Chapter 18
Building Automation Systems: Recent Trends, Design and Development

Jignesh G. Bhatt
Dharmsinh Desai University, India

ABSTRACT

Building Automation Systems (BAS) have started attracting focus of global research community and demonstrating rapid growth potential due to their transformation from the legacy stand-alone security systems into intelligent computerized wired or wireless communication technology based solutions. Amid rising concerns over energy and security globally, BAS demonstrates commendable outperformance with promising research and commercial opportunities. Rising energy costs, stringent energy requirements and vibrant, but abnormal-unpredictable swings in environment, etc. all have contributed immensely as driving forces for BAS developments. This chapter presents the learning outcomes from author's research work and experiences in terms of instrumentation engineer's perspective towards the focused area nicely supported by literature review as well as practical hands-on exposure. The chapter judiciously puts forth historical and modern perspectives in overall development of BAS for reader's digest.

1. INTRODUCTION

Building Automation System (BAS) is a data acquisition and control system that incorporates various functionalities provided by the control system of a building. As mentioned by (Kastner, Neugschwandtner & Newman, 2005), in general, BAS are also known by other names such as: Energy Management Control Systems (EMCS), Building Management Systems (BMS), Building Energy Management Systems (BEMS), Facility Management Systems (FMS) and so on. As presented by (Granzer, Kastner, Neugschwandtner & Praus, 2006), Modern BAS is a computerized, intelligent network of electronic devices, designed to monitor and control lighting, internal climate and other systems in a building resulting in optimized energy usage, safety, security, information, communication and entertainment facilities. (Kastner, Neugschwandtner & Newman, 2005) has also mentioned that Home Automation System (HAS) or domotics is possibly the system believed to have the highest level of functional similarity to building automation.

DOI: 10.4018/978-1-5225-8060-7.ch018

But the former has significantly different characteristics. While BAS focuses on financial benefits, the domotics focuses on comfort and mental peace. Domotics are of comparatively quite smaller scale, with low costs of equipment as well as commissioning and maintenance.

As per (Bhatt, 2009), BAS have been deployed to improve the indoor climate as well as to reduce the operational costs. As mentioned by (Kastner, Neugschwandtner & Newman, 2005) and (Bhatt & Verma, 2010), originally, BAS mostly configured to operate with HVAC systems. To further enhance overall building management, reduce costs incurred in lighting, safety, security, entertainment, etc. of the building and for supervision of asset movements, BAS are being employed. (Bhatt & Verma, 2015) have mentioned that BAS, in general, maintains the internal climate of building within a specified range by regulating temperature and humidity, regulates lighting based on parameters like occupancy, ambient light and timing schedule, monitors system performance and device failures; and generates audio visual email and/or text notifications to building O&M staff. The BAS reduces building energy consumption and thereby, reduces operational and maintenance costs as compared to an uncontrolled building. A building controlled by a BAS is often referred to as an Intelligent Building. Typically, the functionalities like entertainment, communication and information exchange need high data rates, while the features like automation, safety and security need low data rates but low latency, high network reliability and data security. Moreover, the BAS designs for residential buildings must be cost-effective and affordable to common citizens and easy to operate without specialized training.

The chapter begins with introduction section covering preliminary information, and next, background section including recent trends, historical data in brief regarding evolution as well as literature review covering review of recent works. The next section, Technological study includes technical details regarding BAS such as generalized and functional architectures, device classes, as well as major wired and wireless communication technologies. Design and development section covers design objectives, functionalities being implemented, architectural modularity and data communication in a building, Solutions and Recommendations section starts with clarifying differences between security system and building automation system. Later, the same section presents in-depth coverage of wired solutions and wireless solutions. In this section, wired as well as wireless versions of home security system and building automation system developed by author have been covered. Future research directions section throws light over possible extensions and future scope of the work presented along with upcoming opportunities. Finally, the chapter ends with conclusions, acknowledgments and list of references cited. Major attractions of this chapter includes, simple but efficient drafting, justification to the focused topic and extensive discussions supported by interesting diagrams and more importantly, the work contribution by the author of this chapter.

2. BACKGROUND

2.1 Recent Trends

Recently, almost all countries have been observed revamping their infrastructure facilities, especially the electric power grids. In many developing countries, in synchronization with developed countries, conventional electric grids are being replaced by smart grids. As presented by (Bhatt, 2013) and (Bhatt, Shah & Jani, 2014), Smart Grid (SG) has been referred as integrated network to converge an existing power grid with an information and communication infrastructure. It has caused the dynamic change and