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Posture Correction Device Using ESP32 and MPU6050

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Abstract: Prolonged sitting, especially among students and professionals, often leads to poor posture, leading to chronic back pain and musculoskeletal issues. This project proposes a posture correction device leveraging the MPU6050 sensor and ESP32 microcontroller. The system continuously monitors spinal orientation and alerts the user via a buzzer and OLED display when slouching is detected. Unlike traditional methods such as ergonomic furniture or physical therapy, this device offers real-time, non-intrusive feedback. Its lightweight, affordable design encourages daily use, promoting healthier posture habits and minimizing long-term health risks.

Keywords: ESP32, MPU6050, Posture Monitoring, Wearable Device, Alert System, Buzzer, OLED.

I. INTRODUCTION

Poor posture has become prevalent due to the excessive use of digital devices and prolonged sedentary lifestyles. Traditional posture correction methods—ergonomic furniture, physiotherapy, or wearable belts—either lack interactivity or require external supervision. With advances in embedded systems and sensor technology, posture monitoring can now be implemented in real-time. The proposed system uses an MPU6050 (3-axis accelerometer and gyroscope) to monitor back alignment, and an ESP32 microcontroller to process the sensor data. The system issues alerts via a buzzer and OLED display when posture deviates beyond a threshold. Its small size makes it suitable among students, office workers, and the elderly.

II. LITERATURE SURVEY

Several research studies emphasize the relevance and benefits of wearable posture monitoring systems:
- Hansraj (2004) and Liao (2016) identify the postural health risks associated with digital lifestyle.
- Uribe-Quevedo (2013) and Cornell University projects highlight the efficacy of real-time feedback through haptic alerts.
- Singh et al. (2019) demonstrated ESP32-based implementations using MPU6050 for cost-effective, real-time monitoring.
- Park et al. (2020) validated posture wearables for educational and workplace applications.
- Kendall et al. (2005) emphasized the need for user comfort to ensure regular usage.

III. METHODOLOGY

The system architecture integrates the MPU6050 sensor with ESP32 to detect angular tilt. When slouching is detected, the system provides audio and visual alerts through a buzzer and OLED display respectively.

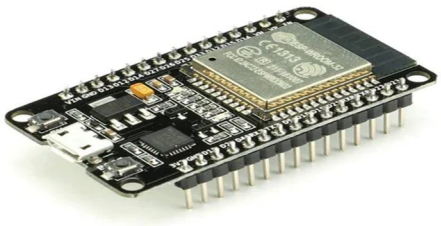

Fig1: ESP32

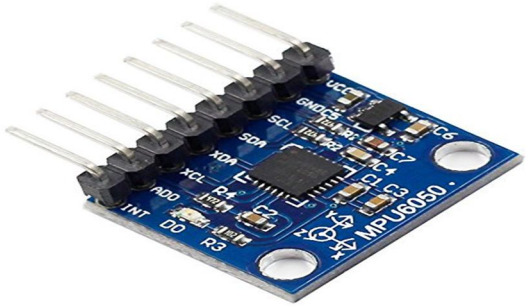

Fig2: MPU6050

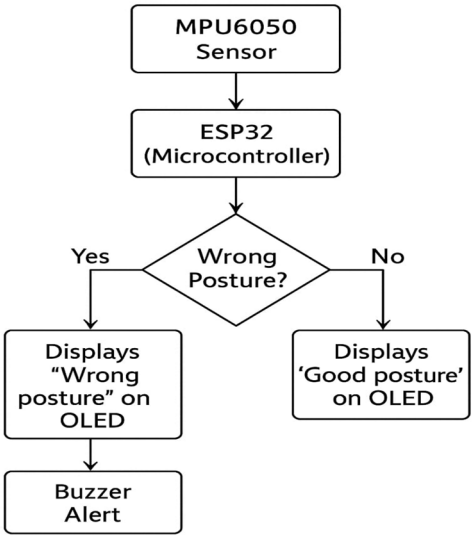

Fig3: Block diagram

IV. IMPLEMENTATION

The embedded system is programmed using the Arduino IDE. The code initializes the MPU6050, continuously reads acceleration data, calculates pitch, and triggers alerts if the posture threshold is breached. Bluetooth capability is included for potential future extensions like mobile alerts or logging in addition with visual and audio feedback.

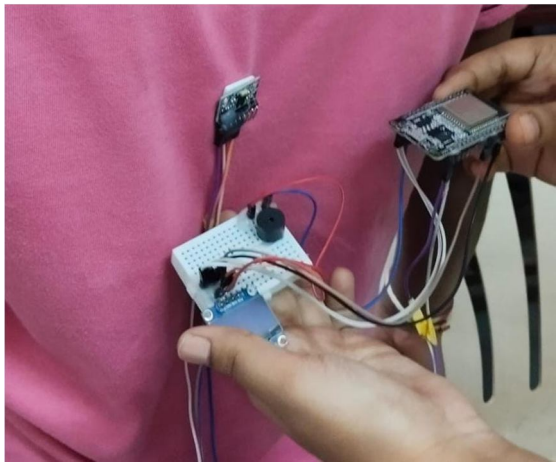

Fig4: Prototype

V. RESULTS

The device was assembled as a compact wearable with the MPU6050 placed on the upper back. When tested, the system effectively detected poor posture and issued alerts within milliseconds. The OLED displayed appropriate messages, and the buzzer provided timely audio feedback.

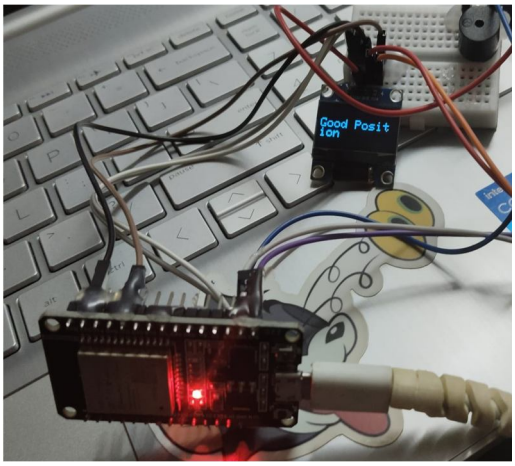

Fig5: Output - 1

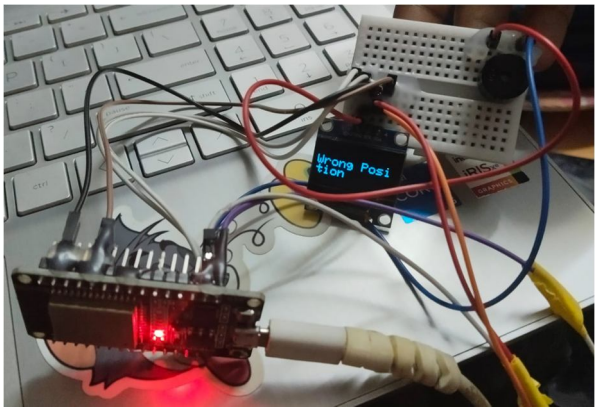

Fig6 : Output – 2

VI. CONCLUSION

The posture correction system presented is a lightweight, low-cost, and real-time solution for improving postural habits. With reliable tilt detection using MPU6050 and effective alerts via buzzer and OLED, the device demonstrates good potential for practical daily use.

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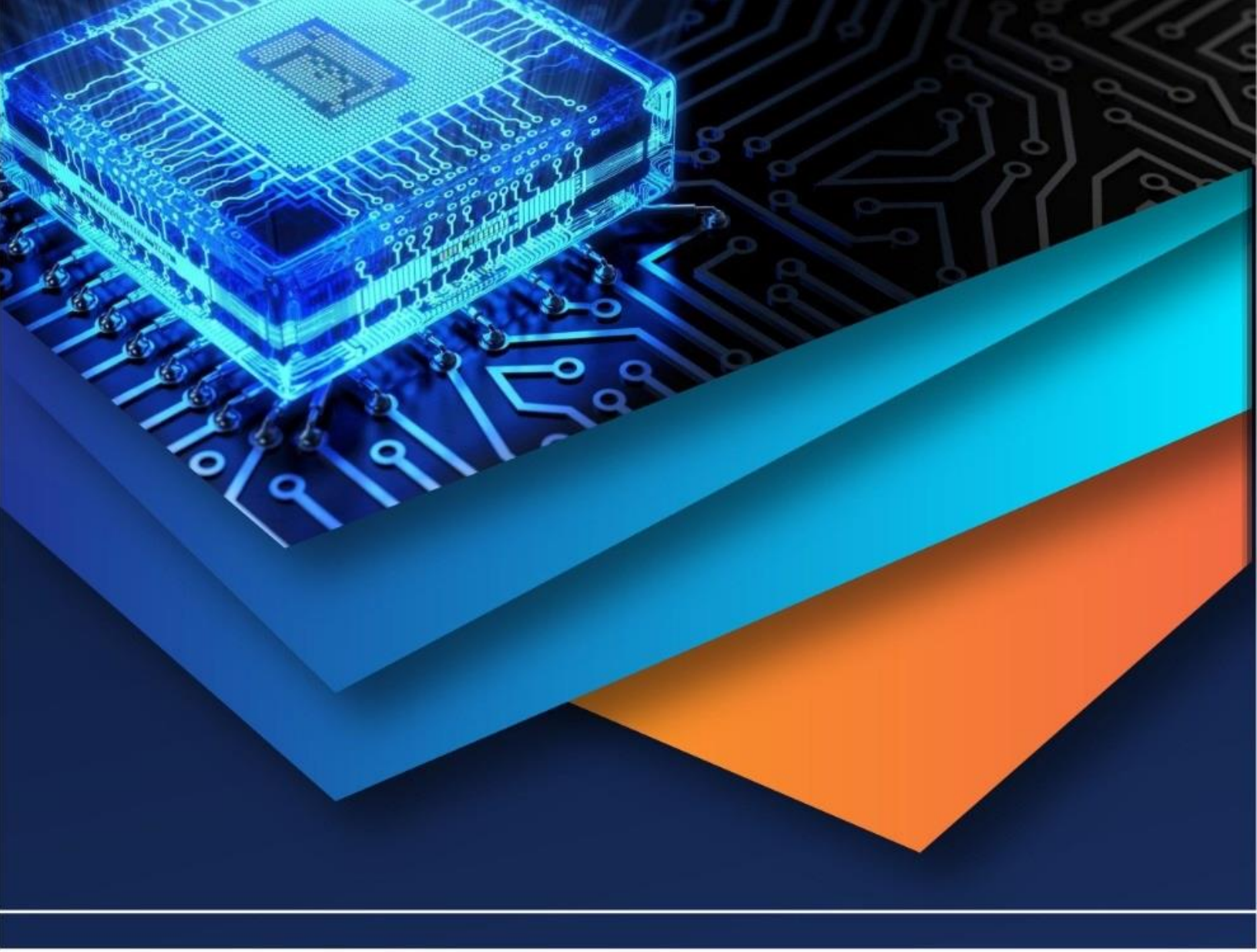

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