

Overview

- A home energy management system is required to coordinate household appliances usage and distributed renewable energy resource and storage.

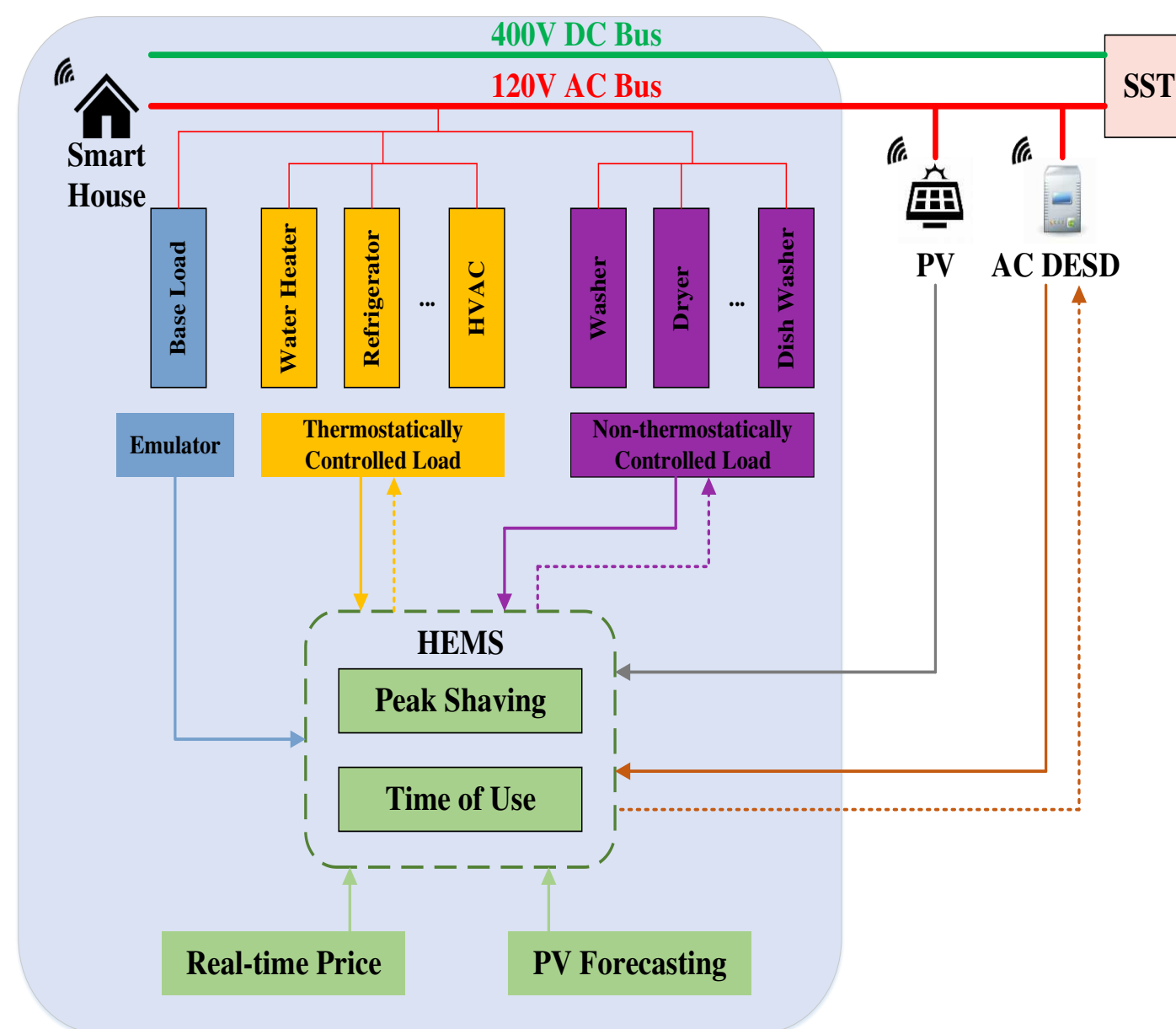


Fig. 1 A Layout of the Physical Hybrid Smart Home Test System at FREEDM System Center.

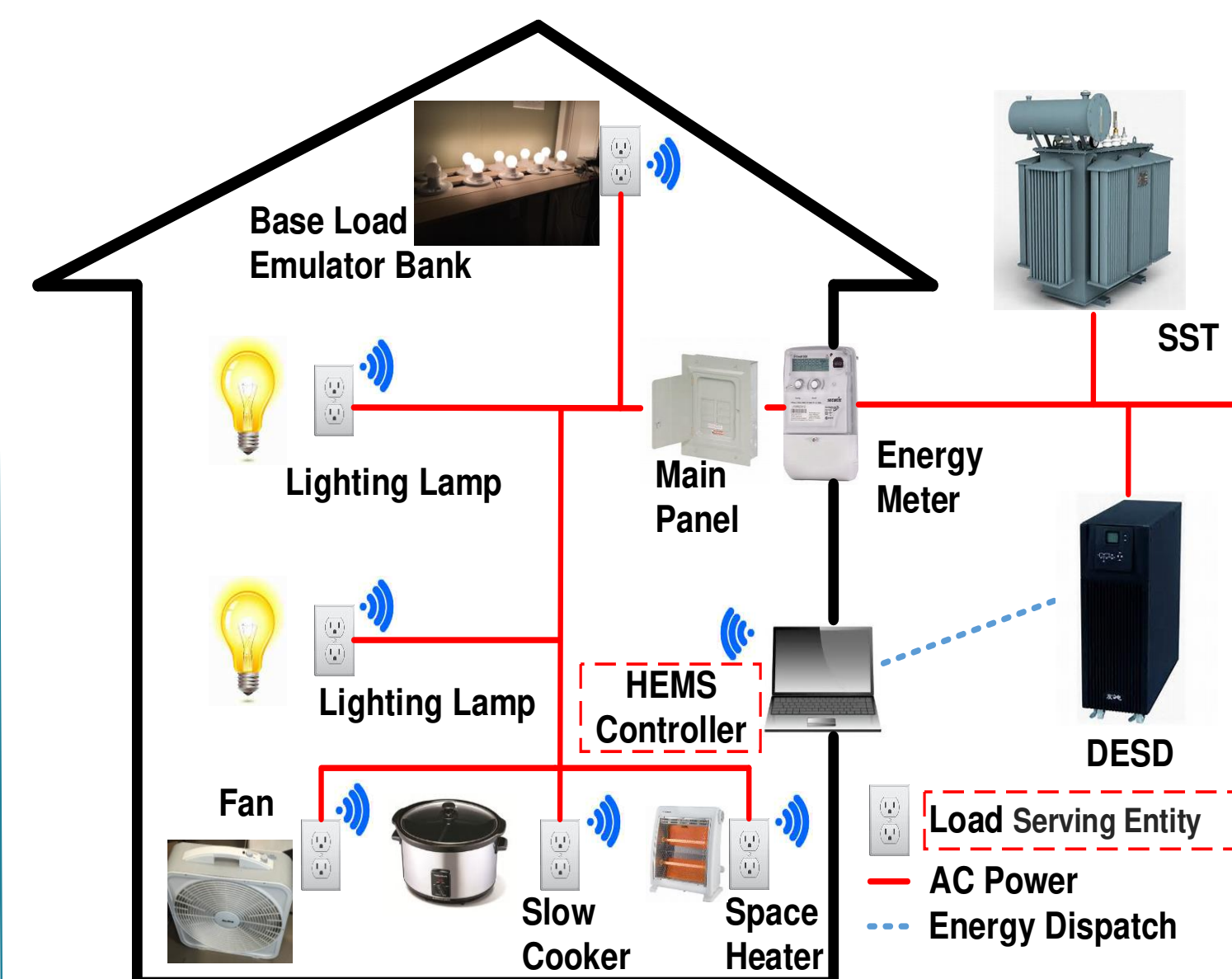


Fig. 2 The Architecture for HEMS Test System

Hardware Setup

- HEM System
 - System inputs: power measurements and environment information
 - Communication method: ZigBee and Message Queue Telemetry Transport (MQTT)

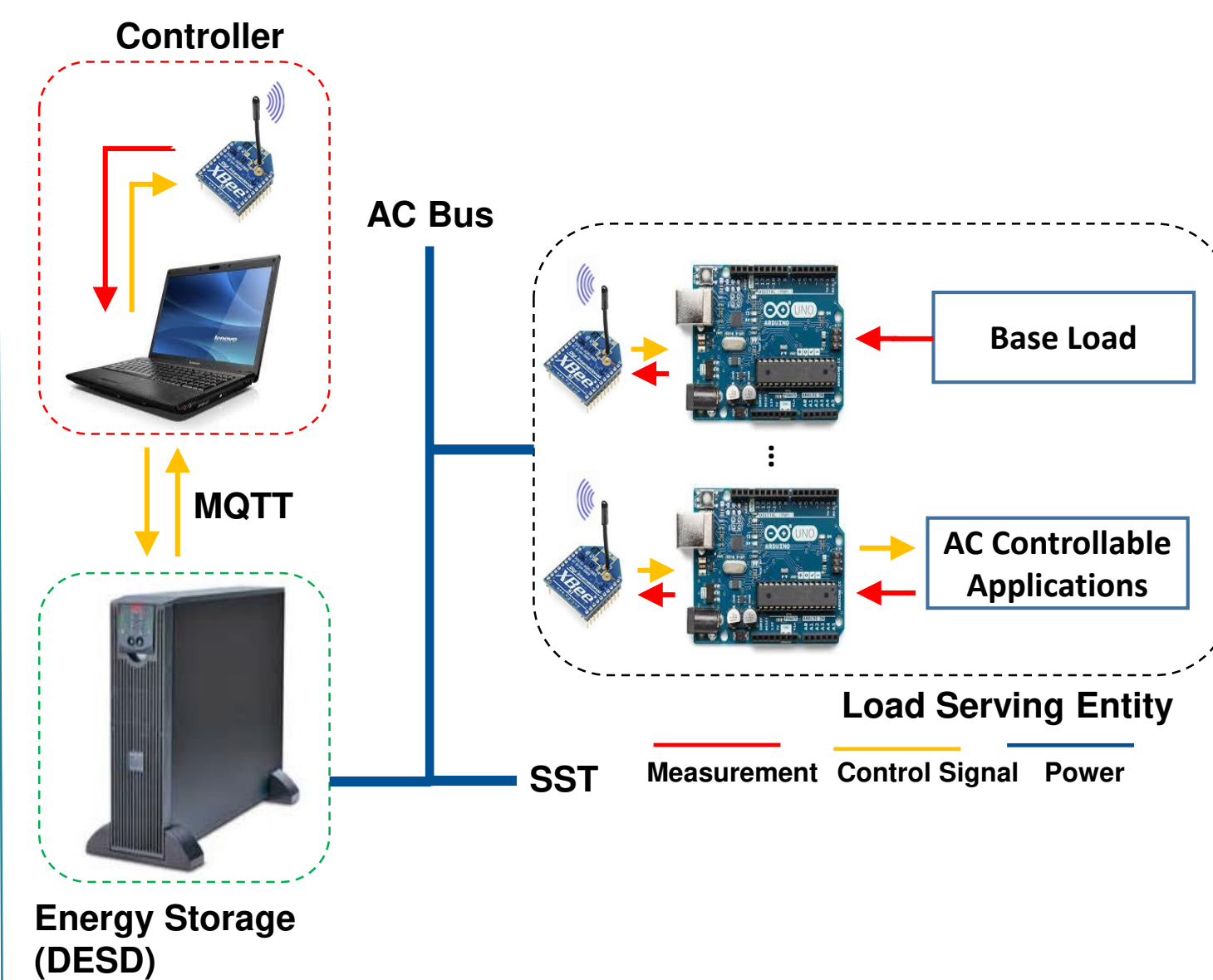


Fig. 3 Physical Approach for HEMS

- Arduino based Load Agent
 - Smart Power Meter.
 - Data Receiver and Sender.
 - Local Controller.



Fig. 4 Load Agent Setup for HEMS System Testbed

Results

- To implement the HEM system, a cost-effective and user-friendly hardware test system is designed and implemented.



Fig. 5 HEMS testbed in FREEDM System Center

- Some result from the simulation platform GUI
 - Demonstration strategy selection
 - Appliance setting
 - Actual and control load profile
 - Renewable energy: energy storage SOC and dispatching command
 - Appliance status
 - Appliances status manual control
 - Appliance status monitoring
 - Cost comparison before/after control

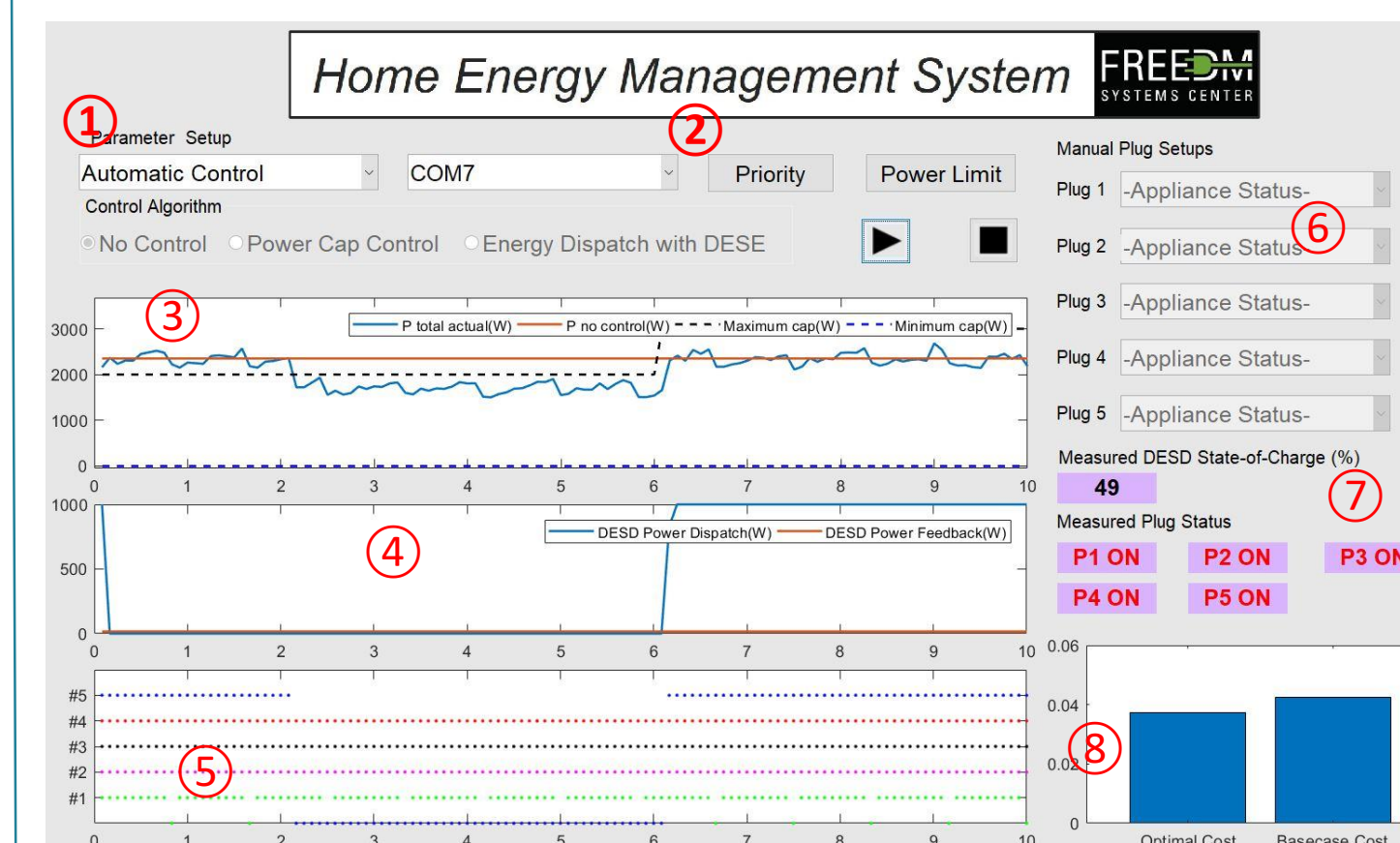


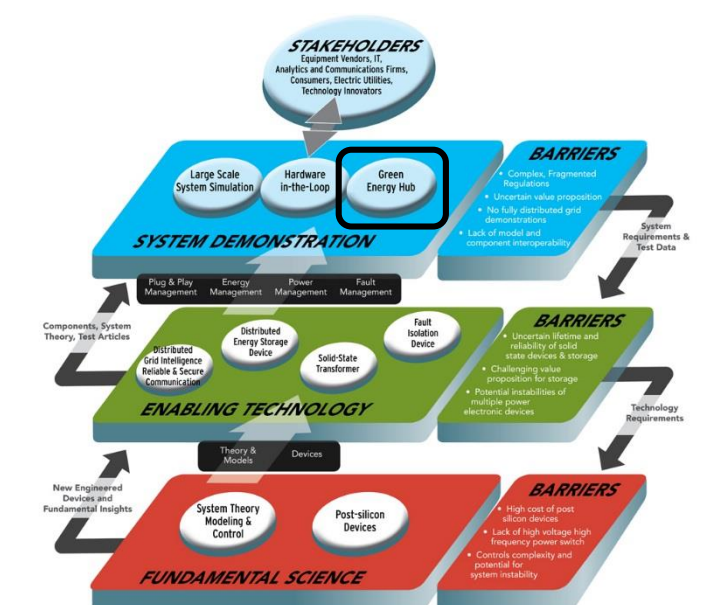
Fig. 6 Main interface of HEMS simulation GUI

Conclusion

- This research aims to develop a practical home energy management system with the main objective to minimize residential customers' electricity bill.
- The hardware system consists of a locally centralized energy management unit (EMU), smart switch for each appliance and a ZigBee based home area communication network.
- A novel design of hybrid controller is proposed, which allow the HEMS to control house appliance with minimum delay and taking the user comfortableness into account.
- The software design considerations are presented, which consist of a user interface, load modeling, load forecasting and load scheduling.

References

- Kuzlu, Murat, Manisa Pipattanasomporn, and Saifur Rahman. "Hardware demonstration of a home energy management system for demand response applications." IEEE Transactions on Smart Grid 3, no. 4 (2012): 1704-1711.
- Han, Dae-Man, and Jae-Hyun Lim. "Smart home energy management system using IEEE 802.15. 4 and zigbee." IEEE Transactions on Consumer Electronics 56, no. 3 (2010): 1403-1410.



Partners

