National Taipei University of Technology

Research Center of Energy Conservation (RCEC) for New Generation of Residential, Commercial, and Industrial Sectors

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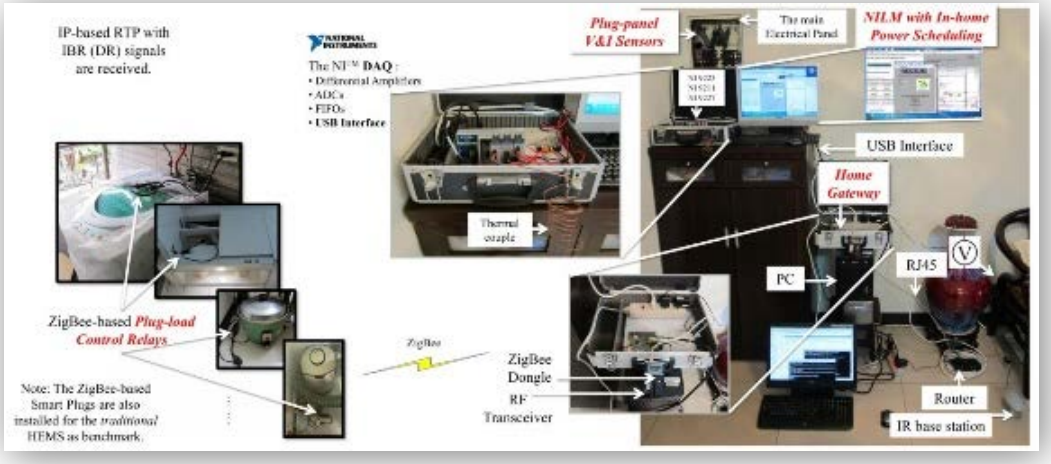
- **Education: PhD, Graduate Institute of Mechanical and Electrical Engineering, National Taipei University of Technology, Taipei, Taiwan**
- **Expertise: Internet of Things, Artificial Intelligence, Edge-/Fog-Cloud collaborative computing, Smart Grid technology**
- **RCEC Principal Research: Residential Smart Energy Management**
- **RCEC Research Goals:**

(1) Design, implementation and practical evaluation of Energy Management Systems based on Fog-/Edge-Cloud computing

(2) Smart power meters/smart plugs based on Fog-/Edge-Cloud computing

(3) Non-Intrusive Load Monitoring techniques/Prognostics and Health Management

(4) Energy Conservation/Energy Efficiency/Demand Response

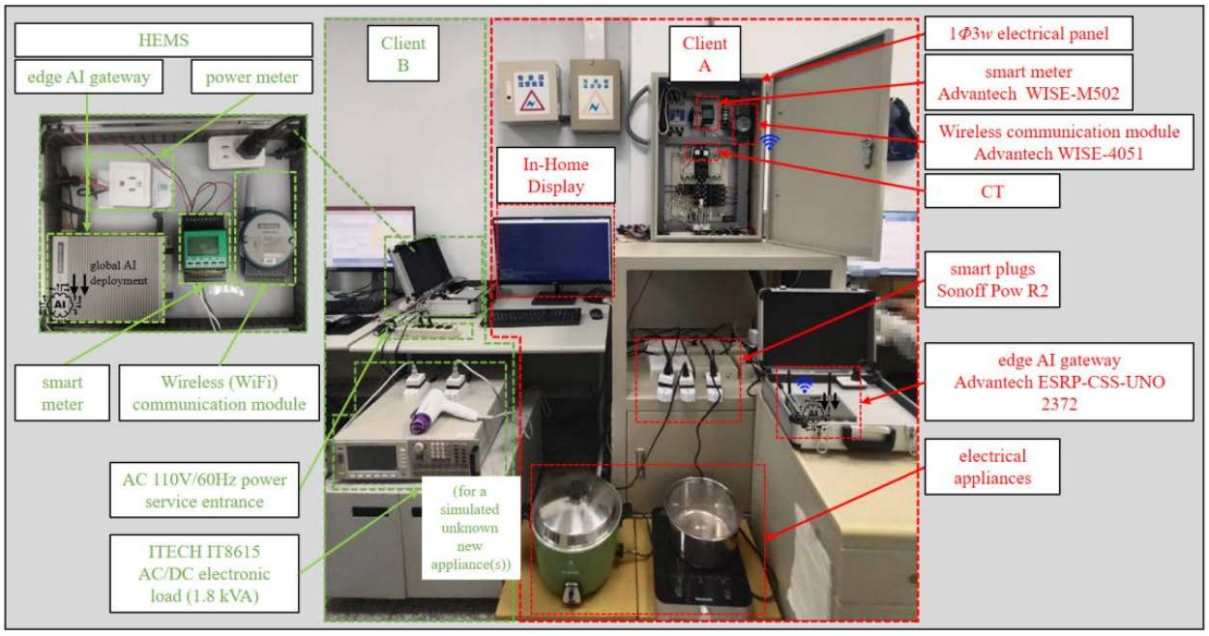


An advanced HEMS facilitated by NILM with Meta-heuristic-based Multi-objective in-home Load Scheduling

Research Method and Application

Active Distributed Residential Mains Energy Disaggregation based on Edge-Cloud Collaboration

Preliminary implementation of the proposed energy management framework utilizing the active edge-cloud collaboration mechanism for smart energy disaggregation at the edge

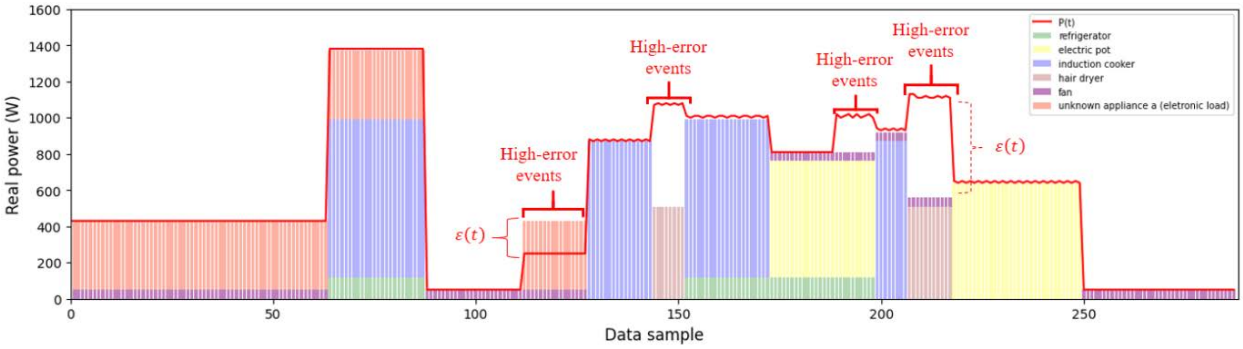


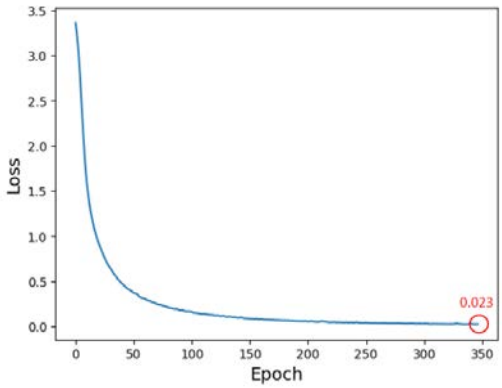
Related Research Highlights

Simulation scenarios demonstrating the proposed framework

		HEMS framework	client	ILM (e.g., a preliminary stage of energy disaggregation)	energy disaggregation	active edge-cloud collaboration	global knowledge sharing	electrical appliances					
								refrigerator	electric pot	induction cooker	hair dryer	fan	electronic load (a new appliance)
Scenario 1	demo 1.1	single field	A	✓	✓	×	-	✓	✓	✓	✓	✓	×
	demo 1.2			×	✓	✓		✓	✓	✓	✓	✓	✓
Scenario 2	demo 2	distributed multiple fields	A	✓	✓	✓	●	✓	✓	✓	×	×	×
											●	●	✓
			B	✓	✓	✓	●	×	×	×	✓	✓	×
								●	●	●			●
			C (new)	×	✓	✓	●	×	×	×	×	×	×
								●	●	●	●	●	●

Simulated power profile





AI training loss curve

Smart energy disaggregation results

		appliance class to be classified with obtained F_1 score by the corresponding AI model							
		refrigerator	electric pot	induction cooker	hair dryer	fan	unknown appliance a (electronic load)	unknown appliance b (electronic load)	unknown appliance c (electronic load)
AI model	old model	0.98	0.99	1.00	1.00	1.00	×	×	×
	new model a	0.98	0.98	1.00	1.00	1.00	1.00	×	×
	new model b	0.98	0.98	0.99	0.99	0.98	1.00	0.95	×
	new model c	0.99	0.99	0.98	0.98	0.99	1.00	0.94	1.00