

Design of Athlete Plantar Pressure Collection System based on Flexible Thin Film Pressure Sensor

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Abstract: According to the needs of athletes and coaches, a plantar pressure collection system for athletes based on flexible thin film pressure sensors is designed. The system integrates flexible thin film pressure sensors, STM32 microcontrollers, and HC-06 Bluetooth modules, and develops a supporting mobile app. Through system production and experimental verification, the system can real-time collect plantar pressure data of athletes and display it through computer serial port assistants and mobile apps. This system provides a convenient tool for analyzing plantar pressure of athletes, which helps improve the scientificity and specificity of athlete training.

Keywords: Flexible Thin Film Pressure Sensor; Plantar Pressure; Bluetooth; Real-time Collection.

1. Introduction

In the training and performance of athletes, the distribution of plantar pressure is a crucial indicator. Understanding the distribution of plantar pressure can help coaches and athletes better understand the stability of movements, distribution of force, and potential risk of injury [1]. However, traditional pressure collection systems are often plagued by problems such as large hardware volume, heavy weight, and inconvenient wearing, limiting their application in actual sports scenarios.

This paper aims to propose an athlete plantar pressure

collection system based on flexible thin film pressure sensors to address the limitations of traditional systems. The system uses flexible thin film pressure sensors as the main sensor, which has the characteristics of small volume, light weight, and easy wearing, better adapting to the needs of athletes.

2. Overall Composition of the System

The pressure collection system designed in this paper consists of three parts: pressure collection device, host computer system, and mobile end. The composition diagram of the system is shown in Figure 1.

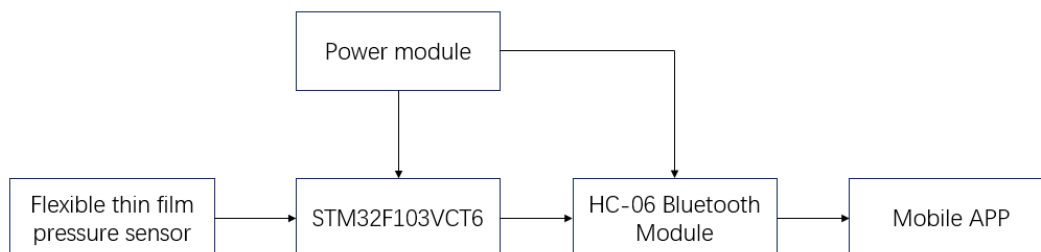


Figure 1. Composition Diagram of Pressure Collection System

2.1. Flexible Thin Film Pressure Sensor

For athletes, the most important thing is portability and lightweight control. Therefore, when selecting pressure collection sensors, factors such as comfort, price, performance, and applicability were comprehensively analyzed. The ZNX-01 flexible thin film pressure sensor was selected and designed [2], as shown in Figure 2.

The ZNX-01 is a resistive pressure-sensitive flexible thin film pressure sensor with 8 pressure-sensitive points on each foot. It is connected to the ADC pins of the STM32 microcontroller through bottom pins and can real-time transmit pressure data to the microcontroller.

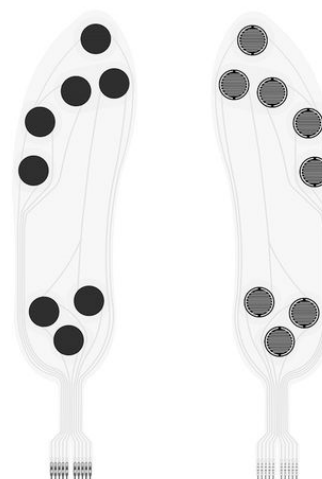


Figure 2. ZNX-01 Flexible Thin Film Pressure Sensor

2.2. STM32F103VCT6 Microcontroller System

The STM32VCT6 microcontroller is a high-performance 32-bit microcontroller launched by STMicroelectronics, with rich peripheral interfaces and powerful computing capabilities, including a 12-bit ADC that can directly convert analog signals into digital signals[3]. It can also drive the Bluetooth module directly through the serial port to complete the transmission of pressure data. In addition to the STM32 microcontroller, the system also includes a power module and a pressure signal conditioning circuit, where the pressure signal conditioning circuit is mainly responsible for signal conversion and AD conversion.

2.3. HC-06 Bluetooth Module

The HC-06 Bluetooth module is a simple and easy-to-use, low-cost Bluetooth serial port transparent module, suitable for Bluetooth connection and data transmission of various embedded systems and smart hardware[4]. The HC-06 module can set parameters such as name, password, baud rate, and master-slave mode through AT commands, thereby transmitting the pressure signals collected by the STM32 microcontroller to the mobile app for analysis and processing, and real-time display of athlete plantar pressure information.

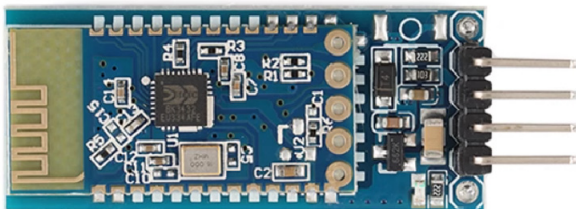


Figure 3. HC-06 module

3. Pressure Signal Collection

When the flexible thin film pressure sensor collects pressure data, its principle is to utilize the sensitivity of the sensor to convert plantar pressure into electrical signals, and convert analog signals into digital signals through the ADC of the STM32 microcontroller. During data collection, a serial port assistant on a computer or a mobile app can be used for collection, with the main difference being the method of displaying data. [5] During system testing, the pressure collection system device is first worn on the plantar of the experimenter, and then the experimenter starts to walk or run within a certain range. Specific pressure information can be read from the serial port assistant, as shown in Figure 4.

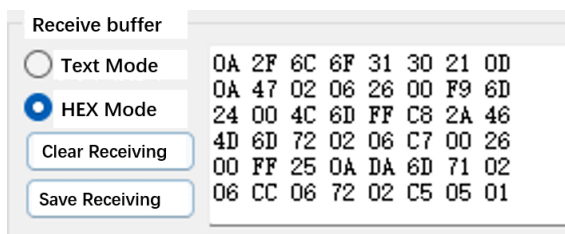


Figure 4. Serial Port Assistant Receiving Pressure Data

When the serial port assistant displays data, it indicates that the system is in normal working condition. The next step is to use the mobile app to display the plantar pressure distribution diagram: connect the HC-06 Bluetooth module to the system,

configure the baud rate through AT commands, and then receive the pressure data sent by the Bluetooth module through the mobile app. The experimental results are shown in Figure 5.

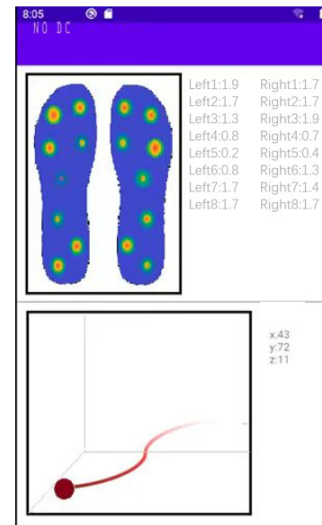


Figure 5. Plantar Pressure Distribution Diagram

4. Conclusion

Based on the needs of athletes in practical training, this paper proposes an athlete plantar pressure collection system based on flexible thin film pressure sensors, which consists of flexible thin film pressure sensors, STM32 microcontrollers, HC-06 Bluetooth modules, and mobile apps. In experiments, both computer-side serial port assistants and mobile-side apps can receive data well and achieve the display of plantar pressure distribution diagrams, which helps coaches and athletes fully understand the plantar pressure data during training.

Acknowledgments

Chengde National Sustainable Development Agenda Innovation Demonstration Zone Construction Science and Technology Special Project(202202F006).

References

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