Wearable Sensor-Based System for Detecting Neck and Back Posture Problems

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Introduction

- ❖ Flex Sensor-Based Angle Detection: Employing flex sensors for angle detection.
- ❖ Gyrometer-Verified Angle Determination: Utilizing gyrometers to verify and confirm angles.
- ❖ STM32 Data Collection via Sensors: Data collection facilitated through STM32 microcontroller and sensors.
- ❖ STM32 and NodeMCU Integration: Establishing connectivity and data exchange between STM32 and NodeMCU.
- ❖ Wireless Data Transmission: Transmitting collected data wirelessly using NodeMCU.
- ❖ User Interface and Calibration: Implementation of a user interface and calibration mechanisms.
- ❖ Visual Representation of Angle Data: Rendering graphical representations of bending angles for enhanced visualization.

Specifications and Design Requirements

- ❖ Key Focus on Bending Angle Detection: The primary project emphasis is on precise bending angle detection utilizing flex sensors, supported by previous characterization efforts.
- ❖ Wireless System Integration: The system's wireless nature eliminates cumbersome wiring constraints, enhancing overall flexibility.
- ❖ Calibration for Algorithm Flexibility: A calibration process is integral to the design to accommodate variations in the flat resistance of flex sensors, ensuring compatibility with the characterization algorithm.
- ❖ Utilization of IC2 and UART: The project leverages IC2 and UART knowledge for effective sensor integration and data communication.

Solution Methodology

- ❖ In this project, the STM32 microcontroller is utilized to acquire data from a range of sensors. Subsequently, the analog data from flex sensors is processed to determine bending angles. Once computed, this data is transmitted to a NodeMCU module. The NodeMCU module serves a dual function by collecting raw data and concurrently creating a user interface that incorporates visual bending animations.

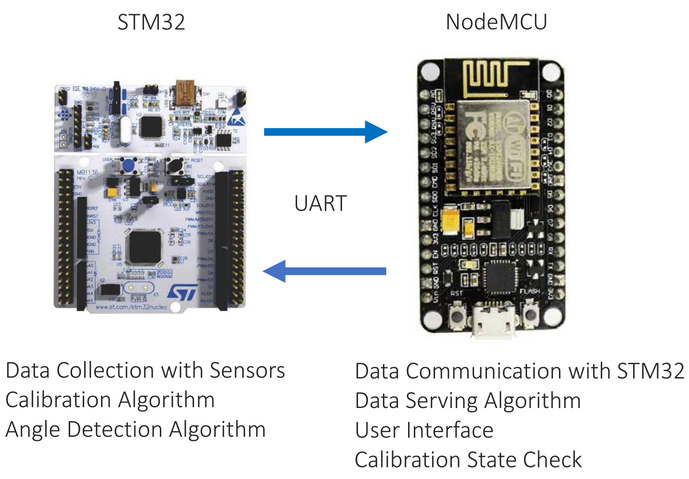
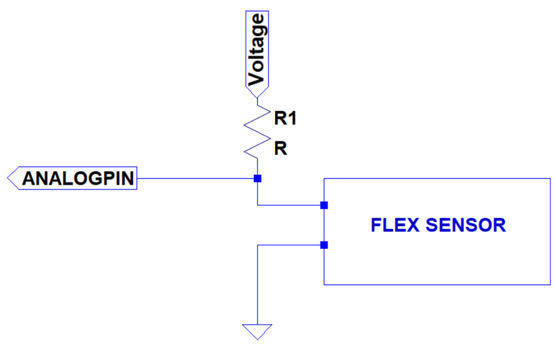


Figure: An overall description of the project components.

- ❖ The project team requires a circuit to effectively read data from a Flex Sensor, which essentially functions as a potentiometer. To accomplish this task, we have implemented a Voltage Divider circuit as outlined below.



Application Areas

- ❖ Biomedical Engineering Application: The system finds utility in Biomedical Engineering.
- ❖ Real-Time Posture Data Collection: It enables real-time posture data collection.
- ❖ AI Integration: Collected data can be utilized to train AI algorithms.
- ❖ Wireless Synchronization: The system supports long-distance team collaboration through wireless connectivity.

Results and Discussion

- ❖ Successful Bending Angle Detection: The project successfully achieved precise bending angle detection using flex sensors and the STM32 microcontroller.
- ❖ Voltage Divider Circuit Integration: The implementation of a Voltage Divider circuit, akin to a potentiometer, proved to be a reliable method for extracting sensor data, ensuring data accuracy and consistency.
- ❖ Wireless System Efficiency: The wireless system, enabled by the NodeMCU module, eliminated wiring limitations, enhancing system flexibility and data transmission capabilities.
- ❖ Calibration for Adaptability: The calibration process was introduced to account for variations in flex sensor flat resistance, enhancing the system's adaptability to different sensor types.
- ❖ IC2 and UART Integration: Utilizing IC2 and UART knowledge streamlined sensor integration and data communication, contributing to the project's technical excellence.
- ❖ User Interface Enhancement: The NodeMCU module served a dual purpose by collecting raw data and creating an intuitive user interface, complete with visual bending angle representations.
- ❖ Biomedical Engineering Potential: The project's achievements highlight its potential for applications in biomedical engineering, demonstrating robust sensor integration, wireless capabilities, and adaptability to varying sensor characteristics.

References

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