National Taipei University of Technology
Research Center of Energy Conservation (RCEC) for New Generation of Residential, Commercial, and Industrial Sectors
## Graduate Institute of Automation Technology
Prof.   Men-Shen Tsai

- **Education: PhD, EE Dept, University of Washington, USA**

- **Expertise: Industrial Internet of Things (IoT) Technology, Wireless Sensor Networks (WSNs), Signal Measurement, Feature Recognition, Smart Grid**

- RCEC Principal Research: Smart grid technology IEC61850,
  Non-Intrusive Load Monitoring

- RCEC Research Goals:

  (1) Substation Automation

  (2) Distributed Energy

  (3) Event Detection (accuracy:98%~99%)

  (4) Load Identification(accuracy:97%~98%)

Office: Room 605-1, Integrated Technology Complex
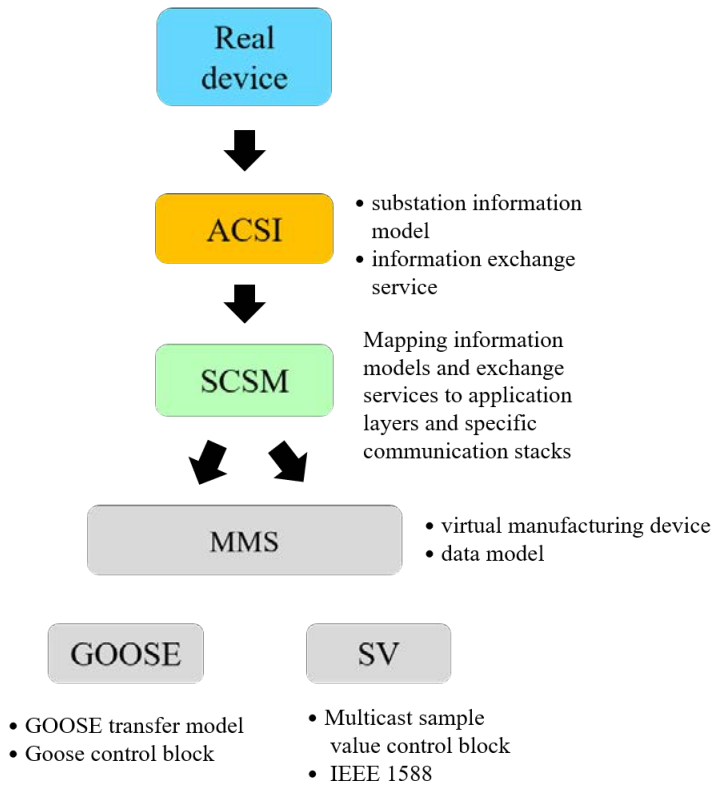
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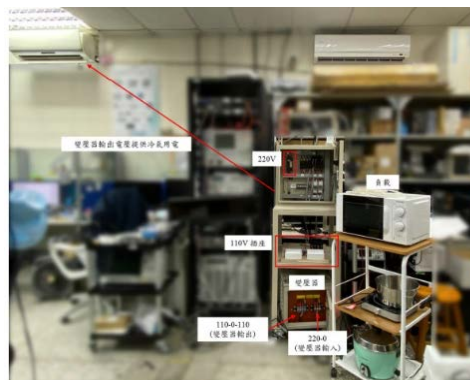
Power Consumption Environment

Research Method and Application

IEC61850 communication services

Real device

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ACSI
- substation information model
- information exchange service

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SCSM

Mapping information models and exchange services to application layers and specific communication stacks

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MMS
- virtual manufacturing device
- data model

GOOSE
- GOOSE transfer model
- Goose control block

SV
- Multicast sample value control block
- IEEE 1588

Researsch Focus:

1. **Construction of sampling system with Precision Time Protocol**
2. **Merging Unit**
3. **Construction of voltage triggered analog protection system**
4. **Low voltage control protection relay**
5. **Circuit Breaker IED**

Non-Intrusive Load Monitoring(NILM)

Power signal acquisition

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Event detection

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Load feature extraction

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Load identification
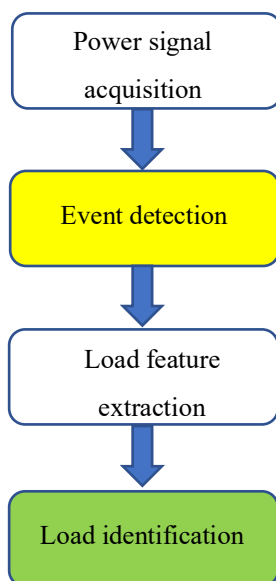
1.Event Detection:

probabilistic statistics : CUSUMs

Non-parametric test

Machine learning: CNN

Self-Attention Based

2.Load Identification:
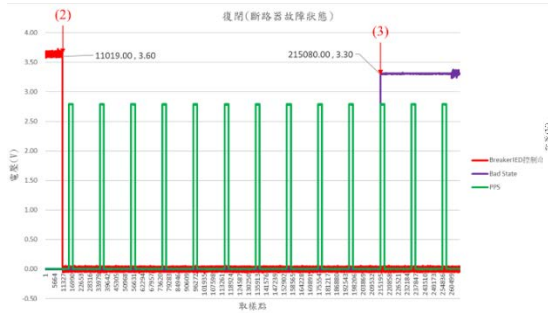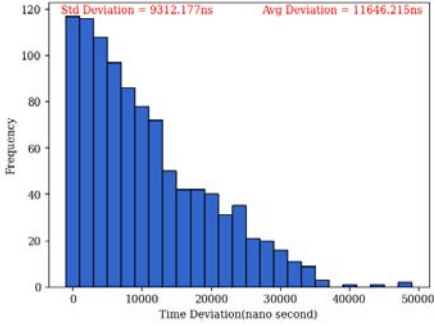
probabilistic statistics : Gaussian Mixed Model

Machine learning : 1D-CNN

2D-CNN

Siamese network

Transfer learning

Related Research Highlights
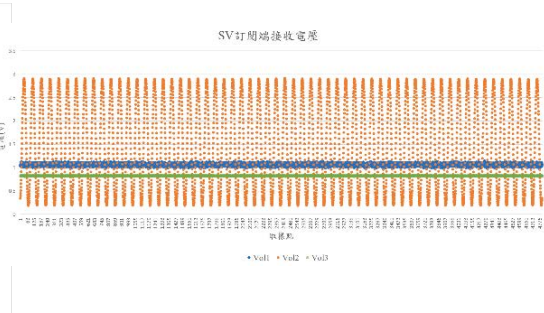
Implementation of an Under Voltage Protection System by Integration of IEC 61850 GOOSE and SV

GOOSE Transmission for IEC61850 Based Circuit Breaker Intelligent Electronic Devices
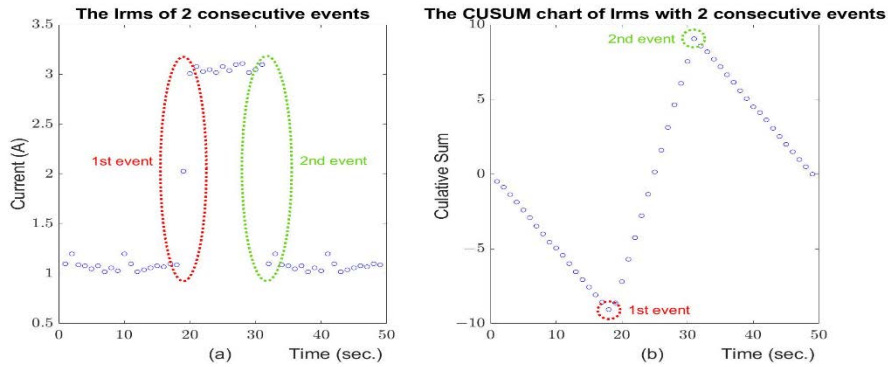
Results of Nonlinear-Load hybrid experiment