

Development of Smart Electricity Distribution Algorithm for Multi-Source and Segmented Loads in Buildings

Abdul-Azeez Dauda, Stephen Oyewobi, and Supreme Ayewoh Okoh

Department of Telecommunication Engineering, School of Electrical Engineering & Technology
Federal University of Technology, Minna, Niger State, Nigeria
abdulazeezdauda6@gmail.com, oyewobistephen@futminna.edu.ng, okoh@ieee.org

Umar Suleiman Dauda

Department of Electrical & Electronic, School of Electrical Engineering & Technology
Federal University of Technology, Minna, Niger State, Nigeria,
dauda.umar@futminna.edu.ng

Abstract

Nigeria has encountered numerous power issues in recent years, including limited and irregular power supply, high power costs, and underdeveloped power facilities, all of which have had major negative consequences on the country's socio-economic development. To improve power availability in buildings and ensure adequate usage efficiency, this paper presents the development of a smart electric power distribution algorithm for multi-source and segmented loads, for implementation on distribution boards. This research aims to develop an algorithm that may be used to support the current building wire infrastructure in Nigeria, allowing for 24/7 reliable power supply and effective management of limited power supply in buildings. It employs a multi-source and segmented load system to provide reliability and energy efficiency measures to balance power supply and demand in buildings. Actual data from offices in the engineering complex of Niger State Polytechnic Zungeru, Nigeria, was used to simulate the developed system in MATLAB Simulink. Results showed that the developed algorithm conserved power by 33.71% compared to the conventional distribution board.

Keywords

Smart distribution board, Smart distribution algorithm, multi-source, segmented load, energy efficiency.

1. Introduction

Our contemporary society has become very dependent on the availability of electric power (National Institute of Open Schooling 2019). The consumption of electrical energy is a part of our daily life in such a depth that we can almost not do without adequate supply of electricity. We constantly need electrical energy for domestic and industrial purposes. A nation's development is measured by the per capita consumption of electrical energy by its citizens (Olugbenga et al. 2013). Energy plays a crucial role in the global economy's expansion and socioeconomic development. The ability to access energy is essential for an economy to grow sustainably, and its absence could have serious ramifications that are harmful to society as a whole (Onyekwena et al. 2017). Industries, agriculture, transportation, and the service sector are important sections of the economy where energy cannot be substituted. Future energy demand is anticipated to rise in response to rising global population, living standards, and fast industrialization (OECD 2012)

However, the supply of electricity constantly faces challenges ranging from generation down to the final consumption (Sambo et al. 2012). The inability to store electricity in its alternating form (a.c) is one of the greatest problems facing the generation and supply of electrical energy (El et al. 2020). It has to be consumed as it is being generated and still, the rate of consumption has consistently exceeded the rate of generation. Also, the world's rapid population increase and industrial growth has made this even a more pressing challenge. The available energy is very limited to sustain the booming world population and this has consequently influenced the high cost of the little available supply.