
*Measuring long term use of assistive technologies with object mounted sensing:
the Need-Accuracy-Duration framework*

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Background

Real world effectiveness of assistive technology depends on sustained use, yet short trials and self report fail to capture routine formation, adaptation, and discontinuation. Long term assessment across analog and digital devices is therefore motivated before a sensor and analysis approach is outlined that observes user experience parameters over months with minimal intrusion.

Methods

Devices are instrumented rather than users. Low burden sensors are mounted on the object, including magnetic contacts, simple switches, capacitive or pressure layers, and inertial units for movement dynamics; digital products contribute native telemetry. Processing comprises robust signal conditioning, threshold based event detection, and calibration with periodic checks. From these streams, user experience parameters are derived: counts of episodes, episode duration, inter event intervals, intensity or load, bout dynamics, and exposure to slopes. Quality control includes drift monitoring and simple plausibility rules. Energy, storage, and maintenance budgets are treated as primary design constraints.

Results

Feasibility and quality criteria are demonstrated in laboratory and real world deployments up to twelve weeks. Signal stability, event fidelity, and energy demand are quantified. Key metrics are obtained, including hours of use per day, bout duration, inter event intervals, slope exposure, and abandonment hazard. These outputs are organised by a Need Accuracy Duration framework. Need reflects the questions of producers, consumers, or experts. Producers may require design targets and service triggers. Consumers may prioritise comfort, ease of use, fatigue, and independence. Experts may seek safety indicators and rehabilitation goals. High need combined with high accuracy favours richer fusion at shorter observation periods. Low need combined with extended observation favours sparse event sensing. Mixed contexts benefit from adaptive duty cycling and selective fusion. Practical rules are provided for sampling rates, calibration intervals, and power and storage budgets that align with a chosen triplet of need, accuracy, and duration.

Conclusions

Object mounted sensing enables months scale monitoring of user experience with minimal burden and without continuous user observation. Framing study design by need, accuracy, and duration makes the governing trade offs explicit and supports selection of feasible configurations that maximise insight into sustained use.

Keywords

Assistive technologies; Object-mounted sensing; Long term use; User experience metrics; Need Accuracy Duration framework.