









# Monitoring of renewable energy systems by IoT-aided SCADA system

Md Ohirul Qays<sup>1</sup>  | Musse M. Ahmed<sup>1</sup>  | M. A. Parvez Mahmud<sup>2</sup>  |  
Ahmed Abu-Siada<sup>3</sup>  | S. M. Muyeen<sup>4</sup>  | Md Liton Hossain<sup>3</sup>  |  
Farhana Yasmin<sup>1</sup>  | Md Momtazur Rahman<sup>5</sup> 

<sup>1</sup>Faculty of Engineering, Universiti Malaysia Sarawak (UNIMAS), Kota Samarahan, Malaysia

<sup>2</sup>School of Engineering, Deakin University, Geelong, Victoria, Australia

<sup>3</sup>Discipline of Electrical and Computer Engineering, Curtin University, Bentley, Perth, Australia

<sup>4</sup>Department of Electrical Engineering, Qatar University, Doha, Qatar

<sup>5</sup>Electron Science Research Institute, Edith Cowan University, Joondalup, Western Australia, Australia

## Correspondence

S. M. Muyeen, Department of Electrical Engineering, Qatar University, Doha 2713, Qatar.

Email: [sm.muyeen@qu.edu.qa](mailto:sm.muyeen@qu.edu.qa)

## Abstract

With the rapid increase of renewable energy generation worldwide, real-time information has become essential to manage such assets, especially for systems installed offshore and in remote areas. To date, there is no cost-effective condition monitoring technique that can assess the state of renewable energy sources in real-time and provide suitable asset management decisions to optimize the utilization of such valuable assets and avoid any full or partial blackout due to unexpected faults. Based on the Internet of Things scheme, this paper represents a new application for the Supervisory Control and Data Acquisition (SCADA) system to monitor a hybrid system comprising photovoltaic, wind, and battery energy storage systems. Electrical parameters such as voltage, current, and power are monitored in real-time via the ThingSpeak website. Network operators can control components of the hybrid power system remotely by the proposed SCADA system. The SCADA system is interfaced with the Matlab/Simulink software tool through KEPServerEX client. For cost-effective design, low-cost electronic components and Arduino Integrated Development Environment ATmega2560 remote terminal unit are employed to develop a hardware prototype for experimental analysis. Simulation and experimental results attest to the feasibility of the proposed system. Compared with other existing techniques, the developed system features advantages in terms of reliability and cost-effectiveness.

## KEYWORDS

energy and asset management, hybrid renewable energy system, Internet of Things, online condition monitoring