Chapter 3
Implementation of Smart Grid Test Bed Using OPNET and PLC

ABSTRACT

In this chapter, a design that allows testing of the performances of various models was developed with OPNET for the simulations in the PLC-base data link layer. As the model proposed earlier, the design includes a smart home and a Smart Grid environment where a comparison between Zigbee and WiMax-based models can be performed. The Smart Grid Test Bed has been implemented using OPNET and Power Line Communication is proposed in this book. It is being designed to allow Test Bed experiments in four layers among seven OSI layers. This chapter is organized as follows: the physical layer and datalink layer for Smart Grid Test Bed in Section 1; the transport layer for Smart Grid Test Bed in Section 2; and finally, application layer for Smart Grid Test Bed in Section 3.

1. PHYSICAL LAYER AND DATALINK FOR SMART GRID TEST BED

A comparative analysis of performances between Zigbee and WiMAX has been conducted by deploying twelve terminal nodes in each home network that uses either of these three communication technologies. For the Zigbee scenario, Zigbee Coordinator, six Zigbee Routers and twelve Zigbee end-devices were deployed whereas one Server, two Routers, and six base stations, and twelve terminal nodes were deployed for the WiMAX scenario to compare...
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data transfer rates between a coffee pot and the server, as an example. Figure 1, Figure 2 and Figure 3 represent Mobile WiMAX and Zigbee and Power Line Communication scenarios respectively and show complex network systems in a Smart Grid Test Bed.

Figure 4 shows scenarios of performance evaluation. The Mobile WiMAX-based node model and router model will be demonstrated in the future extended study. The four separate electric cookers are being displayed in each scenario but this is to show the readers that other appliances can be used in the system replacing the coffee pot but the same interface will be used for the system. Applicable appliances could be automated vacuum cleaners, Smart Closets, or CCTVs with mobility and intelligence, all of which are expected to be produced in the future.

1.1 Implementation of Zigbee Architecture for Smart Grid Test Bed

Zigbee refers to the standard technology for the small-scale wireless Mesh networks that feature low-cost, low-power, long battery life, higher security and low-level transmission speed. Because of its low-cost characteristic, a wide range communication is possible with low-power requirement by deploying

Figure 1. Mobile WiMAX scenario
Optimal Design of Modified Power System Stabilizer Using Multi Objective Based Bio Inspired Algorithms
www.igi-global.com/article/optimal-design-of-modified-power-system-stabilizer-using-multi-objective-based-bio-inspired-algorithms/210124?camid=4v1a

System Reliability
www.igi-global.com/chapter/system-reliability/195991?camid=4v1a