

# **Low Cost Framework for Non-Intrusive Load Monitoring (NILM) to Monitor Human Behavioral Pattern**

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## **Abstract**

Non-Intrusive Load Monitoring (NILM) is a technique that measures and samples voltage and current from an electrical power source in order to infer what devices or appliances are being used at a given time. A NILM system can monitor a single phase or 3-phase electrical system. This system basically captures those waveforms and then calculates the power waveforms for each phase. Thus, a NILM system may monitor the electrical system from a single reference point, such as a circuit breaker box. The associated software is the biggest challenge in this area, as it has to detect on/off events for each device using only the power waveforms.

This thesis presents a low cost framework design and hardware implementation of NILM designed to monitor residential activities inside the home. The motivation for this work is specifically to monitor seniors in their homes, such as is currently done in residential living communities such as TigerPlace in Columbia, Missouri. The goal of this work is to be able to monitor the usage of appliances and electrical devices inside the home, thereby allowing analysis of the daily, monthly, or yearly pattern of usage that might reveal changes in an everyday routine. A key criterion for developing a monitoring system for the home is to protect the privacy of residents; NILM is a natural choice because it does not require any intrusive sensors.

The development, testing, and results from deploying a prototype NILM system are described, along with ideas for extending the work of this thesis.