CATCH System 2.0: Enhanced Autonomous Ball-Collection Vehicle for Paralympic Table Tennis Athletes

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Wheelchair Paralympic athletes lose 25% of their training time collecting table tennis balls manually, causing fatigue and affecting their autonomy, performance and motivation. This is a global problem that has not been explored enough, leaving athletes without the necessary tools for training. This is where CATCH System comes into play. The redesigned version integrated a HuskyLens 2 AI Camera using a custom YOLOv8 object detection model, trained to identify white and orange balls and move based on its coordinates, a conveyor belt mechanism was added to the wheel collection system to transport the balls to the upgraded storage unit and a voice command system was added, working through a mobile app to activate and deactivate the robot. Field tests were done at CIDAR Academy to evaluate detection and collection effectiveness. The results show that the vehicle collects 21.67 balls per minute with a 93.09% accuracy. The storage capacity increased by 256.5% (from 23 to 82 balls), successfully minimizing training interruption and gaining training time, Voice command provided an effective hands-free operation of the robot for wheelchair athletes. CATCH System (2.0) gives athletes back the autonomy and motivation they deserve, achieving its mission of allowing athletes to focus on what really matters; training, improving and enjoying, proving that the most complex barriers in sports do not always require the most expensive solutions and ensuring that the only thing an athlete has to focus on is their next serve, proving once and for all that physical limitations do not define athletic potential.

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