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Application
Group

捷足先登一步態復健之外骨骼裝置 Exoskeletal Support Device for Walking

隊伍名稱 外骨骼裝置 / Exoskeletal Device

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作品摘要

本作品針對運動中最常見的足踝扭傷，研發踝關節外骨骼步行輔助系統，希望解決因運動傷害後造成的行動不方便。傷者在穿戴之後不需動到受傷的腳踝，即可達到正常的步行動作。使受傷的軟組織可以充分的復原，免除了過去受傷之後必須隨身攜帶著笨重的拐杖。

系統架構主要分為兩部分，第一部分為「步態感測環」穿戴在未受傷的腳上，將初步運算的結果以藍芽無線傳輸至外骨骼步行輔助器，提供外骨骼步行輔助器進行後續的分析；第二部分為『外骨骼步行輔助器』穿戴在受傷的腳上，當系統偵測到步行動作時，將接收自雙腳上加速度感測器的加速度訊號，辨識出目前正在進行的步態動作。根據步行軌跡、跨步距離及移動速度控制外骨骼腳板，使兩腳踝之間的步伐一致，以達到正常行走之功能。

由於外骨骼步行輔助器屬於穿戴式裝置，支撐著傷者的重量及提供動力，因此在機構設計上必須輕巧且堅固，故我們使用碳纖維作為主要材質，以一體成型的方式製作整個外骨骼骨架。另外我們利用微處理器做為控制及運算核心，建置整個嵌入式系統，不需要龐大的運算器或電腦。



圖 1. 外骨骼系統穿戴示意圖

Abstract

In this work, we developed an exoskeleton ankle walking assistance system to assist the persons affected by an ankle sprain. By wearing this walking assistance system, the wounded can walk normally without moving the injured ankle. The major advantage of this walking assistance system over carrying a heavy stick is that the injured soft tissues can get a better restoration effect.

The system architecture is divided into two parts. The first part is the gait sensing ring, transmits the preliminary calculated results to the assistance system for subsequent analysis. The second part is the exoskeleton device which the wounded wear on their injured feet. When the system detects the user's walking, it will receive the acceleration signals from the device worn on the user's feet and identify the gait movement. We can control the exoskeleton device based on the foot path, step distance and moving speed.

Carbon fiber is used to manufacture the entire exoskeleton device. As the exoskeleton device has to support the user's weight, the light weight and sturdy nature of carbon fiber makes it the best option. A microprocessor is used as the control and computing core of the exoskeleton device.



Fig 2. The diagrams of push off heel strike action for ground stair walking