

Application Fields and Innovative Technologies

Feasibility of Using Smart-Plug Television Data for Lifestyle Monitoring in Older Adults Living Independently B.M. Mathunjwa¹, S. Maiti¹, A. Banerjee¹, Y.L. Hsu¹. *Gerontechnology* 25(s)

Purpose Home monitoring technologies for older adults can be broadly categorized into wearable devices, ambient sensors, and household utility meters. While wearable and ambient sensing systems can be intrusive or require complex installation, household-level sensing offers a low-burden alternative. Smart electricity and water meter data have previously been used for long-term lifestyle monitoring of older adults living independently [1]. However, the potential of smart plugs connected to entertainment appliances, such as televisions, remains largely unexplored. This study investigates the feasibility of using smart-plug television data to monitor daily activities and examines its complementary role alongside sleep monitoring to improve overall activity coverage. **Method** A smart plug was installed between the television and the wall socket in the home of an independently living older adult. Power consumption was recorded at 10-second intervals, generating a continuous stream of wattage (W) measurements (Figure 1, top). Readings of 0 W indicated that the TV was powered off, while values around 12 W corresponded to standby mode. To ensure robustness across different TV models and prevent false detections, an ON-threshold of 20 W was applied; values equal to or above this threshold were classified as TV usage events. TV usage events were defined as periods during which power values exceeded the threshold. Single-sample spikes were removed to avoid noise-induced false positives. Daily TV activity was then aggregated into 15-minute intervals, labeled “1” when TV usage occurred and “0” otherwise (Figure 1, bottom). The resulting activity pattern was analyzed in relation to sleep monitoring availability for the same day [2], demonstrating how TV usage provides behavioral information during waking periods when in-bed or sleep is not observed. **Results and Discussion** The smart plug-based approach reliably identified daily TV usage patterns and generated structured activity representations over the monitoring period; Figure 2 presents a representative example from a single day. Figure 2 (top) compares the daily TV usage pattern with the corresponding sleep data for the same day (Figure 2, bottom) [2], illustrating post-sleep and wake-time behaviors that are not captured by sleep monitoring alone. TV activity was observed during periods when no in-bed or sleep data were available, demonstrating the complementary value of appliance-based monitoring. These observations suggest that TV usage data can extend activity coverage beyond sleep, particularly during morning and evening hours when older adults are awake but not engaged in in-bed activities. When integrated with sleep monitoring, appliance usage provides a more complete representation of daily routines and engagement patterns at the individual level. While this study focused on television usage, the same smart plug-based approach may be extended to additional household appliances to further broaden observable activity coverage. Future work will incorporate norm-based analysis of TV and appliance usage patterns to support automated detection of long-term behavioral deviations, enabling scalable and unobtrusive lifestyle monitoring for older adults living independently. This exploratory case study involves a single independently living older adult, and the results should not be interpreted as evidence of effect size or generalizable outcomes. Rather, the findings demonstrate technical feasibility and provide illustrative examples of appliance-derived activity patterns. Potential confounding factors, including the presence of other individuals in the home and background television activity (e.g., the television remaining on during sleep), were considered during interpretation, with television usage treated as an indicator of appliance activity rather than confirmed user engagement.

References

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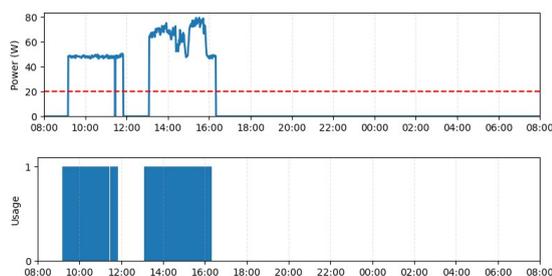


Figure 1 Power consumption data (top) converted to TV usage (low)

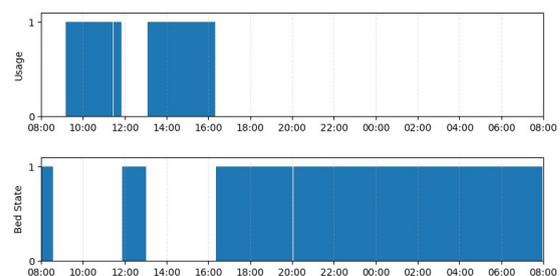


Figure 2. Comparison of daily TV usage pattern and sleep activity, illustrating post-sleep behaviors not captured by sleep monitor