



# POSTURE BUDDY : A FRIENDLY COMPANION DESIGNED TO ASSIST YOU IN MAINTAINING HEALTHY POSTURE

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*Abstract:* Poor posture has become a prevalent issue in today's sedentary work culture, leading to musculoskeletal disorders and long-term health concerns. This paper presents **Posture Buddy**, an intelligent system that provides real-time monitoring and feedback to encourage healthy sitting habits. The system utilizes **MediaPipe's pose estimation** to identify key body landmarks such as the shoulders, spine, and hips, calculating angles to assess posture quality. To enhance accuracy, it integrates **additional sensors** for multimodal data collection. When poor posture is detected, users receive instant visual cues through an interactive interface, and if sustained beyond a set threshold, an auditory alert is triggered to prompt correction. Data on posture is securely stored using **Firestore**, enabling personalized tracking and analysis over time. Designed to be adaptable across workplaces, homes, and educational settings, **Posture Buddy** combines **computer vision, sensor integration, and real-time user interaction** to promote ergonomic well-being. Future enhancements may incorporate machine learning for improved posture classification and mobile platform support for broader accessibility.

**Index Terms** – Posture detection, Pose estimation, MediaPipe, Computer vision, Real-time monitoring, Machine Learning.

## I INTRODUCTION

The increase in sedentary lifestyles, especially with the rise of desk jobs, online education, and remote work, has resulted in poor posture becoming a widespread health concern. Prolonged sitting with improper posture contributes significantly to musculoskeletal conditions such as back pain, neck strain, and spinal deformities. These issues not only affect physical health but also productivity and quality of life. Unfortunately, conventional methods of posture correction—whether through manual observation or corrective braces—tend to be either uncomfortable, unreliable, or reactive rather than preventive. This growing problem highlights the need for a proactive solution that can monitor posture in real time and provide immediate corrective feedback.

To address this challenge, we present Posture Buddy, a smart posture monitoring system powered by artificial intelligence and computer vision techniques. This system utilizes MediaPipe's pose estimation model, which identifies 33 key landmarks on the human body, including the shoulders, hips, and spine. By analyzing the spatial relationships between these landmarks, the system calculates crucial body angles to assess whether the user is sitting in a healthy or unhealthy posture. The angle measurements are then compared to predefined ergonomic thresholds to determine if corrective action is needed.

A core feature of Posture Buddy is its ability to deliver real-time feedback. When poor posture is detected for a sustained period beyond a set time limit, the system provides visual cues and triggers an auditory alert, prompting the user to adjust their posture immediately. This instant notification mechanism promotes the formation of healthier sitting habits and helps reduce the risk of long-term musculoskeletal complications. Beyond computer vision, Posture Buddy incorporates additional sensors to enhance the reliability of posture detection. This multimodal approach integrates physical sensor data with image-based pose estimation, reducing false positives and improving system accuracy across varied environments. User data—including authentication credentials and posture records—are securely stored using Firestore, ensuring seamless cloud-based data management and personalized user tracking. Through its user-friendly interface developed with Tkinter, Posture Buddy offers features such as login, live posture monitoring, history viewing, and posture improvement tips, making it accessible even to users with minimal technical expertise.

Research in recent years has shown the growing potential of AI-based posture monitoring solutions. Prajapati et al.[1] explored the use of MediaPipe combined with machine learning algorithms for exercise posture recognition, demonstrating effective pose tracking for fitness applications. Patel et al.[2] applied MediaPipe to real-time gesture recognition in gaming environments, enabling intuitive human-computer interaction. Mokar [3] demonstrated how Firestore Cloud Messaging could be leveraged for mobile

application control, showcasing Firebase's utility in real-time data handling. Drawing from these prior works, Posture Buddy integrates these advanced technologies into a single, comprehensive system aimed at real-time posture assessment and correction. The system's architecture combines several layers: pose detection using MediaPipe, angle calculation through trigonometric methods, threshold-based classification, and cloud-based data storage. OpenCV is employed for video capture and processing, enabling the system to work seamlessly with a standard webcam. Meanwhile, Firebase handles authentication and data logging, offering scalability and secure storage. The interface built with Tkinter ensures real-time interaction and intuitive visualization of posture status, using color-coded indicators and warnings to guide users. Unlike traditional solutions that focus solely on corrective measures after posture-related discomfort arises, Posture Buddy emphasizes preventive care by continuously monitoring posture and providing instant feedback. The system keeps a log of posture deviations over time, allowing users to review their history, recognize patterns, and make informed adjustments to their daily routines. By integrating pose estimation, sensor fusion, real-time feedback, and historical tracking, Posture Buddy offers a holistic solution suitable for various settings, including corporate offices, educational institutions, healthcare facilities, and home workspaces. Its scalable design ensures adaptability to different user needs, while its lightweight implementation makes it accessible without requiring expensive hardware.

In conclusion, this work proposes an innovative approach to posture correction by combining AI, computer vision, and cloud technologies into a unified posture monitoring system. Posture Buddy provides an interactive, real-time, and user-centered platform aimed at improving ergonomic health and reducing the prevalence of posture-related disorders in modern sedentary environments.

## II PROPOSED METHODOLOGY

The development of Posture Buddy involved integrating computer vision with real-time user interaction to monitor and correct poor sitting posture. The methodology centers around the following key components:

### 2.1 .Pose Detection Using MediaPipe:

The system leverages MediaPipe's pose estimation model to detect 33 critical body landmarks, focusing especially on areas like the shoulders, spine, and hips. These landmarks are used to calculate body angles to determine if a person is sitting in a healthy posture.

### 2.2 Angle Calculation and Classification:

Specific angles—such as the angle between the spine and shoulders—are computed using basic trigonometric formulas. These calculated angles are compared to preset thresholds to assess whether the posture is acceptable. Any deviations beyond these limits are flagged as poor posture.

### 2.3.Sensor Integration for Accuracy:

To improve detection reliability, the system supports integration with external sensors such as flex sensors or accelerometers. This multi-input approach helps improve detection accuracy, especially in challenging environments or lighting conditions.

### 2.4.Feedback Mechanism:

The system provides instant visual feedback through a color-coded interface and auditory alerts when incorrect posture is sustained for more than a few seconds. This allows users to self-correct their posture immediately.

### 2.5.User Data and Cloud Storage:

Firebase is used to handle user authentication and securely store posture data over time. Each session logs details such as posture classification and timestamp, allowing users to track their posture history.

### 2.6.User Interface Design:

A simple, interactive desktop interface was built using Tkinter. This enables users to log in, start or stop the posture monitoring session, view posture tips, and analyze historical trends in posture behavior.

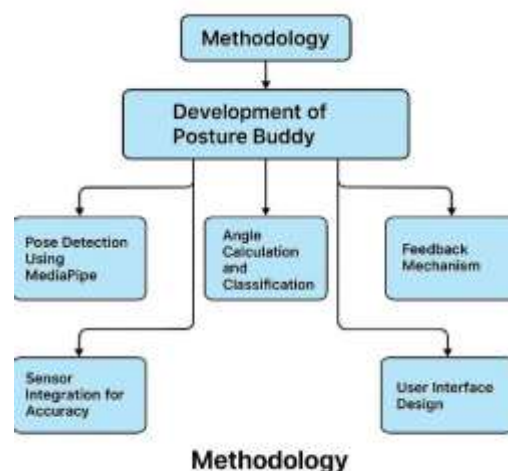


Fig 2.1:Methodology

## III RESULTS AND DISCUSSION

The Posture Buddy system was evaluated through hands-on testing in real-world scenarios, particularly focusing on users who spend extended periods seated, such as students or professionals.

Key Observations:

### 1.Reliable Posture Detection:

The system demonstrated high accuracy in identifying poor posture, especially when the camera had a clear view of the user. Detection was typically accurate within the range of 95–96%, as confirmed through repeated test cases.

### 2. Responsive Feedback:

Users received near-instant visual and audio alerts whenever incorrect posture was detected and sustained. This helped reinforce positive behavior through gentle nudges.

### 3. Historical Data Logging:

The posture history feature allowed users to review when and how often they slouched. This data was stored securely in Firebase and presented in a clear format, making it easy for users to identify recurring habits.

### 4. User Engagement and Learning:

The in-app posture tips, along with visual summaries of posture trends, helped users understand how to improve their habits. Over time, users reported being more conscious about their sitting posture, even outside of app usage.

### Limitations:

A few challenges were noted, such as decreased accuracy in low-light conditions or when parts of the user's body were not visible to the camera. These issues may be addressed in future updates through additional sensors or infrared vision.

Overall, the results highlight that Posture Buddy is an effective, user-friendly system that can positively influence ergonomic habits through real-time monitoring and feedback.

## IV CONCLUSION AND FUTURE WORK

An important advancement in ergonomic health solutions is the development of Posture Buddy, a real-time posture monitoring system that combines computer vision, pose estimation, and sensor integration to identify and correct improper posture. This study has demonstrated that integrating MediaPipe's pose estimation framework with angle-based analysis enables accurate detection of poor posture, providing timely visual and auditory feedback to encourage healthy sitting habits. The system offers notable improvements in detection speed, accuracy, and user engagement compared to traditional posture correction methods. By leveraging secure cloud storage through Firebase and an intuitive graphical interface, Posture Buddy empowers users to monitor their posture, track historical trends, and proactively reduce posture-related health risks. Future work should focus on several critical areas to enhance the system's functionality and scalability. First, incorporating wearable sensors alongside vision-based detection will improve the system's robustness, particularly in environments with limited camera visibility or occlusions. Expanding the system's compatibility to mobile platforms will further increase accessibility, enabling posture monitoring across a wider range of settings. Additionally, integrating machine learning models trained on larger, more diverse datasets will enhance the model's adaptability to varied body types, seating arrangements, and environmental conditions. Incorporating personalized feedback based on individual posture history and ergonomics could further promote long-term behavioral change. Lastly, introducing gamification elements, such as progress tracking, achievement badges, or posture challenges, may improve user motivation and sustained engagement.

Continued research and development in these areas will be pivotal in refining AI-driven posture monitoring systems, ensuring their scalability and practical effectiveness across workplaces, educational institutions, healthcare settings, and home environments. By advancing such technologies, we contribute to reducing the prevalence of posture-related health issues and promoting ergonomic well-being in increasingly sedentary societies.

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