Advancements in Sensor Technology for Autonomous Walker ★

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Abstract. By 2050, the global population will experience significant aging, with the proportion of individuals aged 65 and older increasing from 10% in 2022 to 16% [1], and the number of people aged 80 and above tripling [2,3]. This demographic shift has driven interest in technologies that improve quality of life and autonomy for older adults. Walkers, essential for mobility and independence, require enhancements in usability and automation [4]. This paper outlines the design of a motorized smart walker, integrating user feedback and focusing on affordability, with the goal of improving safety and mobility through sensor-equipped systems. Key steps in the development process include:

- Conducting user surveys to identify desired enhancements for existing walkers.
- Sourcing cost-efficient components such as sensors and batteries based on user feedback.
- Modifying a commercial walker by designing and installing prototypical supports for batteries, screens, and regulators.
- Designing and integrating an electronic board equipped with various sensors.

Implementing a data collection system to monitor performance, tracking movement speed, applied force, and user interactions for ongoing prototype refinement. Design the electronic board

This approach seeks to improve mobility for the aging population and enhance walker integration in public spaces.

Prototype development: The components were designed using Autodesk Inventor© software and fabricated through 3D printing processes utilizing PLA (polylactic acid) and resin materials as can be seen in Figure 1.

Fig.1 Sketches: a) for the batterie, b) controller and c) position in the walker

Design the electronic board. The electronic board has been designed to accommodate both the current and future components, ensuring scalability. The board's optimized layout allows for seamless integration into the walker, utilizing a low-power ESP32 microcontroller with multiple communication interfaces and a 32-bit processor for real-time sensor data processing (Figure 2). The prototype incorporates various sensors, including IMU, Time of Flight (ToF), and LiDAR, to collect precise data on movement, distance, and environmental mapping. Initial tests have shown high reliability, effectively tracking gait, balance, and walking intent, enabling future integration of AI for enhanced data analysis and user safety.

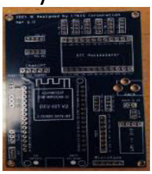

Fig.2. Figure of the design board

References

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