

Intelligent Footwear System Embedded with Fabric Pressure Sensor

智能鞋監測系統

Daily foot conditions, especially spatial and temporal plantar pressure distributions, are useful data for monitoring diabetic patients from developing peripheral neuropathy and foot ulcerations. Based on arrays of fabric sensors, the intelligent footwear system is able to measure, display and record data of foot conditions during daily activities in smartphone or PC. The data includes spatial and temporal plantar pressure distributions, in-shoe temperature and humidity, centre of pressure (COP), 3-axis accelerations and pressure time integral. The system has demonstrated satisfactory accuracy, repeatability and wearing comfort.

It was evaluated in clinical trials which the trial subjects included healthy people and patients who have already had or have a tendency to develop the diabetic foot syndrome. The evaluation results accord with clinical observations.

足底信息，特別是足底壓力分佈，對於監測糖尿病患者的神經病變和足底潰爛等併發症狀非常有用。基於織物壓力傳感器矩陣的智能鞋系統可監測日常活動中的足底信息，並在智能手機或者電腦終端上顯示、存儲和分析。這些信息包括足底壓力的時間空間分佈、鞋內溫濕度、壓力中心點坐標、足部三維加速度和壓力時間積分參數。該系統通過了醫院試穿測試，其準確度、重複性和穿著舒適度都令人滿意，對初期糖尿病患者和糖尿病足患者的評估結果與醫學觀察一致。



Application 應用

The intelligent footwear system helps diabetic patients avoid foot damage and improve quality of life by warning them the extremely high plantar pressure, and pressure time integral that exceeds the normal threshold. It is important for high risk patients, who have one side ulcer or ulcer history, and another foot without ulcer, to monitor and protect the normal side of foot. It can also assist doctors to evaluate effects of surgical procedures and treatments on diabetic patients. Furthermore, it can be applied to areas like entertainment, sports training, man-machine interaction and rehabilitation.

基於織物壓力傳感器的智能鞋系統可在足底壓力值或壓力時間積分值超過正常水平時為糖尿病患者提供警示，有助降低足部受損潰爛的機會，改善患者的生活；幫助高危糖尿病足患者（即其中一隻足部受損或已癒合）保護未受損傷的足部；系統也能幫助醫生評估針對糖尿病足患者的手術和治療的效果。智能鞋系統還可應用於娛樂、體育訓練、人機互動狀況、物理復康治療等方面。

Industry Benefits 業界效益

Specification and standardisation of intelligent footwear system for mass production in commercialisation process have been established. It displays to the clothing and footwear industry a window into non-traditional new applications and market, such as wearable electronics and medical textiles. It adds substantial values to traditional textile and electronic products.

智能鞋系統大規模商業生產的標準已經建立起來，有助傳統的製衣製鞋業邁向嶄新的應用和市場發展，比如穿戴式電子和醫用紡織品，為傳統的紡織行業提供高附加值的產品。

||| Technical Specification 技術指標 |||

Item 項目	Parameter 參數	Performance 性能
Pressure measurement 壓力測試	Range 範圍	0 ~ 1000kPa
	Accuracy (measurement error) 準確度 (測量誤差)	5% ~ 7%
	Repeatability (maximum measurement variation in repeated tests) 重複性 (重複測量差異最大值)	6%
	Sampling frequency 採樣頻率	10 ~ 50Hz
Temperature and humidity 溫濕度	Range 範圍	<ul style="list-style-type: none"> • 40°C ~ 100°C (Temperature/溫度) • 0 ~ 100% (Humidity/濕度)
	Accuracy 準確度	<ul style="list-style-type: none"> • 1°C (Measurement error of temperature/溫度測量誤差) • 3.5% (Measurement error of humidity/濕度測量誤差)
	Sampling frequency 採樣頻率	0.5Hz
Acceleration 加速度 (X, Y, Z)	Range 範圍	-2 ~ 2G
	Accuracy 準確度	5%
	Sampling frequency 採樣頻率	10 ~ 50Hz
Battery 電池	Continuous use time 持續使用時間	20 hours / 小時
Charger 充電器	Charge time 充電時間	3 hours / 小時

||| Licensing Details 獲取專利 |||

A non-exclusive licence covers:

- The knowhow to fabricate an intelligent footwear system including a pair of shoes, a mobile computing device, a Bluetooth based wireless transmission module, a Li-ion battery and a three-axis acceleration sensor
- A user guide of the intelligent footwear system

非獨家專利授權許可包括：

- 整備智能鞋監測系統的技術，系統包括鞋、可攜式電腦裝置、藍芽無線傳送裝置、鋰離子電池及三軸加速感測器
- 智能鞋監測系統的使用手冊

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Organisation
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