Omni Wheel: An Innovative Wheel Design for a Walker With Pressure Tracking, Lidar Sensing and Braking Capability

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About 38 million falls are reported among older adults each year in the US alone with more than 50,000 fall injuries associated with walkers, leading to more than 30,000 hospitalizations. One of the key reasons for these falls is the level of difficulty encountered by walker users while maneuvering around, and particularly when turning. The standard Straight Wheel walker requires significant manipulation, and commonly needing to be picked up while turning, contributing to several falls. I developed an Omni Wheel for walkers, which allows users to maneuver very smoothly and turn on their own center of rotation rather than drag the Straight Wheel walker about the axis. This wheel has a Bell and Cup design to connect to the walker. An original Arduino RP2040 sensor was also designed to enhance walker safety in 3 ways – 1. Embedding pressure sensors to monitor and track instability in gait patterns or muscle weaknesses that can lead to falls; 2. Attaching Lidar sensors to identify potential obstacles in the way of the walker, which can lead to tripping and falls; and 3. Developing a braking mechanism that activates upon sensing obstacles to help users from tripping over obstacles. Pressure Sensors were embedded in all 4 legs of the walker to continuously gather load data. The Lidar sensors were attached to the front of the walker at a 30o angle to sweep the area in front of the walker to track obstacles, and the automated brake made of a motor, coupler, T-nut and Acme screw engaged upon appropriate triggering. All the engineering components like the Omni Wheels, the load sensors, the Lidar, and the brakes were tested rigorously in multiple ways, across multiple trials, and yielded very successful results consistently.

Awards Won:

Third Award of $1,000

NC State College of Engineering: Alternates (not read aloud)