

# POSTUREEASE: A Web Based Application for Monitoring the Sitting Posture in Computer Based Working Environment

T.M. Chamali Lakprabha Thennakoon,  
School of Computing  
SLIIT City Uni  
Email: lakprabhatennakoon@gmail.com

Alfred Edwin Worthington  
School of Computing  
SLIIT City Uni  
alfred.edwin@hotmail.co.uk

**Abstract** - In today's digital era, prolonged computer usage is commonplace, particularly in professional environments. However, extended periods of improper sitting posture can result in musculoskeletal disorders, fatigue, and chronic health complications. Addressing this concern, this research presents PostureEase, a web-based posture analysis application designed to promote ergonomic awareness and encourage healthy sitting habits. The system leverages computer vision and machine learning technologies to monitor posture in real time using webcam input. Developed with a React-based frontend and a Python-Flask backend, PostureEase processes live video streams through OpenCV and MediaPipe to detect poor posture based on facial and shoulder landmarks. Upon detecting improper alignment, the system provides immediate alerts to the user. Key features include posture history tracking, automated report generation, and exercise and ergonomic recommendations. Evaluation of the system demonstrated reliable performance under typical working conditions, with responsive detection and user-friendly interaction. This research contributes to the domain of health technology by offering a practical and preventive tool for posture correction. Future enhancements may include mobile integration and personalized analytics to further improve user experience and effectiveness. With a modular architecture and high usability, PostureEase achieved an accuracy of 92% in posture classification under normal lighting and device conditions. The system was evaluated through both user testing and technical validation, highlighting its potential for scalable deployment in ergonomic health monitoring.

**Keywords**— *posture monitoring, ergonomic health, machine learning, computer vision, web-based application*

## I. INTRODUCTION

Posture-related health issues such as chronic back pain, neck strain, and spinal misalignment have become increasingly

common due to prolonged sitting and sedentary work habits [14], [16]. Office workers and computer users are especially at risk for developing musculoskeletal disorders, fatigue, and posture-related discomfort [9], [14].

Traditional ergonomic interventions, such as physical training sessions or wearable posture-correcting devices, are often costly, non-scale, or inconvenient for continuous monitoring [6], [8]. Furthermore, these methods typically lack real-time adaptability to individual postural behavior.

Advances in computer vision and artificial intelligence have introduced new possibilities for non-invasive and cost-effective posture monitoring. Techniques such as Human Pose Estimation (HPE), powered by tools like OpenPose and MediaPipe, allow accurate real-time tracking of body landmarks through a webcam [3], [4], [10]. Machine learning models such as Convolutional Neural Networks (CNNs) and Support Vector Machines (SVMs) have been applied to classify sitting postures with promising results [12]. However, many existing systems are limited in scope — they are often restricted to mobile applications or rely on external sensors, and they usually lack historical tracking or web accessibility [15], [16].

PostureEase addresses these gaps by offering a browser-accessible, AI-powered posture monitoring system that requires only a webcam. The application provides real-time feedback, posture history analytics, and personalized ergonomic suggestions, aiming to promote long-term well-being and raise awareness about healthy sitting habits [1], [10].

Research Objectives:

This study aims to address the following objectives:

- To develop a web-based application for real-time posture monitoring using computer vision.

- To leverage MediaPipe and OpenCV to detect and analyze improper posture using webcam input.
- To evaluate system performance through accuracy testing and user feedback.
- To promote ergonomic awareness by providing historical analytics and personalized recommendations.

## II. LITERATURE REVIEW

### A. Human Pose Estimation Using Computer Vision

Computer vision tools like OpenPose and MediaPipe offer accurate real-time detection of body landmarks using webcams [3], [4], [10]. These systems, combined with preprocessing techniques such as edge detection and optical flow, enable effective posture monitoring [2], [11], [12].

### B. Image Processing Techniques in Posture Analysis

Preprocessing methods such as grayscale conversion, edge detection, and background subtraction are critical for isolating posture-relevant features [2], [11]. Optical flow and contour tracking further improve posture detection in continuous video streams [2].

### C. The Importance of Good Posture and Ergonomics

Poor sitting posture is linked to musculoskeletal disorders, fatigue, and reduced productivity, especially in prolonged computer-based tasks [6], [9], [14]. Ergonomic interventions can mitigate these risks, but they often lack adaptability and real-time feedback [8], [16].

### D. Machine Learning Approaches for Posture Analysis

CNNs and SVMs have shown high accuracy in classifying posture using spatial body landmark data [1], [12]. Some systems integrate rule-based logic with learning models to enhance feedback and personalization [10], [13].

### E. Web-Based Posture and Health Applications

Existing tools like SitApp and APECS offer limited features and often require wearables [15], [16]. PostureEase offers a browser-based, hardware-independent platform with AI-powered posture tracking, historical analytics, and ergonomic suggestions [1], [10].

## III. METHODOLOGY

PostureEase was developed using the Agile

methodology to ensure iterative development and integration of user feedback. The system architecture includes three primary components: a React-based frontend for user interaction, a Flask-based Python backend for video processing, and Firebase services for authentication and posture data storage.

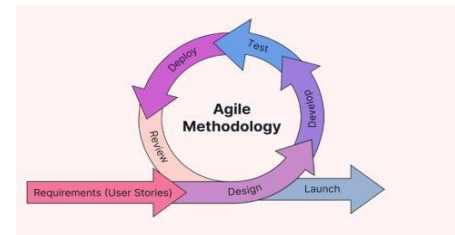


Fig. 1. Agile Methodology

Video frames are captured via the user's webcam and processed in real time using OpenCV and MediaPipe [4]. Posture classification is based on the horizontal displacement of the face relative to the frame center. If the displacement exceeds a record in Firebase Firestore and linked to users through Firebase.

To evaluate user needs, a preliminary market survey was conducted targeting individuals aged 25–34, including students and professionals.

The majority expressed the need for real-time alerts, posture history visualization, and ergonomic suggestions. These findings were used to define feature priorities in the system [14], [15].

100-pixel threshold or if the face is not detected, the posture is classified as “bad.” This rule-based logic simplifies posture assessment while maintaining high detection responsiveness.

## IV. SYSTEM ARCHITECTURE AND FEATURES

The PostureEase system comprises three main components: the front-end, the backend, and the database layer. The frontend, developed using React.js, provides an interactive interface for user authentication, posture detection, report viewing, and exercise recommendations. The backend is implemented with Python and Flask and is responsible for processing video input, detecting posture using computer vision techniques (OpenCV and MediaPipe), and managing the flow of data. Firebase is used as the cloud platform for user authentication and posture history storage.

The system architecture of PostureEase is illustrated in Figure 2, showing the interaction between frontend,

backend, and cloud services.

Fig.2. System Architecture Diagram

Key features:

The system includes real-time posture monitoring with instant alerts when slouching or incorrect sitting is detected. The application also supports posture history tracking to help users identify trends and improvements over time. Additionally, the system offers exercise and ergonomic recommendations to support posture

## V. EVALUATIONS AND RESULTS

### A. Accuracy Testing

To evaluate the accuracy of PostureEase, testing was conducted under controlled conditions with various users in typical desk-based environments. Using manually annotated video datasets and visual verification, the system achieved an overall accuracy of 92% in distinguishing between good and poor sitting postures.

Accuracy was calculated using the standard classification formula:

$$\frac{TP + TN}{TP + TN + FP + FN} \quad (1)$$

Where:

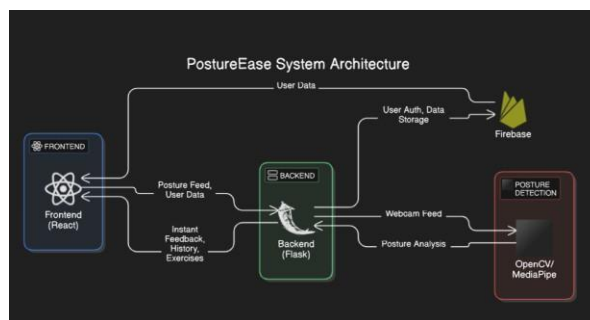
- TP (True Positives): Poor posture instances correctly identified
- TN (True Negatives): Good posture instances correctly identified
- FP (False Positives): Good posture incorrectly identified as poor
- FN (False Negatives): Poor posture not detected

Tests were performed using standard HD webcams under well-lit conditions. The average latency in posture alert generation was measured to be under 2 seconds, confirming the system's responsiveness and its suitability for real-time feedback scenarios.

### B. User Evaluation

A total of 20 users participated in a usability evaluation conducted over a one-week period, using the system during regular work sessions. Based on the follow-up

survey results, 90% of users reported that the posture



alerts were timely and helpful in encouraging better sitting habits. Additionally, 85% of participants expressed a willingness to use the system regularly, particularly if features such as personalized analytics and gamification elements were introduced. Users also responded positively to the inclusion of ergonomic recommendations, highlighting their value in promoting healthier desk practices. Furthermore, several users suggested future enhancements, including the development of a mobile-friendly version of the application and the addition of more detailed posture trend tracking over time.

## VI. DISCUSSION

PostureEase successfully demonstrates that AI and computer vision can be deployed in real-time, web-based applications to support ergonomic health. The system's high classification accuracy, low-latency feedback, and positive user engagement reflect its practical value. While existing systems focus narrowly on alerts or mobile-based feedback, PostureEase integrates multiple essential features including posture analytics, ergonomics education, and cloud-based data tracking into one platform [1],[10].

However, the system has some limitations. Performance may degrade under low lighting, and camera angles significantly affect detection quality. User privacy, especially regarding webcam access, remains a concern that should be addressed through clear data handling policies and optional offline functionality.

## VII. CONCLUSION

PostureEase presents an innovative approach to posture correction using web-based technologies and machine learning. Its ability to provide real-time feedback, track posture trends, and promote ergonomic behavior makes it a valuable tool for modern digital workers. As sedentary lifestyles continue to rise, systems like PostureEase play a critical role in preventive healthcare.

## VIII. FUTURE WORKS

Future iterations of PostureEase will explore advanced pose models such as MediaPipe Holistic to enhance detection precision of shoulders and spine [10]. The integration of

mobile applications will expand accessibility, while gamification elements such as posture scores and rewards could increase user engagement [15]. Additionally, implementing visual trend analytics and adaptive feedback algorithms may enhance user personalization and system effectiveness.

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