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Wrong Posture Detection and Correction System

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Abstract-*The Wrong Posture Detection and Correction System is designed to detect incorrect body posture and help users maintain proper posture during daily activities. Prolonged sitting and excessive use of computers and mobile phones can lead to poor posture, neck strain, and back pain. The proposed system uses two MPU6050 sensors to monitor the orientation of the upper and lower back. An ESP32 microcontroller processes the sensor data to identify incorrect posture. When improper posture is detected, a coin vibration motor provides an alert to remind the user to correct their posture. Blynk IoT is used to monitor posture-related data on a mobile phone through Wi-Fi connectivity. This system provides a simple, wearable, and cost-effective solution for real-time posture monitoring and correction. It aims to improve posture awareness, encourage healthy sitting habits, and help to prevent posture-related problems.*

Keywords—posture detection, wearable device, MPU6050 ESP32, Vibration motor, Blynk.

I.INTRODUCTION

Posture refers to the proper alignment of the body while sitting, standing, or performing any activity.

Maintaining proper body posture is essential for promoting physical comfort and reducing the risk of posture-related health problems. In recent years, prolonged sitting, extended computer usage, and sedentary lifestyles have increased concerns regarding incorrect posture among students, office workers, and other individuals. Maintaining an improper posture for extended periods may contribute to neck strain, back discomfort, and reduced physical well-being. Conventional posture monitoring methods primarily rely on manual observation and individual awareness, which may not provide continuous monitoring or immediate feedback. Therefore, the development of an automated posture monitoring system capable of detecting incorrect posture and notifying users in real time has become increasingly important.

The Wrong Posture Detection and Correction System designed to monitor body orientation and identify deviations from predefined posture thresholds. The proposed system uses sensor-based measurements to capture changes in body position, which are processed by a microcontroller to determine the user's posture status. When the measured orientation exceeds the specified limits, the system identifies an incorrect posture and generates an alert to encourage the user to correct their position. By integrating sensor technology, embedded processing, and real-time feedback, the proposed system provides a practical approach to continuous posture monitoring. The system is designed to improve posture awareness and help users maintain appropriate body alignment during daily activities.

The proposed system aims to provide a cost-effective, reliable, and user-friendly solution for posture monitoring in homes, educational institutions, and workplaces. Its design focuses on continuous posture assessment, timely alerts, and ease of implementation. Unlike conventional methods that depend primarily on manual observation, the system supports automated identification of incorrect posture based on predefined orientation parameters. The integration of sensing technology and embedded processing offers a practical approach to encouraging proper posture habits. This paper presents the design, implementation, and working methodology of the proposed system, highlighting its potential application in real-time posture detection and correction.

II. RELATED WORK

In [1], Hob Eom Han et al. (2020) proposed a wearable Forward Head Posture (FHP) monitoring system for detecting incorrect neck posture. The methodology used a magnet–magnetometer sensor pair combined with machine learning algorithms to estimate the Craniovertebral Angle (CVA). The system effectively identified abnormal neck posture and provided a reliable approach for continuous posture monitoring and correction.

In [2], Pedro Ribeiro et al. (2020) developed a wearable posture correction system named Spine Cop for detecting incorrect spinal alignment. The methodology integrated inertial sensors such as accelerometers, gyroscopes, and magnetometers with classification algorithms to identify improper postures. The system provided real-time feedback to assist users in maintaining correct posture and reducing posture-related health risks.

In [3], Hao-Yuan Tang et al. (2021) proposed a smart sitting posture recognition system using wearable Inertial Measurement Unit (IMU) sensors and Long Short-Term Memory (LSTM) networks. The methodology analyzed body movement patterns and classified different sitting positions. The system demonstrated the effectiveness of deep learning techniques for automatic posture detection and monitoring.



In [4], Chungzhi Yi et al. (2021) developed an IMU-based error detection and correction method for wearable posture monitoring systems. The methodology detected sensor displacement errors

and improved joint-angle estimation accuracy. The proposed method enhanced the reliability of wearable devices used for posture assessment and correction.

In [5], Slavomír Matuška et al. (2022) proposed a smart sitting posture monitoring system using pressure sensors, Arduino IoT technology, and a mobile application. The methodology analyzed pressure distribution to detect incorrect sitting positions and generated real-time alerts. The system helped users improve their sitting posture during prolonged activities.

In [6], S. Namwongsa et al. (2022) investigated the effect of smartphone usage posture on neck muscle activity. The methodology analyzed different neck flexion angles among smartphone users to evaluate muscle fatigue. The study concluded that prolonged forward head posture increases cervical muscle strain, highlighting the need for posture monitoring systems.

In [7], U.K. Chowdhury et al. (2023) developed a neck and shoulder muscle fatigue assessment method using surface electromyography (sEMG) and signal processing techniques. The methodology identified muscle fatigue patterns caused by incorrect posture and repetitive activities. The study supported the development of posture correction systems for preventing musculoskeletal disorders.

In [8], researchers (2023) proposed a computer vision-based posture detection system using deep learning-based human pose estimation. The methodology extracted body key points from camera images to identify incorrect body alignment without wearable sensors. The system provided a non-contact approach for posture monitoring and correction.

In [9], Guymon Park and Ima Y. Jung (2024) proposed a real-time Forward Head Posture detection and correction system using a single IMU sensor integrated with a Raspberry Pi platform. The methodology measured neck inclination, detected posture deviations, and provided corrective feedback. The system improved posture awareness through continuous monitoring and real-time correction.

In [10], researchers (2024) developed an AI-based posture recognition system using wearable sensors and machine learning algorithms. The methodology combined sensor data processing with classification models to detect incorrect sitting and standing postures. The system improved accuracy and reliability for real-time posture monitoring applications.

In [11], A.B. Crane et al. (2024) proposed a wearable posture monitoring system using inertial sensors for detecting body alignment errors. The methodology collected motion data and generated alerts whenever incorrect posture patterns were identified. The system improved user awareness but required further improvement in comfort and portability.

In [12], Rushi raj Gadhvi et al. (2025) proposed Pose Pilot, an Edge-AI-based posture correction framework. The methodology integrated lightweight pose estimation models, Bilt networks, and temporal motion analysis to detect posture deviations. The system generated personalized corrective feedback suitable for real-time posture improvement applications.

In [13], Y.R. Guo et al. (2025) developed a neck posture monitoring system using flex sensors to detect excessive neck curvature. The methodology measured neck bending angles and generated warning alerts when posture exceeded predefined limits. The system achieved effective posture detection but required accurate sensor placement for reliable performance.

In [14], researchers (2025) proposed an IoT-based wearable posture correction system using IMU sensors and embedded processing. The methodology continuously monitored body alignment and provided vibration-based alerts when incorrect posture was detected. The system supported real-time posture correction during daily activities.

III. PROPOSED METHODOLOGY

3.1 BLOCK DIAGRAM

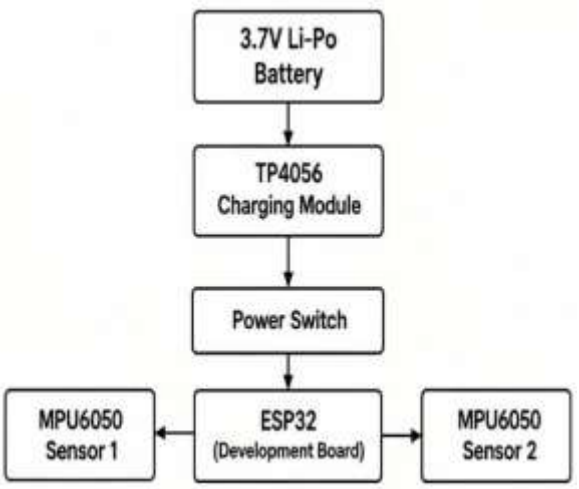


Fig 3.1 Block Diagram of Wrong Posture Detection and Correction System

The block diagram shows the main components of the proposed system, including the battery, charging module, power switch, ESP32, and two MPU6050 sensors. These components work together to monitor body posture and detect incorrect positions**.**

1.3.7V Li-Po Battery:
Supplies power to the wearable system and makes it portable.

2. TP4056 Charging Module:
Recharges the Li-Po battery through a USB connection.

3. Power Switch:
Turns the system ON or OFF and helps conserve battery power.

4. ESP32 Development Board:
Processes sensor readings, compares them with predefined posture thresholds, and controls the alert system.

5. MPU6050 Sensor 1:
Measures body movement and orientation near the upper-back region.

6. MPU6050 Sensor 2:
Measures body movement at another body position to help detect posture changes.

7. Sensor Data Processing:
The ESP32 compares sensor readings with reference values to identify incorrect posture.

8. Posture Alert:
When incorrect posture persists, the vibration motor alerts the user to correct their position.

The system continuously monitors body posture using two MPU6050 sensors. The ESP32 processes the sensor readings and compares them with predefined reference values. When incorrect posture persists, the vibration motor alerts the user.



The user can adjust their body position to maintain proper posture. This system helps improve posture awareness during daily activities.

3.2 FLOWCHART

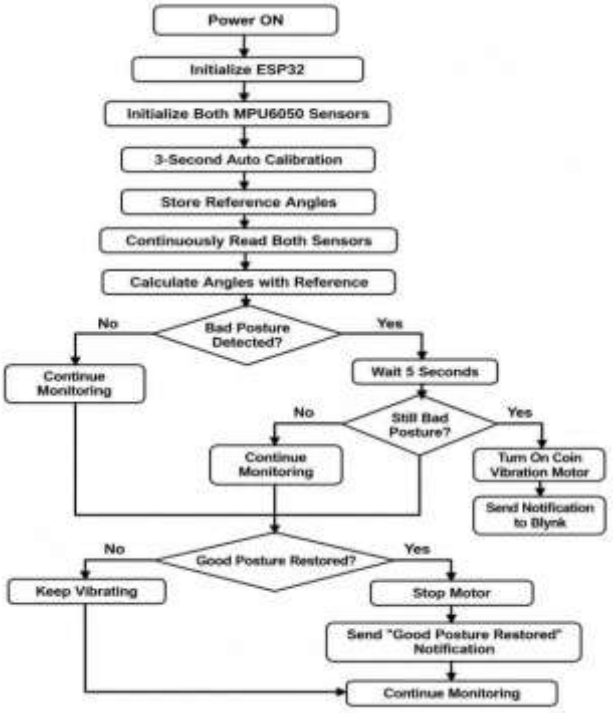


Fig 3.1 Flowchart of Wrong Posture Detection and Correction System

Power ON:
The system is switched ON, and the battery supplies power to the circuit.

Initialize ESP32:
The ESP32 microcontroller starts operating and prepares to control the connected components.

Initialize Both MPU6050 Sensors:
Both MPU6050 sensors are initialized to measure body movements at the neck/upper-back and lower-back/hip positions.

3-Second Auto Calibration:
The sensors record reference readings for three seconds while the user maintains the desired posture.

Store Reference Values:
The reference posture readings are stored and used for comparison with the current sensor measurements.

Continuously Read Both Sensors:
Both MPU6050 sensors continuously measure body movements using their accelerometers and gyroscopes.

Calculate Current Angles:
The ESP32 processes the sensor readings to determine the current body orientation, if angle calculation is implemented in the program.

Compare Current Values with Reference:
The current sensor readings are compared with the reference values and predefined threshold limits to identify possible posture deviations. The readings exceed the allowed limits, the ESP32 identifies the posture as incorrect. This helps the system provide a timely alert to the user to correct their posture.

Incorrect Posture Detected:
The system checks whether the measured posture exceeds the permitted limits. If the posture is normal, monitoring continues. If incorrect posture is detected, the system proceeds to the next step.

Wait 5 Seconds:
The system waits for five seconds before checking whether the incorrect posture continues. This helps avoid alerts caused by temporary movements.

Still Incorrect Posture:
After five seconds, the ESP32 checks whether the posture remains outside the acceptable range. If the posture returns to normal, monitoring continues.

Turn ON Vibration Motor:
If incorrect posture persists, the ESP32 activates the vibration motor to alert the user and encourage posture correction.

Send Notification to Blynk:
If Blynk notification functionality is configured, the system sends posture-related information or an alert to the connected mobile application.

Good Posture Restored?
The system checks whether the user's posture has returned to the acceptable range. If the posture is corrected, the system proceeds to stop the alert.

Stop Motor:
When the user restores an acceptable posture, the ESP32 switches OFF the vibration motor according to the programmed logic.

Continue Monitoring:
The system continuously reads sensor data and checks the user's posture. This allows repeated posture detection and correction alerts during daily activities.

IV. HARDWARE AND SOFTWARE COMPONENTS

HARDWARE COMPONENT

ESP32 Microcontroller:



Fig.1: ESP32 Microcontroller

ESP32 is a microcontroller used to control the entire system. Receives data from the MPU6050 sensor and processes the sensor readings to identify posture changes. It compares the measured values with predefined reference values to detect whether the user's posture is correct or incorrect. When incorrect posture is detected, it provides a control signal to activate the coin vibrator through a suitable driver circuit. ESP32 has built-in Wi-Fi and Bluetooth connectivity. It sends posture-related information to the Blynk mobile application through Wi-Fi. The ESP32 supports fast data processing and provides reliable system operation. It communicates with the MPU6050 sensor using the I2C communication protocol.



It can also send real-time posture updates to the mobile application. It helps coordinate the working of all connected components. Thus, ESP32 plays an important role in detecting incorrect posture and providing timely alerts to the user.

MPU6050 Sensor:

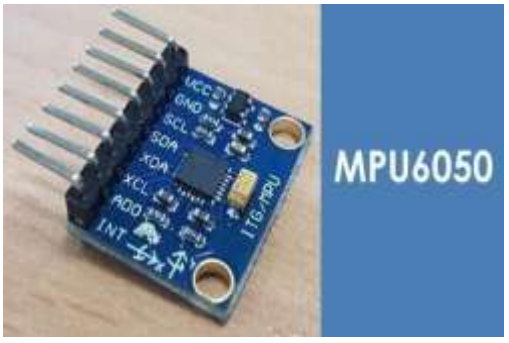


Fig.2: MPU6050 Sensor

The MPU6050 is a sensor used to measure body movements and orientation. It contains a three-axis accelerometer and a three-axis gyroscope. The accelerometer measures acceleration along the X, Y and Z axes. The gyroscope measures rotational movement around these three axes. It helps identify changes in the user's body position. The sensor sends movement data to the ESP32 through I2C communication. The ESP32 processes these readings to identify incorrect posture. It provides continuous posture monitoring during daily activities. Thus, the MPU6050 helps detect posture changes accurately.

Coin Vibrator



Fig.3: Coin Vibrator

The coin vibrator is a small vibration motor used to provide alerts to the user. It is compact, lightweight and easy to install in the system. It produces vibrations when an electrical signal is supplied. The ESP32 controls its operation based on the detected posture condition. When incorrect posture is identified the vibrator is activated. It provides a physical alert to remind the user to correct their body position. The motor is connected through a suitable driver circuit. It consumes relatively low power during operation. Thus the coin vibrator helps improve posture awareness.

Li-Po Battery



Fig.4: Li-Po Battery

A Li-Po battery is a rechargeable lithium-polymer battery used to supply power to the system. It is lightweight and compact in size. It provides the required electrical energy to operate the ESP32 and other connected components. The battery makes the system portable and suitable for regular use. It can be recharged when the battery power becomes low. It offers good energy storage capacity for its size. It supplies power to the circuit through the required connections. It helps the system operate without a continuous external power supply. Thus, the Li-Po battery supports portable operation.

TP4056 Type-C Charging Module:



Fig.5: TP4056 Type-C Charging Module

The TP4056 Type-C charging module is used to recharge the Li-Po battery. It receives power through a USB Type-C connection. It controls the battery charging process using a suitable charging circuit. It helps prevent overcharging by controlling the charging voltage. The module generally supports a charging voltage of 4.2V for a single-cell lithium battery. It provides a convenient way to recharge the battery. Some versions also include battery protection features. It is compact and easy to connect to the battery circuit. Thus, the TP4056 module provides a simple and convenient battery-charging arrangement.

MP3608 DC-DC Step-Up Boost Converter Module



Fig.6: MP3608 DC-DC Step-Up Boost Converter Module



The MP3608 DC-DC step-up boost converter is used to increase the input DC voltage to a higher required voltage. It receives power from the Li-Po battery. It converts the lower battery voltage into a higher output voltage. This helps provide the required voltage to components that need a higher supply. It uses a switching circuit to perform the voltage conversion. The output voltage can be adjusted in supported module versions. It helps maintain a suitable power supply for the connected circuit. It is compact and suitable for portable electronic projects. Thus, the boost converter supports the power requirements of the system.

SOFTWARE COMPONENTS

Arduino Software (Arduino IDE)



Fig.7: Arduino Software (Arduino IDE)

Arduino IDE is software used to write compile and upload programs to the ESP32 microcontroller. It provides a simple environment for developing embedded system applications. The program is written using the Arduino programming language which is based on C and C++. It is used to configure the MPU6050 sensor and read its data. It processes the sensor readings to identify posture changes. It also controls the coin vibrator based on the detected posture. The software supports libraries required for ESP32 and sensor communication. It uploads the program to ESP32 through a USB connection. Thus Arduino IDE helps develop and control the complete system.

Blynk IoT Platform



Fig.8: Blynk IoT Platform

Blynk is an IoT platform used to monitor the system through a mobile application. It allows communication between the ESP32 and the user's smartphone through Wi-Fi. It displays posture-related information received from the ESP32. It helps users monitor the working condition of the system. When incorrect posture is detected, the application can display an alert notification. It provides a simple dashboard for viewing system information. Users can access the connected device through the Blynk mobile application. It supports real-time monitoring through an internet connection. Thus, Blynk improves user interaction and remote posture monitoring.

V RESULTS

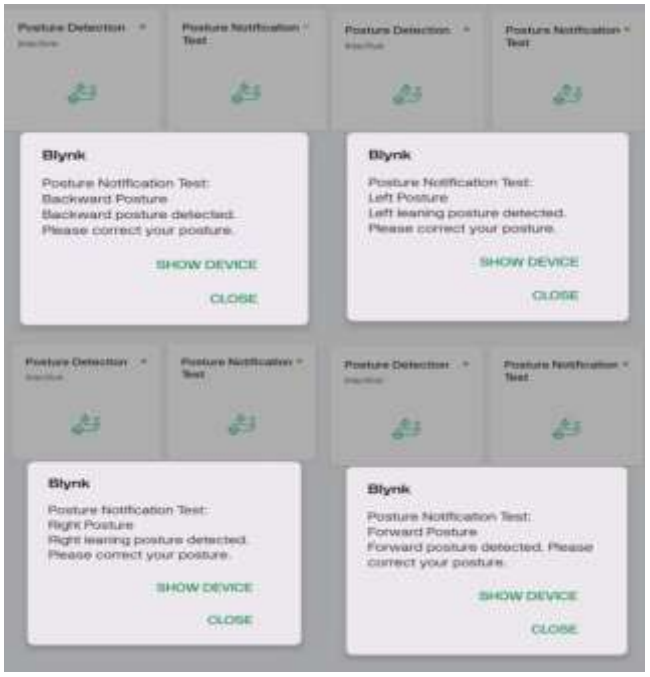
Posture monitoring systems can detect changes in body position using sensors and provide timely feedback to users. The use of accelerometers and gyroscopes helps measure body movements and identify incorrect posture. The system can alert users when their body position moves beyond the allowed limits. The study highlights that continuous posture monitoring can improve user awareness and encourage better sitting habits. It also shows the importance of sensor-based technology in developing simple and cost-effective posture detection and correction systems.



Fig.9: prototype hardware setup & wearable posture sensor setup of the Wrong Posture Detection and Correction System

The image shows the prototype hardware setup of the Wrong Posture Detection and Correction System. It consists of an ESP32 microcontroller, MPU6050 sensor, rechargeable battery, connecting wires and other electronic components arranged inside a protective box. The MPU6050 sensor measures changes in body position using its accelerometer and gyroscope. The ESP32 receives the sensor data and compares the measured posture with predefined threshold values to identify incorrect posture. The battery provides power to the entire system while the connecting wires establish communication between the components. The hardware box protects the electronic component and the belt is used to attach the prototype to the user's body. When incorrect posture is detected, the ESP32 sends a notification to the Blynk mobile application through Wi-Fi. This prototype demonstrates the working of the proposed system in real-time posture monitoring and correction.

The wearable posture sensor setup of the Wrong Posture Detection and Correction System. The prototype is attached to the user's back using a belt and adjustable straps. The MPU6050 sensor is placed near the upper back to measure changes in body position and movement. The sensor detects the bending and tilting of the user's body and sends the collected data to the ESP32 microcontroller for processing. The ESP32 compares the measured values with predefined threshold values to identify incorrect posture. When the user maintains an incorrect posture, the system sends a notification through the Blynk mobile application using Wi-Fi. This setup helps monitor body posture during daily activities and reminds users to maintain a correct sitting and standing position.



The image shows the posture notification results from the Blynk mobile application. It displays four different types of incorrect posture detected by the system: backward posture, left-leaning posture, right-leaning posture and forward posture. When the user bends or leans in an incorrect direction, the MPU6050 sensor detects the change in body orientation and sends the data to the ESP32 microcontroller. The ESP32 processes the sensor values and identifies the incorrect posture based on predefined threshold limits. After detecting the incorrect posture, the ESP32 sends a notification to the Blynk application through Wi-Fi. The notification displays the type of incorrect posture and asks the user to correct their body position. The user can select the Show Device option to view the connected device. This result demonstrates that the proposed system can identify different incorrect posture positions and provide timely notifications to improve posture awareness.

VI CONCLUSION

The Wrong Posture Detection and Correction System is designed to monitor and identify incorrect sitting postures and help users maintain a healthy body position. The system uses an ESP32 microcontroller and MPU6050 sensor to detect changes in body orientation, such as bending forward, slouching, and leaning to one side. When incorrect posture is detected continuously, the system activates a vibration motor to alert the user and sends a notification through the Blynk IoT application using Wi-Fi connectivity.

This project provides a simple, low-cost, and effective solution for reducing the risk of muscle strain, back pain, and other posture-related problems. It helps users become aware of their sitting habits and encourages them to maintain proper posture during long working or studying hours. The system can be further improved by adding more sensors, enhancing detection accuracy, and developing additional monitoring features. Overall, this project demonstrates how embedded systems and IoT technology can be used to improve daily comfort, support better posture habits, and promote a healthier lifestyle.

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