IOT Enabled Wrong Posture Monitoring and Alert System

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Abstract—**Posture-related health issues are becoming increasingly prevalent due to extended periods of sitting and poor ergonomic habits in modern work and learning environments. These conditions contribute significantly to back pain, spinal misalignment, and musculoskeletal disorders. Traditional posture correction approaches—such as braces or physiotherapy—lack the ability to provide real-time feedback, making them ineffective for timely intervention. This paper presents an IoT-enabled wearable posture monitoring and alert system designed to detect incorrect postures using an MPU-6050 sensor integrated into a belt. The system distinguishes between full bending, half bending, and side tilting, and generates unique audio alerts for each, allowing users to correct posture instantly without visual input.**

I. INTRODUCTION

Over the past few years, technological innovations in the Internet of Things (IoT) domain have profoundly influenced the landscape of health monitoring systems. Among these advancements, posture monitoring has emerged as a crucial area of concern, particularly in light of the increasing sedentary lifestyle adopted by individuals in both professional and educational environments. Poor posture is associated with a myriad of health issues, ranging from musculoskeletal disorders and chronic back pain to long-term spinal deformities. Despite widespread awareness, posture-related problems continue to grow due to the lack of real-time, accessible, and personalized monitoring tools. The current study aims to bridge this shortcoming by proposing an IoT-enabled wrong posture monitoring and alert system, with a wearable belt-mounted device that captures posture data and displays real-time feedback on a web interface.

II NEED OF WEARABLE POSTURE MONITORING

With the rise in inactive habits and prolonged sitting, maintaining poor posture has increasingly contributed to back pain and musculoskeletal issues. Traditional methods like braces or manual correction lack real-time feedback and continuous monitoring. A wearable posture monitoring system offers a practical solution by enabling constant tracking of the user's posture through sensors like the MPU-6050. When integrated into a belt, it ensures comfort and consistent sensor placement.

III AIM AND SCOPE

We spend so much time glued to our screens that we often forget to sit up straight. To help with that, we've designed a small, smart device built around an MPU-6050 motion sensor, an ESP32 microcontroller, a custom PCB, and a rechargeable power pack that quietly watches your posture. Whether you're sitting perfectly upright or have slumped into a full bend, half bend, slight lean, or tilt, the gadget detects it. The moment you start to hunch, a soft buzzer alert gives you a quick reminder to straighten up. It's like having a gentle posture coach in your pocket, helping you avoid backaches and spinal strain from poor seating habits.

Iv LITERATURE SURVEY

The Survey focuses on Postural well-being,which has received growing attention in recent years due to its direct connection with chronic back pain, particularly in younger populations and office workers. Poor posture is a major contributor to lower back pain and is associated with problems such as dysfunction of the transversus abdominis muscle. To address these concerns, various wearable technologies have emerged to promote and correct posture in real time .Dhulap et al. (2021)[1] proposed a smart wearable device that monitors spinal posture using an IMU (MPU-6050) and flex sensors, with real-time alert mechanisms enabled through IoT integration.

Back pain has become a prevalent health concern worldwide, often triggered by poor posture, especially during prolonged computer or gadget use. To address this, several posture monitoring and notification-based correction systems have been introduced and studied in recent years. A comprehensive review of various systems reveals diverse approaches using sensors, microcontrollers, and feedback mechanisms .One of the systems focused on Internet of Things (IoT)-based posture monitoring integrated with wearable technology. It incorporated NodeMCU and

MPU6050 IMU sensors to detect changes in posture using angular and positional data. The addition of flex sensors provided real-time feedback, and corrective action was initiated using vibration motors and notification alerts. Another design utilized RL78 Renesas Microcontrollers with three accelerometers to detect inappropriate body posture[3]. The setup involved determining threshold values aligned with the Rapid Entire Body Assessment (REBA) framework. Alerts were delivered through a custom Android application, reinforcing user awareness and encouraging correction. A more algorithm-centric approach involved employing the Real-Time Self-Calibrating (RTSC) algorithm[2], using tri-axial accelerometer data.

V EXISTING SYSTEM

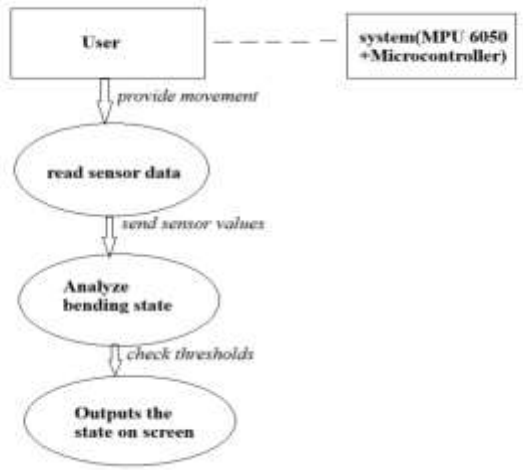
Posture monitoring technologies have seen growing recognition in the field of overall health and wellness, especially with the rise of sedentary lifestyles and prolonged sitting in office or academic settings. Current existing systems for posture monitoring primarily focus on hardware-based designs, utilizing inertial sensors to detect user posture. These sensors are typically fixed directly onto the user's back, which can be restrictive and uncomfortable for daily use. The sensor captures angular changes and sends the data to a microcontroller, which then uses a buzzer to alert the user upon detecting a posture deviation. This design approach has been widely implemented in several academic and hobbyist projects due to its simplicity and affordability.

VI PROPOSED SYSTEM

To overcome the shortcomings of the existing posture monitoring systems, we propose an advanced IoT-enabled wrong posture monitoring and alert system that combines user comfort, intelligent alert mechanisms, and real-time data visualization. This system is implemented as a wearable belt, which houses the sensor and microcontroller in a compact and ergonomic manner. The belt can be worn easily over regular clothing, ensuring the device remains stable and comfortable for prolonged use

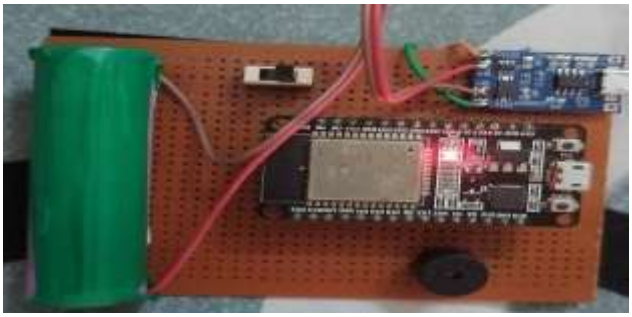
VII METHODOLOGY

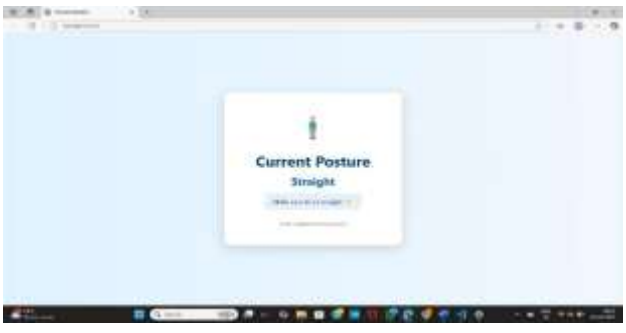
Input Stage (Sensor Unit):
-Sensors like the IMU and flex sensor gather data about the user's posture (e.g., how much the spine bends or moves).
Processing Stage (Control Unit):IOT ENABLED WRONG POSTURE MONITORING AND ALERT SYSTEM
- The data from the sensors is sent to a microcontroller (the "brain").
- The microcontroller checks if the posture is good or bad. If the posture is bad, it sends a signal to the vibration motor to alert the user.
Output and Communication (User Feedback):
- The vibration motor alerts the user about bad posture.
- The processed data can also be sent wirelessly to a user interface (like a mobile app) to show posture details.
Power Supply (Power Unit) A battery provides power to the sensors, microcontroller, and motor to keep the system running. By following this process, the system detects incorrect posture, notifies the user, and helps them correct it.

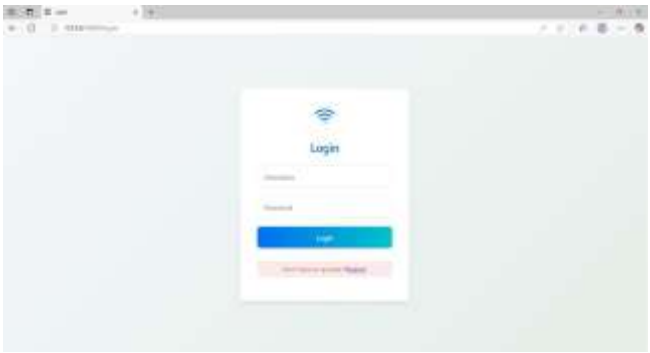


VIII RESULTS

An IoT-Enabled wrong posture monitoring and alert system was developed utilizing the ESP32 microcontroller, MPU6050 sensor, and a buzzer for alert notifications. The system demonstrated reliable detection of posture deviations and delivered prompt alerts via both physical hardware and an integrated web interface. A real-time web application continuously displayed posture data, contributing to an efficient and user-friendly monitoring experience.







IX CONCLUSION

This project successfully showcased the design and development of an IoT-enabled posture monitoring and alert system. By combining the ESP32 microcontroller with the MPU6050 sensor, the system was able to accurately detect and categorize different postures. Real-time alerts through a buzzer and a web interface help users stay aware of their posture and take corrective action when needed. The Arduino IDE made it easier to manage communication between the sensor and microcontroller, while a Django-based web application provided a simple, user-friendly platform for ongoing posture tracking.

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