ABSTRACT

Knowing real-time information about the electricity consumption of each operating electrical appliance in a room is an essential step in energy consumption management to overcome the energy crisis. Meanwhile, electricity consumption can only be seen on the kWh meter. This tool offers total power use data, makes electricity management less efficient. The system built in this thesis solves the electricity management problem. The designed system is smart metering to monitor and identify electronic appliances for households based on their electricity usage profile by applying the Non-Intrusive Load Monitoring (NILM) technique in energy disaggregation. It implements the Semi-Supervised Learning method on ARM-based processors for load identification processes.

Based on the test results, it was selecting the most influential parameters in determining the electricity consumption pattern of electrical appliances obtained that the current, active power, and apparent power are the most relevant features. With a dataset approach that collected datasets with low sample frequency on ten appliances tested (i.e., fans, hair dryers, laptops, computers, phone chargers, dispensers, rice cookers, air conditioners, lamps, and irons), compared several algorithms (i.e., Random Forest, Decision Tree, K-Nearest Neighbor, SVM, and Naive Bayes) based on semi-supervised learning. Random Forest obtained the most optimal results with the highest cross-validation score at 0.99. The system is implemented for novelty load identification on single-phase power grids using selected features and algorithms, obtaining 96% accuracy on the total tested events and being able to categorize anomalous loads as "unidentified". The built system can also store new input data and update the training model every 24 hours as an implementation of semi-supervised learning techniques.

Keywords: Non-Intrusive Load Monitoring (NILM), Energy disaggregation, Electricity consumption, Appliances, Identification, Smart Metering