

Feasibility analysis of standalone PV powered battery using SEN for Smart Grid

ABSTRACT

In Smart Grid (SG) communication network, sensors integrated communication radios namely ZigBee, Wi-Fi, and Bluetooth are becoming urgent and crucial part of SG wireless communication. Sensor nodes are generally battery powered. With the enhancement and huge utilization of sensor technologies, batteries have not been improved significantly at the same pace. However, batteries are essential to power the sensor nodes and there is no alternative of this energy bank. Therefore, to provide seamless power to the nodes is a challenge when the nodes are meant for integrating distributed renewable generations for years. Necessitate of the battery replacement is not often cost effective when the batteries are drained out. This paper presents a feasibility study of standalone Photovoltaic (PV) powered battery using Sensors-radios integrated Embedded Node (SEN) for SG application. In this study, we have analyzed charging characteristics of a lead-acid battery that can be recharged during day time by a PV module. The aim of this research is to testify the two simultaneous jobs- (i) the battery is sufficient to power Sensors-ZigBee integrated Arduino (SZA) for at least one day operation, (ii) scrutiny the optimal size of PV for recharging the battery considering three different day variations- average, cloudy, and full rainy day. The result from real data analysis reveals that the module is sufficient to recharge the battery on an average day; however, it is not sufficient for full cloudy or full rainy day. Finally, a mathematical model is obtained from regression analysis that shows battery internal resistance is exponential to voltage on both full cloudy and rainy day, but it is linear on average day.

Keyword: Photovoltaic; Smart grid; Wireless sensor; Zigbee radio