

2022 年英特尔杯大学生电子设计竞赛嵌入式系统专题邀请赛

参赛队作品简介

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作品题目 (中英文对照)	智能康复训练辅助系统 The Intelligent Rehabilitation Training Auxiliary System		
作品简介 (中英文对照，中文限 500 字以内)	<p>为解决国内复健医疗资源短缺、疫情形势下患者难以与康复师面对面复健等问题，团队基于 GNS-V40 开发了一款智能康复训练辅助系统。系统硬件主要包括 Arduino、数字血压采集模块、音响、触摸显示屏、摄像头、音频模块、IC 刷卡器等。系统采用 MediaPipe 库提取人体关键点，计算患者肢体活动夹角完成患者肢体活动范围评测；采用 DTW 算法将患者动作与标准动作对齐、比对，完成对康复训练动作的评价与纠正；采用 Face-recognition 库实现人脸识别；采用 PYQT5 库完成对 UI 交互界面的设计；通过分析人体摔倒特征实现对患者摔倒的监测；通过嵌入式模块实现对病人生理数据的采集、语音交互；此外，系统还面向康复师设置了查看患者数据、制定患者训练方案、录制新的训练动作的功能。系统以达到三级康复水平的脑卒中患者为例，针对适合脑卒中患者的锻炼的动作进行了评测。经测试，系统测量的患者肢体活动角度范围与实际角度误差在 7 度以内；训练过程中，检测患者动作准确率基本大于 95%，对于错误动作，可以通过语音提醒患者；跌倒监测误识率在 10% 以下。系统采用边缘计算模式，充分发挥出了 GNS-V40 的优异性能，能有效缓解复健医疗资源短缺、人机交互友好、可扩展性强，有较高的实用价值和广阔的应用前景。</p> <p>In order to solve the problems such as the shortage of rehabilitation medical resources in the domestic and the difficulty of face to face communication between patients and rehabilitation physicians during the epidemic, our team developed an intelligent rehabilitation training assistance system based on GNS-V40. The system hardware mainly includes Arduino, digital blood pressure collection module, speaker, touch screen, camera, audio module, card reader. The system used MediaPipe library to extract the key points of the human body, and calculated the angle of the patients' limb activity to complete the evaluation of the patient's limb range of motion. Use the DTW algorithm to align and compare the patient's movements with the standard movements to evaluate and correct of rehabilitation training actions. Face recognition is realized by face-recognition library. PYQT5 library is used to complete the design of UI interface. By analyzing the characteristics of human fall to realize the monitoring of patients fall; Through the embedded module to achieve the collection of patient physiological data, voice interaction; In addition, the system also sets up the function of viewing the patient data, formulating the patient training program, and recording the new training action for the rehabilitator. The system takes stroke patients who have reached the tertiary</p>		

rehabilitation level as an example to evaluate the exercise movements suitable for stroke patients. The error between the Angle range of limb movement measured by the system and the actual Angle was below 7 degrees. During the training process, the accuracy rate of detecting patient movements is basically greater than 95%, and patients can be reminded to correct wrong movements through the system voice; The misidentification rate of fall monitoring was less than 10%. The system adopts edge computing mode and gives full play to the excellent performance of the GNS-V40, which can effectively alleviate the shortage of rehabilitation medical resources, friendly human-computer interaction, strong expansibility, and has high practical value and broad application prospects.