

# AI5-072

Force Feedback Teleoperation for Medical Rehabilitation

遠端力回饋復健醫療

隊名 醫療零距離

隊長 楊正源 / 長庚大學電機工程研究所

隊員 邱中佑 / 長庚大學電機工程研究所

褚承鑫 / 長庚大學電機工程研究所

指導 張永華 / 長庚大學電機工程學系  
教授 林宏偉 / 黎明技術學院電機工程系

## 作品摘要

傳統的復健醫療無論在療效的即時分析、或療程的彈性規劃與紀錄都有相當的限制。新型態的遠端復健醫療植基於網際網路的訊息傳遞，復健治療師傳送醫療訊息至遠端病患，病患的復健行為亦可即時地回傳給治療師，有利後續療程規劃與療效分析。

本作品旨在實現一個以嵌入式控制核心為基礎之遠端力回饋復健醫療系統，如圖一所示。在主 / 從端機構設計部分，提供包含上 / 下及推 / 拉兩種運動模式；藉由診療師與病患的互動行為，可用以瞭解病患上肢（手臂及手腕）的復健進展。另考量體積小、低成本及操作容易等因素，控制核心採用樹莓派（Raspberry Pi）與 PIC 微處理器的整合設計，相關功能模組包含網路通訊、馬達驅動、回授訊號擷取、控制法則實現及遠端視訊傳送等。本作品同時開發一個可以即時監控主 / 從兩端的人機介面，得以即時地監控相關復健療程，適時校正病患的復健動作，進而有效提升遠端復健的成效。

Traditional medical rehabilitations have quite many restrictions on real-time healing effect analysis, flexible treatment planning and data recording. On the other hand, therapists can send medical messages to remote patients based on an Internet-based teleoperation medical rehabilitation. In addition, patient's therapy behavior can be real-time sent back to therapists for consequent treatment planning and analysis.

This project aims to design and implement a force feedback teleoperation system for medical rehabilitation based on an embedded control kernel, shown in Fig. 1. In the master/slave mechanism design, both the up-down and pull-push movements are provided. According to the interactive operations between patient and therapist, the rehabilitation progress of upper limb healing can be comprehended. Considering the factors of small size, low cost and easy to use, an integrated design of Raspberry Pi and PIC microprocessor is adopted. The developed function modules include network communication, motor driving, data acquisition, control algorithm realization and remote video transmission. Moreover, a user interface is design to simultaneously monitor the master and slave sides, such that the patient's therapy movements can be checked and the effect of remote rehabilitations can be improved.

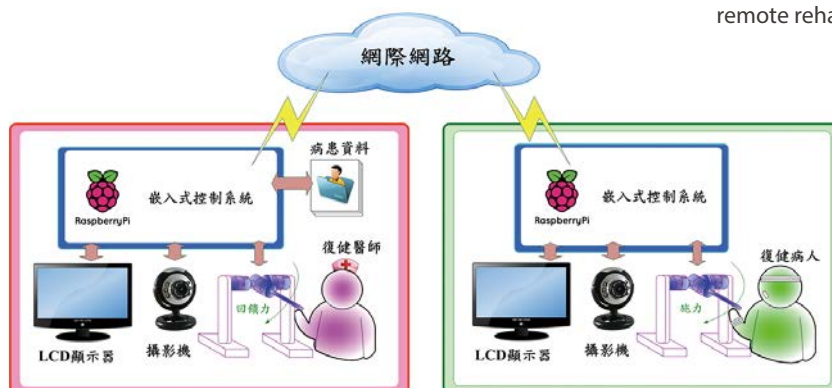


圖 1 / 力回饋醫療架構圖