

Research on AMI Data Applications for Home Care Services

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1. Research Background and Objectives

With the growing prevalence of Advanced Metering Infrastructure (AMI), access to electricity usage data is no longer limited by traditional meters. Beyond the primary function of recording electricity usage for billing purposes, AMI data contains a wealth of hidden information regarding electricity usage patterns.

According to demographic data from the Ministry of the Interior, Taiwan entered the stage of an "aging society" in 1993 (defined by the United Nations as a society where more than 7% of the population is aged 65 or older). As the aging population continues growing, leveraging low-voltage AMI data to gain insights into the daily lives of the elderly can significantly enhance the precision and efficiency of social welfare services.

This research utilizes low-voltage AMI data to evaluate the "activity" and "regularity" of elderly residents' home electricity usage through field verification by recruiting demonstration households. Based on our research, we developed the "Electricity Usage Pattern Indicator," which has been launched in the Taipower App. The goal of this application is to facilitate remote care and interaction between family members and friends, even when they are living apart.

2. Home Care Field Verification Using Smart Meter Data

Our objective in this research is to transform residential AMI electricity usage data into electricity usage pattern indicators for seniors, enabling the detection of any deviations from their typical routines. In this research, we developed a "Health Status Dashboard", which enables users to understand multiple indicators,

electricity usage, and the well-being of the elderly residents in a visualized way. In addition to AMI data, this dashboard integrates other Smart Care Internet of Things (IoT) devices and flexibly combines heterogeneous data streams to facilitate observation from multiple perspectives.

As shown in Figure 1, the "Health Status Dashboard" includes the following elements:

- Two electricity indicators: "Activity" and "Regularity"
- Physiological indicator
- Sleep status
- User self-assessment
- Comprehensive status
- Electrical appliance usage chart
- Four-week pattern analysis chart

Specifically, the physiological indicator is obtained by pairing it with a blood pressure monitor, while sleep status is captured through a smart mattress.

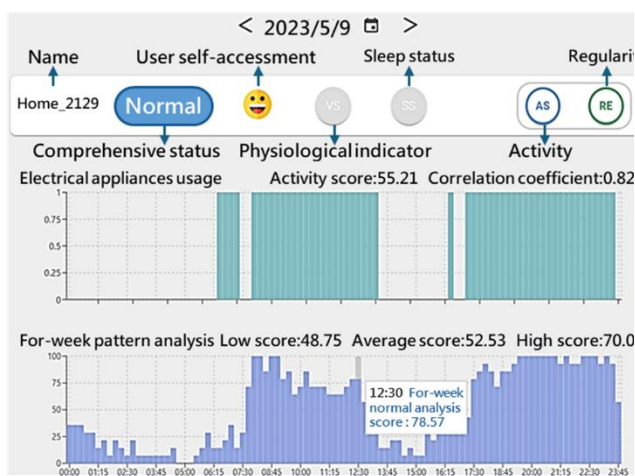
"Activity" and "Regularity" are derived through the following process:

- (1) Establish Background Electricity Thresholds: Background electricity thresholds are established using the users' AMI data, recorded at 15-minute intervals over the course of four weeks (28 days).
- (2) Convert to Electrical Appliance Usage States: Daily electricity usage data from the past four weeks, along with the data from the current date, are compared against the thresholds to determine the electrical appliance usage status (0/1). 0 represents background electricity usage (no active appliance use), while 1 signifies active

electrical appliances usage behavior.

(3) Generate Parameters for Establishing Indicators: Based on the electrical appliance usage states from the past four weeks, parameters such as the electricity usage pattern norm, the activity score, correlation coefficients, and high/average/low scores are established.

(4) Evaluate Two Electricity Indicators: The "Activity" and "Regularity" of the current date are evaluated based on the scores and correlation coefficients.



Source: Created by the authors

Figure 1. "Health Status Dashboard" User Interface

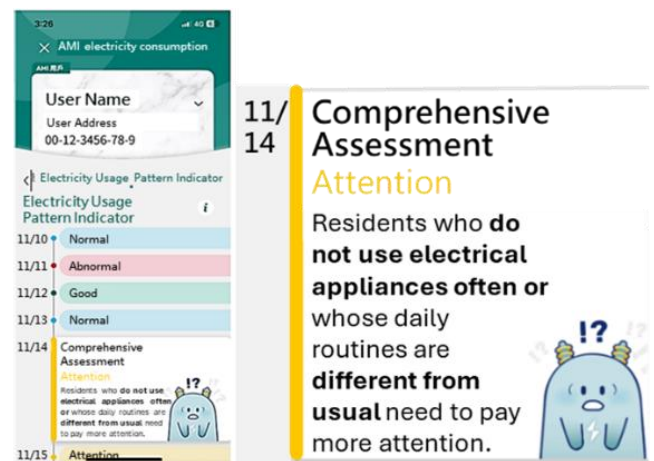
"Activity" reflects the extent of electrical appliance usage, while "Regularity" indicates the consistency of electricity usage patterns. We divided both indicators into four levels, represented by four different colors in descending order: green (Good), blue (Normal), yellow (Attention), and red (Abnormal). Users can understand the status of the elderly individual according to the colors. For instance, as shown in Figure 1, "Activity" was marked as Blue and "Regularity" as Green on May 9, 2023. This indicates that the individual used electrical appliances frequently on that day and maintained a highly consistent routine compared to the previous four weeks.

3. "Electricity Usage Pattern Indicator" Feature in the Taipower App

Based on our research, we developed the "Electricity Usage Pattern Indicator", which was launched in the Taipower App on March 25, 2025. Over 9,000 member households had subscribed by late April 2025.

The "Electricity Usage Pattern Indicator" provides users with the seven most recent analysis results. These results are presented through a comprehensive assessment, with an indicator color that shows whether "Activity" or "Regularity" requires more attention from users. The user interface is shown in Figure 2.

In Figure 2, the user's comprehensive assessment on November 14 was marked as yellow (Attention), which indicates that the user either "did not use electrical appliances frequently" or "exhibited a routine that differed from the usual patterns". By providing analytical indicators, we aim to foster mutual care among family and friends.



Source: Taipower App

Figure 2. "Electricity Usage Pattern Indicator" User

4. Conclusions and Suggestions

(1) Conclusions

- A. We leveraged low-voltage AMI data to establish electricity indicators, which were derived from the frequency of household appliance us-

age, and to determine whether the daily routines of the elderly residents living at home differed from their usual patterns. In addition, we designed a four-color signal system—green (Good), blue (Normal), yellow (Attention), and red (Abnormal)—to provide users with clear and intuitive information.

- B. Ultimately, the results of this research are presented as the "Electricity Usage Pattern Indicator" in the Taipower App. The indicator is available for subscription by all AMI users. Through the app's "Account ID Sharing" (Electricity Meter ID Sharing) feature, primary residents (e.g., seniors) can authorize others (e.g., family members living in different locations) to access their electricity usage pattern indicators. This feature enables users to

understand their own electricity usage pattern while facilitating remote care and sustained interaction with family and friends.

(2) Suggestions

The "Electricity Usage Pattern Indicator" provides a comprehensive assessment of daily electricity activity. For more detailed electricity data, users can check the "Electricity Usage Information" feature in the Taipower App to gain deeper insights into their own electricity usage behavior. We will continue to explore further possibilities for AMI data applications to fully leverage the added value of smart meters.