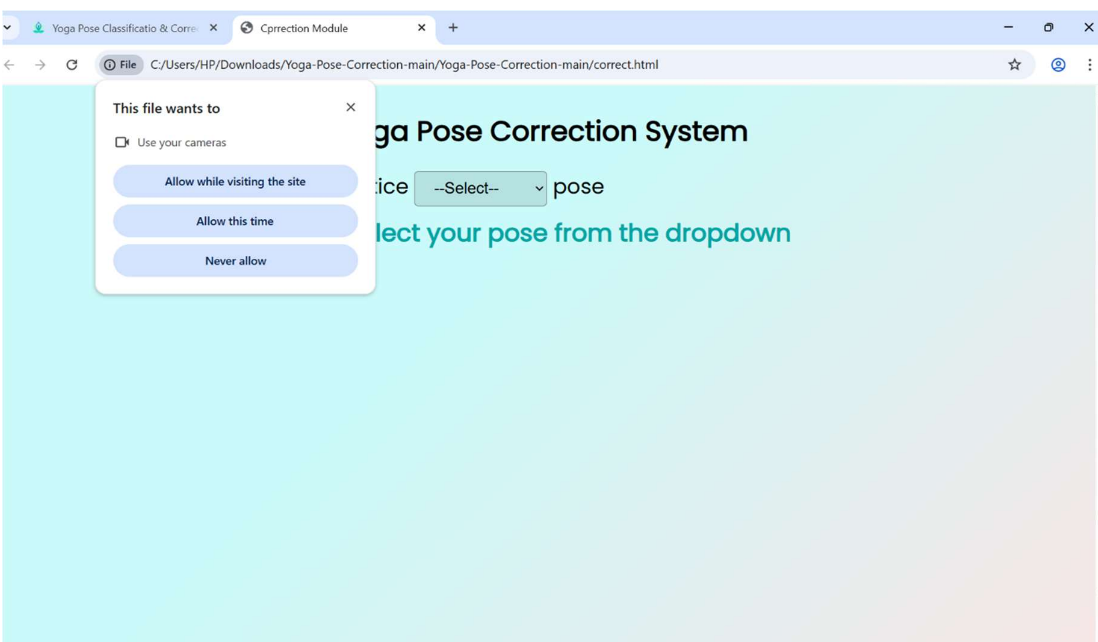


Fig 6.2 WebCam Access

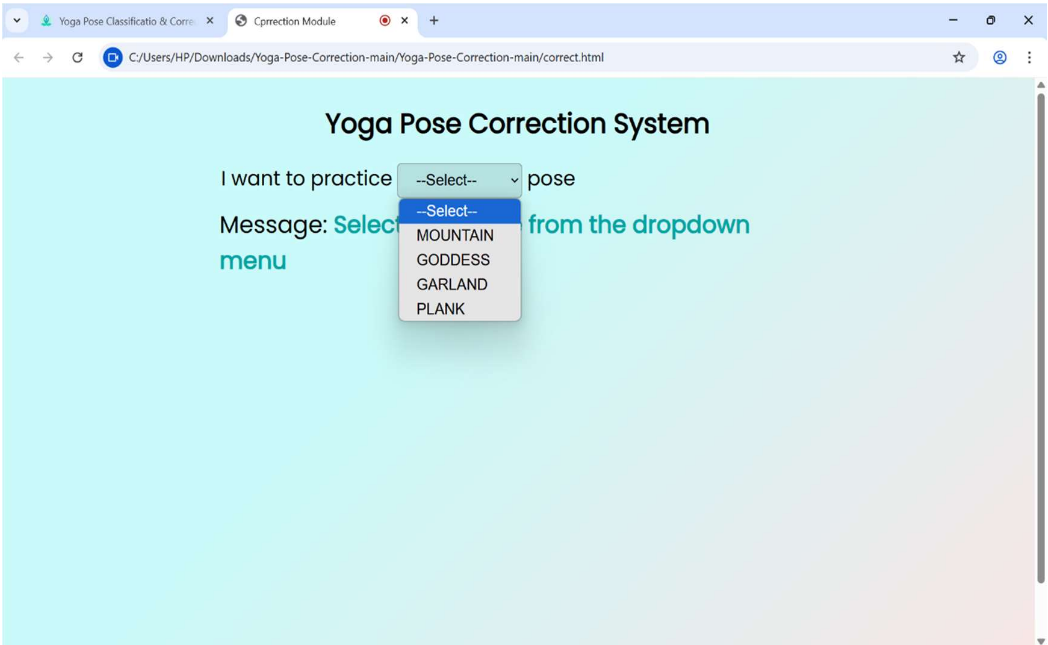
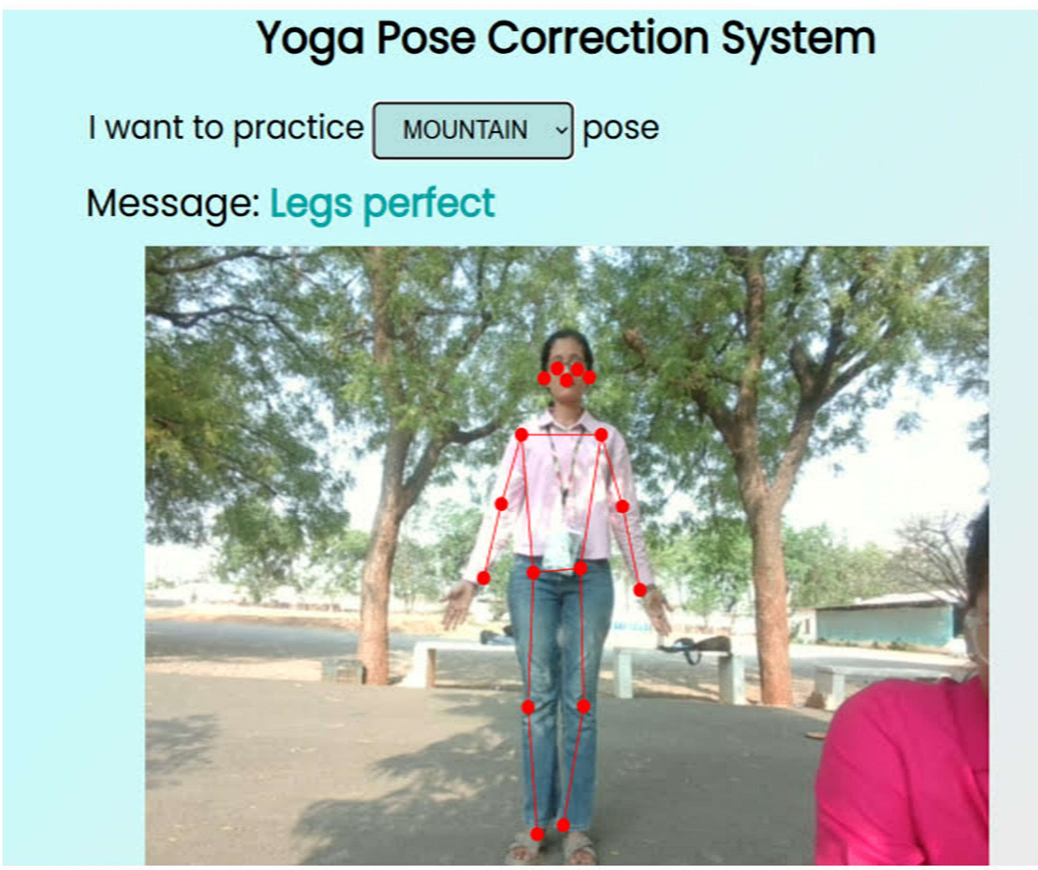


Fig6.3 Posture Correction Page



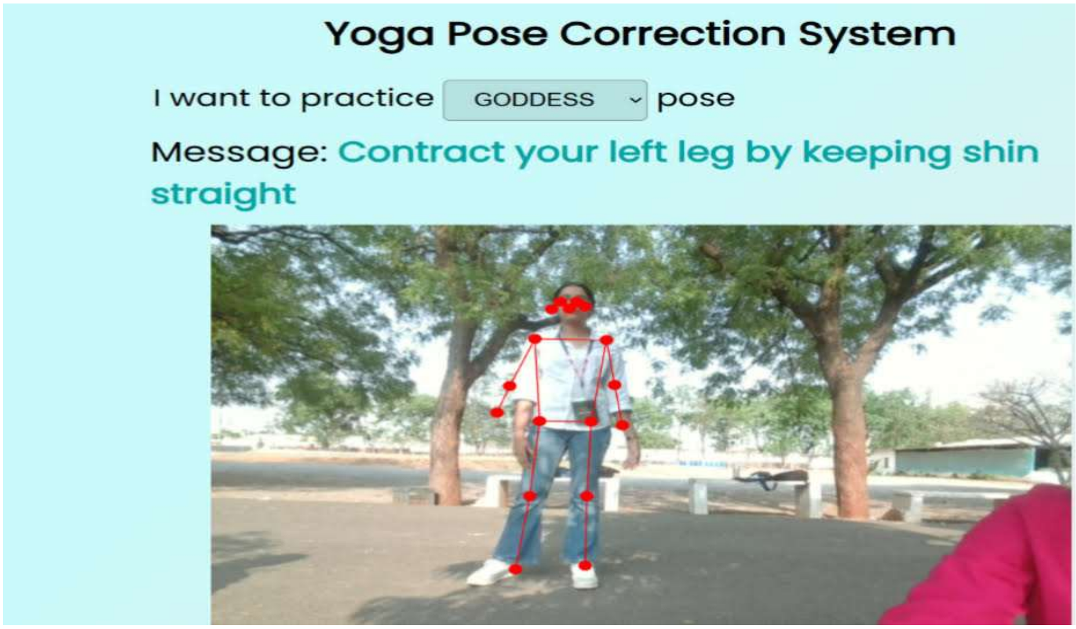


Fig 6.4 Correcting Posture Using Voice And Message Feedback

Conclusion And Future Scope

Conclusion

The Yoga Pose Correction System leverages machine learning and pose estimation technologies to promote safe and effective yoga practice. By integrating PoseNet with a K-Nearest Neighbors (KNN) classifier in a browser-based environment, it offers users real-time feedback on their postures, allowing them to make instant corrections without needing a physical instructor. This system enhances accessibility to quality yoga training and supports safe home practice—minimizing the risk of injury and improving performance. With its intuitive, user-friendly interface, the system holds strong potential for integration into fitness apps, wellness platforms, and personal health solutions, representing a step forward in blending technology with well-being.

Future Scope

- **Mobile App Development**:
  Extend the system to Android/iOS for on-the-go practice.
- **Advanced Classification**:
  Use deep learning models (e.g., CNN, LSTM) for better accuracy.
- **Personalized Recommendations**:
  Suggest yoga routines based on user performance and goals.
- **Multilingual Support**:
  Add voice and text feedback in different languages for broader reach.

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