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An IoT-based Sitting Position Monitoring and Alert System

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Abstract: ***Maintaining a healthy sitting position is critical for preventing musculoskeletal disorders including back discomfort and neck strain, especially in people who spend long periods of time sitting or working in front of computers. This study describes an IoT-based sitting position monitoring and alarm system that detects incorrect sitting positions by combining flex sensors and accelerometers. The technology uses a flex sensor to monitor spinal cord bending and an accelerometer to determine angle of neck movement. A microcontroller processes data from both sensors and decides whether the user is sitting correctly or incorrectly. In the event of a poor seating position, an incorporated buzzer informs the user, requiring fast rectification. The device also features cloud connectivity to save seating position data, allowing for remote monitoring. This tool enables healthcare providers to generate reports and track users' seating behaviours over time, giving significant data for sitting position-related healthcare interventions. The suggested system provides an effective solution for real-time sitting posture monitoring, with the goal of preventing sitting-related health disorders and improving general well-being.***

Keywords: Sitting Position Monitoring, Internet Of Things (IoT), Flex Sensor, Buzzer Alert, Posture Correction, Eye Strain Prevention, Break Remainders.

I. INTRODUCTION

Prolonged sitting with bad posture is a serious health risk, especially for people who spend long hours working at desks, using computers, or indulging in sedentary activities. Incorrect sitting positions can cause a variety of musculoskeletal problems, including chronic back pain, neck strain, and postural imbalances. As modern lifestyles increasingly include extended screen time and desk-bound work, a good sitting posture monitoring solution is more important than ever.

The rise of the Internet of Things (IoT) has enabled creative methods for monitoring and improving daily routines, such as sitting posture. IoT-based solutions use smart sensors and real-time data processing to detect inappropriate seating positions and provide rapid feedback. Traditional posture correction approaches, such as ergonomic chairs and manual examinations, are frequently ineffective in promoting long-term adherence to healthy sitting habits.

This study describes an IoT-based sitting position monitoring and alert system that aims to encourage good posture and reduce the risk of sitting-related health problems. The device uses flex sensors and accelerometers to quantify spinal bending and neck movement angles, ensuring a thorough posture study. A microcontroller analyses sensor data to determine whether the user is in an optimal seating position. If poor posture is recognised, a buzzer sounds an alert, prompting users to improve their posture in real time. Furthermore, cloud-based data storage enables remote monitoring, allowing healthcare providers and users to watch seating behaviour changes over time and conduct appropriate interventions.

By providing a real-time, data-driven approach to posture monitoring, this device intends to prevent musculoskeletal problems linked with poor sitting habits while also improving general well-being. The proposed approach is practical, cost-effective, and advantageous to office workers, students, and those who spend a lot of time sitting down. This study highlights the potential of IoT-based technology to treat health risks associated with poor sitting posture.

II. EXISTING SYSTEM

The existing posture monitoring systems have mostly used flex sensors to monitor the spine. These sensors are good in detecting bending movements and giving feedback on spinal alignment. Several research have proved the practical use of flex sensors in wearable systems that track posture in real time. For example, they evaluate the angle of spinal curvature and notify users when poor posture is identified, urging corrective action. This real-time feedback method improves the effectiveness of these devices by sending users rapid signals prompting them to modify their sitting or standing posture accordingly.

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III. PROPOSED SYSTEM

The suggested system enhances posture monitoring by integrating flex sensors to detect spinal movement and accelerometers to determine neck position. Flex sensors will track the spine's bending and curvature, while accelerometers will assess neck angles. A microcontroller will interpret this information to determine whether the posture is correct, and if not, an alert buzzer will sound. The system will also connect to the cloud for long-term data storage, allowing users and carers to view posture data remotely. Additionally, real-time notifications will notify carers of any poor posture detected, allowing for timely adjustments. This comprehensive strategy seeks to increase awareness and adherence to optimal posture for improved health.

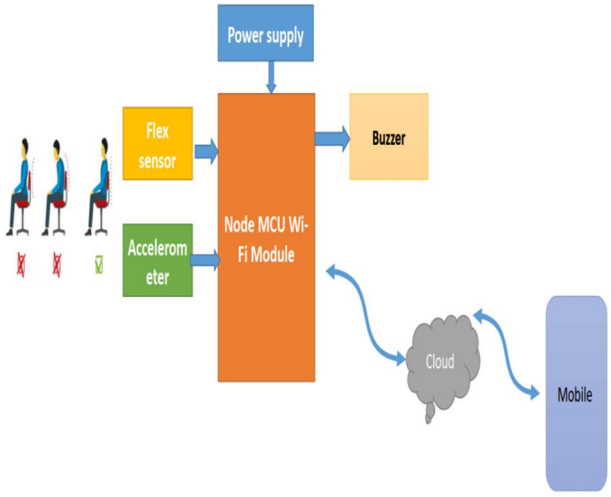

Fig.1. Architecture

IV. COMPONENTS USED AND DESCRIPTION

A. Flex Sensors

A flex sensor or bend sensor is a sensor that measures the amount of deflection or bending. Usually, the sensor is stuck to the surface, and resistance of sensor element is varied by bending the surface. Since the resistance is directly proportional to the amount of bend it is used as goniometer, and often called flexible potentiometer.

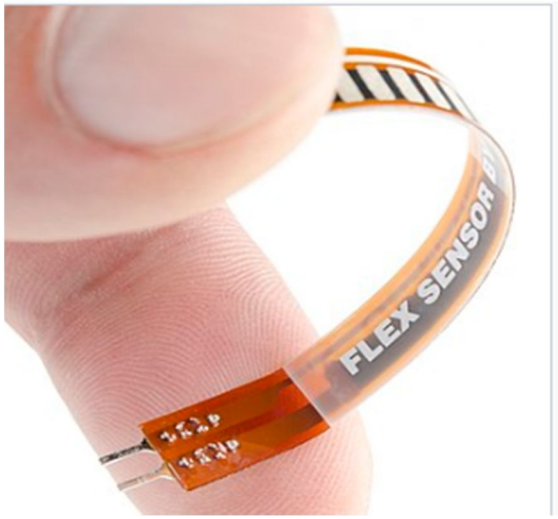

Fig.2.Flex Sensors

B. Accelerometer

An accelerometer is a device that measures acceleration forces, such as gravity and motion, by converting them into electrical signals. These devices are used in various technologies, including smartphones for orientation detection and vehicles for stability control. Their ability to detect and measure changes in speed, direction, and tilt makes them essential in numerous applications.

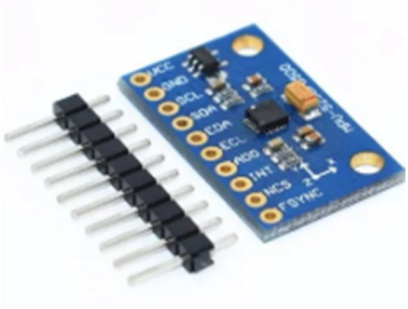

Fig 3:Accelerometr

C. Node MCU

NodeMCU is a low-cost open source IoT platform.[4][5] It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module.[6][7] Later, support for the ESP32 32-bit MCU was added.

Fig.3. Node MCU

D. Buzzer

A buzzer is used to provide audio feedback for system notifications. It sounds an alert when an order is placed, a payment is completed, or when a customer presses the waiter call button. This feature ensures staff members are immediately notified, reducing response time and enhancing service quality.

Fig.5. Buzzer

E. Blynk App

Blynk is an IoT platform designed to make it easier to create web and mobile apps for the Internet of Things. In only five minutes, link more than 400 hardware models, including Arduino, ESP8266, ESP32, Raspberry Pi, and other comparable MCUs, and create drag-and-drop IOT mobile apps for iOS and Android.

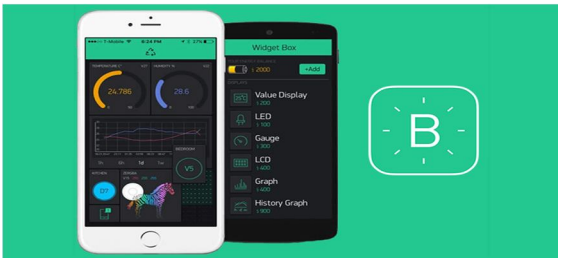

Fig.6. Blynk App

V. WORKING

The proposed system addresses these issues by integrating flex sensors for spinal monitoring and accelerometers for neck position assessment. By continuously monitoring both spinal and neck alignment, the system can provide real-time feedback to users. When poor posture is detected, an alert buzzer will prompt immediate correction. Furthermore, real-time notifications will inform caretakers when improper posture is detected, allowing for timely interventions..

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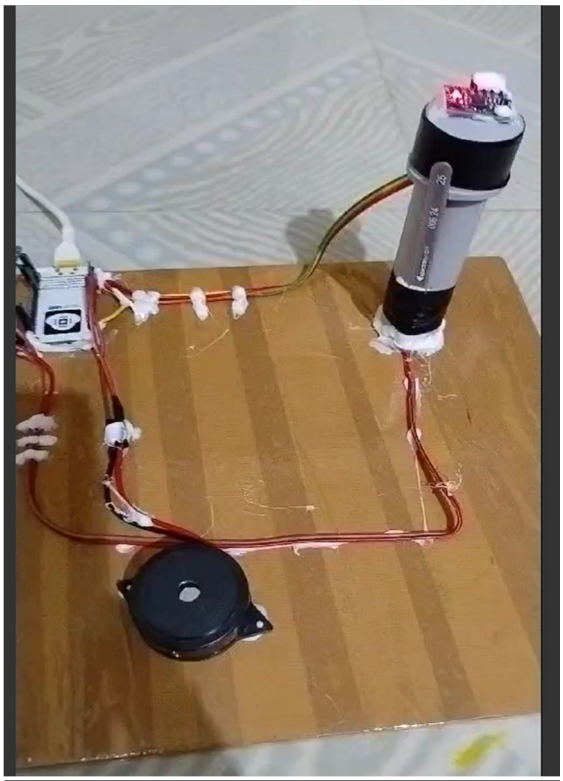
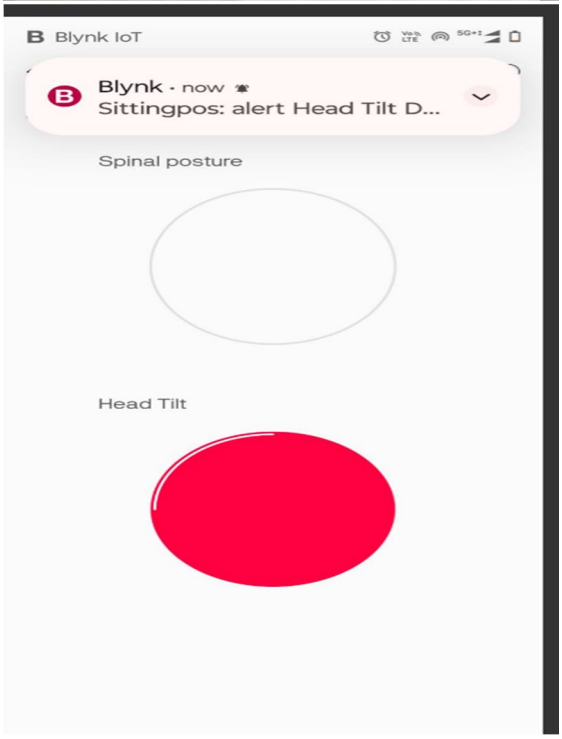
VI. RESULTS





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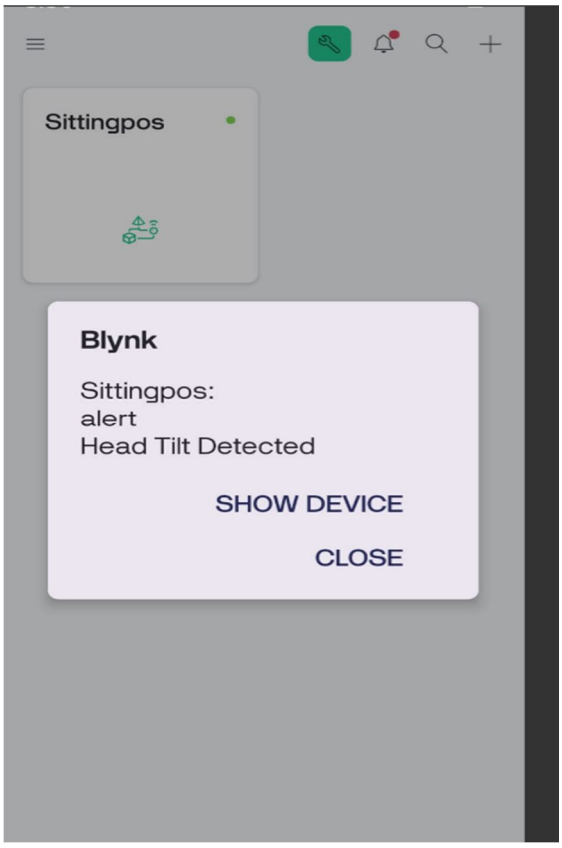

Fig 8:Working

The proposed IoT-based sitting position monitoring and alert system operates through a combination of sensors, a microcontroller, and an alert mechanism. The core working components are as follows:

1) Flex Sensors: These sensors are used to detect the bending and curvature of the spine. When a user slouches or leans forward excessively, the flex sensors detect the deviation from the correct posture and send data to the microcontroller.
2) Accelerometer: This sensor measures the angle and movement of the neck. If the user's neck is tilted at an unhealthy angle for an extended period, the accelerometer detects this misalignment and provides real-time data to the system.
3) NodeMCU: A low-cost open-source IoT platform based on the ESP8266 Wi-Fi module, which serves as the microcontroller. It processes the data received from the flex sensors and accelerometer, determines if the sitting posture is correct or incorrect, and triggers alerts when necessary. Additionally, the NodeMCU connects to the cloud for remote data storage and monitoring.
4) Buzzer: When an incorrect sitting posture is detected, the system activates a buzzer to provide auditory feedback, alerting the user to adjust their posture immediately.
5) Power Supply: The system is powered either by a battery or a USB power source, ensuring continuous operation and portability.

VII. CONCLUSION

The suggested IoT-based sitting position monitoring and alert system is an excellent way to promote appropriate posture and prevent musculoskeletal problems induced by extended sitting. The device detects spinal bending and neck movement accurately using flex sensors and accelerometers, allowing for real-time posture monitoring. The microcontroller interprets sensor data and generates alarms when poor posture is identified, while cloud connectivity allows for remote access and long-term data storage. This device not only raises user awareness, but it also enables healthcare experts and carers to monitor posture patterns and provide appropriate adjustments.

With real-time feedback, cloud integration, and ease of use, this device is an excellent tool for increasing general well-being and lowering posture-related health risks...

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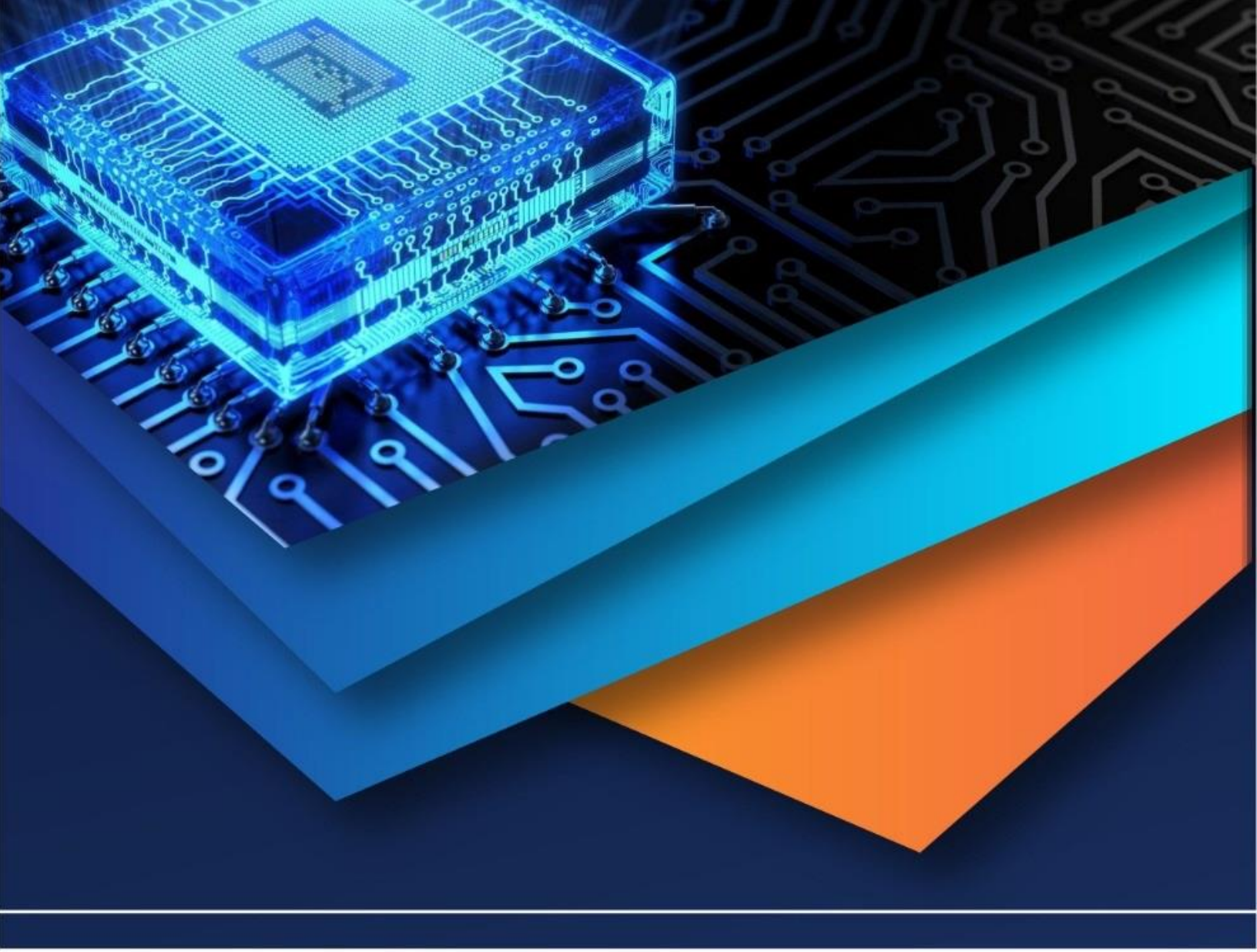

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