Spherical Robot Based on Double-Pendulum Drive System: Structural Design and Motion Control Function Research

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This study presents a spherical robot driven by a double-pendulum mechanism that shifts its center of gravity for omnidirectional movement. A robust 3D-printed shell and internal actuation system, governed by an ESP-32 microcontroller and advanced servo/motor algorithms, enable precise balance and directional control. PID-based control ensures rapid stabilization after disturbances. Experimental tests confirm the robot's ability to maintain balance, execute smooth turns, and travel in straight lines. Future enhancements (e.g., radar integration) aim to expand functionalities such as environmental mapping and swarm behavior, making this design promising for exploration, surveillance, and rescue operations.

Awards Won: