Chapter 1

IoT-Based Management of Smart Microgrid: Smart Energy System

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ABSTRACT

The present power grid is going through a substantial and radical transformation process. Unification of existing electrical infrastructure with information and communication network is an unavoidable requirement of smart grid deployment and operation. The key characteristics of smart grid technology are full duplex communication, advanced metering infrastructure, integration of renewable and alternative energy resources, distribution automation and complete monitoring, as well as control of entire power grid. Smart grid communication infrastructure consists of varied and hierarchical communication networks. Application of smart grid can be realized in the various the facets of energy utilization. Internet of things also plays a pivotal role in smart grid infrastructure as it provides a ubiquitous communication network. This chapter describes an implementation of internet of things (IoT)-based wireless energy management system for smart microgrid communication infrastructure.
INTRODUCTION

The power ‘Grid’ is a generation, transmission and distribution network that carries electrical energy from power plants to customer premises. Smart grid technology is an innovatory move toward improvisation in an existing power grid. It can be envisioned as “Technology for all and everything”. Smart Grid is an automated and largely distributed energy generation, transmission and distribution network. It is characterized by full duplex network with bidirectional flow of electricity and information (Farooq & Jung, 2014). It is a close loop system for monitoring, control and response. Smart Grid network integrates an electrical distribution system with information and communication networks (Mahmood et al., 2015). Smart grid technology ensures consistent, proficient, resilient and advanced energy distribution system with enormous features. Integration of renewable energy resources will lead to reduced carbon footprint and emissions. It can be defined in various ways as per its functional, technological or beneficial aspects. As per the definition given by U.S. department of energy, “A smart grid uses digital technology to improve reliability, security, and efficiency (both economic and energy) of the electric system from large generation, through the delivery systems to electricity consumers and a growing number of distributed-generation and storage resources” (United States Department of Energy, 2009). Various layers of Smart Grid deployment involve diverse set of wired and wireless communication standards. The scope of Smart grid is from electrification to web of all things. Internet of things is an unavoidable component of ubiquitous Smart grid communication infrastructure. IoT is a convergence of various communication protocols for web based monitoring and controlling applications. It comprises of interconnected and heterogeneous entities. Smart grid technology is intelligent in terms of automation and control (Saputro et al., 2012). Apart from these brainy features, clean and green energy generation is the most striking aspect of Smart grid technology. Diminution of carbon emissions through distributed generation using renewable energy resources is the central purpose of Microgrid. Consumers can monitor their energy consumption statistics, take decisions based on priorities and prices, control their appliances and generate revenue by selling extra energy to energy service provider through renewable energy generation. Energy usage statistics is communicated to central home monitor and regulator which is a part of AMI and it further communicates this statistics to main grid through various intermediate networks for billing, fault diagnosis, control and management of generation, transmission and distribution of energy. This makes the process of generation and consumption of energy transparent and reliable. Smart microgrid is intended to expedite the usage of renewable energy sources. An intermittent and non dispatchable nature of renewable energy sources necessitates consistent monitoring and control. This paper explores web based monitoring and control of
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