Stroke Rehabilitation Crutch Robot With Auto-Follow and Fall Alarming System

Chen, Zeshen (School: The Hill School)

Stroke is a significant health problem, imposing a growing burden on patients, families, and healthcare systems. Many stroke patients experience diminished confidence in walking independently, often relying on external assistance after prolonged use of walking aids. This study introduces the Stroke Rehabilitation Crutch Robot (SRCR), a novel crutch robot designed to support stroke patients during rehabilitation while offering care in two distinct modes: Auto-Follow and Manual Control. The Auto-Follow mode facilitates independent walking training and provides necessary care, while the Manual Control mode aids rehabilitation and bolsters patients' confidence in walking. The SRCR employs an Ultra-Wideband (UWB) positioning system for Auto-Follow mode and an MPU 6050 sensor for a fall alarming system. Its structure features an omnidirectional chassis and a handle to support and assist with movement. To assess the SRCR's performance, I conducted accuracy tests for the Auto-Follow mode, a speed test, and a fall detection accuracy test. The results indicated that the SRCR's manual mode speed was 0.4827 m/s, falling within the typical gait speed range for stroke patients. In the straight-line accuracy test, the SRCR achieved a 91.7% success rate, maintaining less than 50 cm from the track. The circle accuracy test demonstrated an 87.5% success rate of offsetting less than 50 cm from the track. The fall detection accuracy was 97.5%. These results suggest that the SRCR holds promise for assisting stroke patients in rehabilitation and providing care. However, further investigations with actual stroke patients are required to verify the SRCR's efficacy in clinical settings. Moreover, the positioning system can be refined to detect individuals standing behind the robot.

Awards Won:
Fourth Award of $500