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Impaired ambulation is a common consequence for patients admitted to the hospital following severe acute strokes. According to research done by Louie et al.[1] 46% of patients admitted to the hospital within 48 hours of an acute stroke were completely reliant on assistance to walk and thus may be admitted to an inpatient stroke rehabilitation clinic. Because clinics rely primarily on visual observations to determine patient readiness for discharge, it is difficult for physical therapists (PTs) to accurately evaluate a patient's dependence on a walker during gait assessments. Incorporating reliable biometric data can supplement visual observations, providing clinicians with additional information to make more data driven and consistent gait assessment decisions.

A review of commercially available walker devices reveals that there are none capable of simultaneously measuring speed and load data, thus physical therapists will not be able to get the full picture of a patient's walker reliance/adeptness with anything on the market. Some devices contain force sensors attached to walker handles to monitor applied load, this includes StrideTech Go sensors, FlexiForce sensors, and AMTI sensors. There are additional methods and devices that monitor distance and speed data, as well as a patent from RS Adrezin et al.[2] that outlines a method and apparatus for gait measurement. However, there is nothing on the market that measures both of these metrics at the same time. Thus there is market potential for a device that is capable of measuring speed, travel distance, and applied force while offering real-time data feedback.

The current prototype consists of modifications done to an existing walker that enable it to measure speed, distance, and applied load in real time during a trial period. To measure speed and distance, an infrared sensor was integrated into the leg of the walker to detect changes in color along a customized wheel with highly contrasting indicators. Using the total number of times the sensed color alternates, speed and distance can be calculated using the circumference of the wheel. To measure load, cuts were made on the walker's legs and 3D-printed holders housing load cells were mounted in all four legs of the walker. Two OLED screens displaying measurement data and a user control switch are mounted near the walker handle. Finally, the microcontroller and power supply are housed within a 3D-printed chamber that is positioned at the front of the walker, out of the way of the user's legs.

Validation of the design consisted of checking measurement accuracy and consistency of the sensors, ensuring the structural integrity of the walker, and assessing power supply capability. The distance and speed testing was performed and results were compared to known distance and speed values: The average percent error was 0.24%. To conduct testing of the load cells, various loads were applied to a bathroom scale, and then to the walker. The percent error prior to integration into the holders was 1.4%. These error values are well within the 5% required for reasonable conclusions on patient recovery to be made as given by an industry professional. Final validation will occur once the load cell holders' final iteration is completed, followed by structural integrity evaluations and battery life testing. These tests will confirm the device's reliability and readiness for broader testing.

A commercial device that can reliably evaluate the key biometric data for walker use would be useful for the nearly 2500 stroke clinics[3], along with the approximately 800,000 individual stroke victims[4] in the United States for walker-based evaluations and progression monitoring post-injury. By continuously measuring travel distance, speed, and applied load data, this device can help clinicians track rehabilitation progression across time and compare data against established benchmarks. This objective feedback can aid physical therapists in tailoring therapy plans, making informed discharge decisions, and ultimately improving patient outcomes.

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[1] Louie et al. (2021)
[2] Adrezin et al. (1996)
[3] K. M. Boggs et al (2022)
[4] CDC (2025)