

A Project Report

On

**“Smart body posture recognition and Guiding system”**

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5. **Introduction**

In today’s fast-paced world, self-service health monitoring systems, such as wellness KIOSKs, are gaining popularity. These KIOSKs provide a convenient and accessible way for users to measure vital health parameters like Body Mass Index (BMI), Bone Mass Composition (BMC), Blood Pressure (BP), Electrocardiogram (ECG), pulse, and temperature without the need for professional assistance.

One key challenge with these systems is that accurate measurements depend heavily on the user's body posture. Even slight misalignments, such as an arm positioned incorrectly during a BP measurement, can lead to inaccurate results.

Our project addresses this issue by integrating an advanced posture detection system into the wellness KIOSK. Using a camera and image processing technology, the system captures and analyzes the user’s posture in real time, ensuring the correct posture for each health test. By providing immediate feedback and guidance, the system helps users achieve accurate and reliable measurements.

**Domain Introduction**

In today's rapidly advancing world of healthcare, there is an increasing shift towards automation and self-service solutions, driven by the demand for efficiency and convenience. One such innovation is the integration of technology into health monitoring, where individuals can independently measure their vital health parameters such as BMI, BMC, blood pressure (BP), ECG, pulse, and temperature through non-assisted, automated systems. The goal of such systems is to enable users to proactively monitor their health and make informed decisions without requiring constant medical supervision.

This project falls within the domain of digital health and self-service healthcare technologies, specifically focusing on posture correction during health measurements using self-service kiosks. Ensuring the correct body posture during measurements is critical for accurate results. With advancements in image processing, real-time posture correction using computer vision frameworks such as Mediapipe has emerged as an effective solution. This domain integrates health monitoring, image processing, and user guidance into a seamless system, ensuring reliability and precision in non-assisted healthcare environments.

1. **Literature Review**

**Posture Recognition Based on Fuzzy Logic for Home Monitoring of the Elderly**

*Damien Brulin, Yannick Benezeth, and Estelle Courtial*

This study introduces a computer vision-based posture recognition method aimed at monitoring the elderly within health smart homes (HSH). By focusing on human silhouettes rather than full body detection, the system enhances reliability despite varying environmental conditions. Utilizing fuzzy logic, the method identifies four static postures and achieves an accuracy of 74.29%. This approach not only assists in real-time posture analysis but also detects emergencies, such as falls, which is critical for elderly care.

The research highlights the potential of HSH solutions to address the challenges of aging populations, emphasizing non-intrusive monitoring. Unlike wearable devices, which can be uncomfortable, this system leverages existing camera technology to enhance the quality of life for seniors while maintaining their autonomy. This approach paves the way for further innovations in health monitoring technologies.

**Smart Mirror E-health Assistant – Posture Analyze Algorithm**

*Biljana Cvetkoska, Ninoslav Marina, Dijana Capeska Bogatinoska, Zhanko Mitreski*

This paper presents a Smart eHealth Mirror model that integrates health monitoring capabilities with everyday functions. By utilizing face recognition and posture analysis, the mirror provides personalized guidance for users to improve their posture over time. The proposed algorithm demonstrates significant improvements in maintaining upright posture among users, proving its effectiveness in early health issue detection and preventive healthcare.

The mirror functions as both a health assistant and a smart device, supporting users in monitoring their well-being while also providing daily utilities like news updates and reminders. This innovative model underscores the potential of smart home technologies in addressing health-related issues, creating a seamless blend of technology and user interaction that promotes healthier lifestyles.

**Sitting Posture Recognition for Computer Users using Smartphones and a Web Camera**

*Jheanel Estrada, Larry Vea*

This research develops models to automatically distinguish proper and improper sitting postures using accelerometer data from key spinal points. By attaching lightweight smartphones to specific locations on the body, the study utilizes readings alongside web camera inputs to analyze upper body positioning. The Decision Tree classifier emerges as the most effective model, achieving an impressive accuracy of 89.83% for spinal posture recognition.

The findings highlight the relationships between individual body frames and their corresponding postures, suggesting that customized solutions could be developed for diverse users. This approach not only raises awareness about the importance of proper sitting posture but also offers a foundation for future advancements in ergonomic health monitoring.

**Vision-based Human Body Posture Recognition Using Support Vector Machines**

*Chia-Feng Juang, Chung-Wei Liang, Chiung-Ling Lee,I-Fang Chung*

This study proposes a method for recognizing four primary body postures—standing, bending, sitting, and lying—using a dual-camera setup. Employing an RGB-based moving object segmentation algorithm, the research distinguishes human figures from backgrounds effectively. The integration of Discrete Fourier Transform (DFT) coefficients with a Gaussian-Kernel-based Support Vector Machine (SVM) classifier results in a high recognition rate for posture classification.

The approach addresses limitations of previous methods that relied on single-camera systems, which struggled with similar body silhouettes. By utilizing two cameras, the study enhances the robustness and accuracy of posture recognition, paving the way for advanced applications in fields such as surveillance and health monitoring.

**Object Detection and Analysis of Human Body Postures Based on TensorFlow**

*Ling Xie, Xiao Guo*

This paper explores the use of deep learning techniques for human body posture recognition, specifically in educational environments. By evaluating various algorithms, the study identifies the most suitable models for detecting and classifying teacher postures, including standing and sitting. The researchers emphasize the limitations of traditional methods, such as OpenPose, and advocate for more efficient algorithms based on TensorFlow.

The findings reveal the effectiveness of deep learning in accurately recognizing specific actions, highlighting its potential for real-time applications in intelligent monitoring systems. This work contributes to the growing field of computer vision by demonstrating how advanced algorithms can enhance human-computer interaction and improve educational environments through better posture recognition.

1. **Objectives**

* **Develop a Non-Assisted Wellness Kiosk:**

To design and implement a self-service wellness kiosk that enables users to measure vital health parameters like BMI, BMC, BP, ECG, Pulse, and Temperature without the need for external assistance.

* **Ensure Accurate Health Measurements:**

To improve the accuracy of vital health measurements by guiding users to adopt correct body postures using real-time image processing and posture analysis techniques.

* **Utilize Mediapipe for Posture Detection:**

To leverage the Mediapipe framework for detecting key body landmarks and ensuring that users maintain the correct posture during health tests.

* **Provide Real-Time Feedback:**

To develop a system that can analyze user posture in real-time and offer immediate feedback, either visual or auditory, to correct deviations from the required posture for each health test.

* **Enhance User Experience through Automation:**

To create a user-friendly and fully automated system that facilitates seamless operation, ensuring that users are accurately guided through the process without requiring assistance from medical personnel.

* **Implement a Flexible Posture Correction System:**

To develop a posture correction mechanism that can adapt to various users' body types and health tests, providing tailored posture corrections based on individual deviations.

* **Improve Health Awareness:**

To promote better health awareness by educating users on the importance of correct posture during health tests, contributing to more accurate monitoring and healthier lifestyle practices.

1. **Methodology/Modules**

* **Image Capture and Processing Module**

*Overview*:

This module captures images of the user's posture using an integrated camera system and processes them using computer vision techniques.

*Features*:

Utilizes the Mediapipe framework for landmark detection of key body parts (e.g., hands, legs, torso).

Extracts posture-related features such as the angle of joints and alignment of body parts.

* **Posture Analysis and Guidance Module**

*Overview*:

This module is responsible for analyzing the detected body landmarks to ensure that the user's posture is correct during the measurement process.

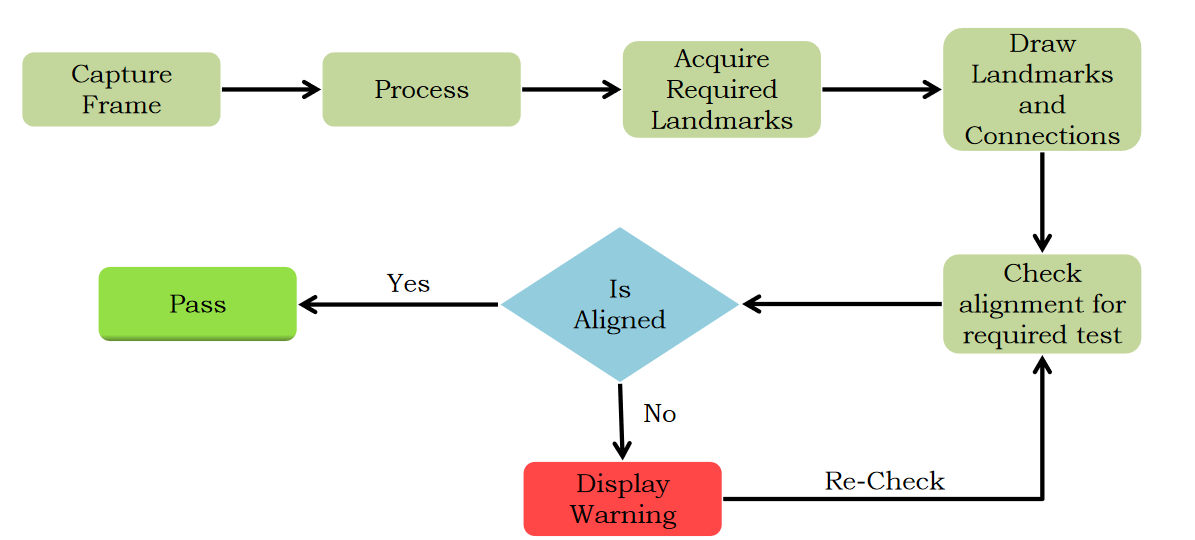
*Features*:

Reference Axis Calculation: A reference axis is established using the detected landmarks, and the system calculates the angle of deviation from the ideal posture.

Deviation Detection: If the posture deviates beyond a predefined threshold angle, the system provides visual and audio guidance to help the user correct it.

Feedback System: Real-time feedback loop that helps users adjust their posture before taking the measurement, ensuring accurate results.

**Architecture**



1. **Timeline for Execution of Project**
2. **Expected Outcomes**

* **Accurate Vital Health Measurements**

The system will accurately measure health parameters such as BMI, BMC, BP, ECG, pulse, and temperature, ensuring reliable and precise data collection.

* **Posture Correction Guidance**

The system will detect improper user posture during the measurement process and provide real-time feedback and corrective guidance. This will help users achieve the correct posture for accurate results.

* **Real-Time Feedback and Notifications**

Users will receive immediate feedback about their posture and vital measurements, including visual and audio alerts when corrections are needed or when the test is successfully completed.

* **Increased Measurement Accuracy**

By ensuring that users maintain the correct posture, the system will reduce measurement errors, providing more reliable health data for better analysis and decision-making.

1. **Conclusion**

The development of a self-service wellness KIOSK that integrates posture correction guidance with vital health parameter measurement represents a significant advancement in non-assisted health monitoring systems. By leveraging the Mediapipe framework for posture detection, the system ensures that users maintain the correct posture during tests, leading to more accurate health data. The real-time feedback and correction system further enhances the user experience, enabling individuals to perform measurements without assistance, thus increasing accessibility and convenience.

This project demonstrates how advanced image processing techniques, combined with user-friendly interfaces, can transform healthcare by improving measurement accuracy and offering a seamless, non-assisted user experience. The ability to provide posture correction and vital health data in a single platform can contribute to more effective health monitoring, especially in settings such as public health kiosks, gyms, hospitals, and other self-service environments. Overall, this system has the potential to improve both individual health outcomes and the broader field of wellness technologies.

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