Using wire and wireless technologies to analyze and evaluate the performance of a control and surveillance network for renewable energy system

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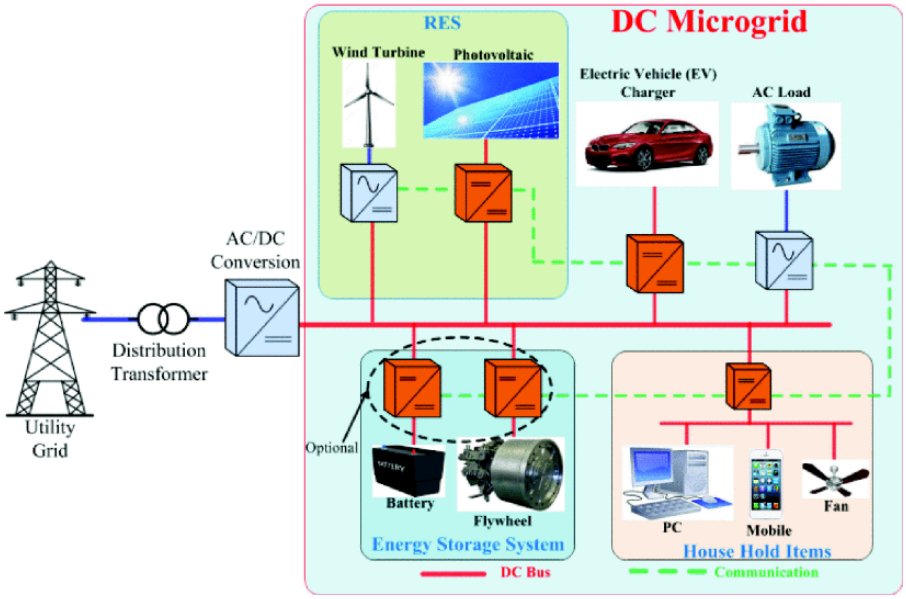
Abstract

The integration of renewable energy systems and the electrical power system has a great interest both in academia and industry. In recent years the main goal of all researchers has been to implement a smart grid that allows each house to meet its special needs of energy from renewable energy sources, such as solar or wind. As a result of the evolution of the control and surveillance systems that rely on the collection of data in real time and energy management and control of the renewable energy systems based on the performance of the telecommunication infrastructure, the process of providing energy from renewable energy sources for each home has become possible.

This paper focuses on the analysis and evaluation of performance of a control and surveillance network using both wired and wireless technologies (Ethernet, Wi-Fi, ZigBee) to monitor and control distributed Energy Systems, which include small wind turbines (WTs) photovoltaic systems (PV), through the definition of different types of wiring and instrument to monitor the status of renewable energy systems for homes and smart buildings using OPNET.

About scientific research.

The final level of integration of renewable energy systems is expected to be wide. Since wind and solar power are the most famous examples, the focus will be on our study of these systems as an example of renewable energy systems.
There are two types of renewable energy systems:
- The widespread systems are large-scale wind and solar farms located in remote areas.
- Limited systems such as small wind turbines WTs and photovoltaic PV panels connected to the electrical distribution system. Our focus in this study will be on renewable energy systems in limited systems.
The size of the control and control network varies according to the renewable energy system used. The control and control network is used in the case of limited systems either in the standalone mode or the main network connection mode, where the investor can feed the excess power in the network or store it using energy storage systems to be used when needed.
The management and operation of renewable energy systems face many challenges, namely, achieving a reliable, safe and cost-effective process that primarily means a perfect integrated control and control network to ensure proper system performance. As a result, the primary objective of the researchers was to work on developing these networks, starting from the communications infrastructure as the main element in the control networks, which allows monitoring the operation and measured information and securing the transmission of control signals between the renewable energy systems and the control center.
Some studies have focused on the design of a solar and wind hybrid system that is used in rural and remote areas and consists of solar panels, wind and load generators, batteries and can be operated in a networked or off-grid mode.
In another study, the researchers designed and carried out a real-time solar wind-controlled solar system, and the current and voltage measurements of the system are carried out using sensors and sensors for voltage and current.
Some studies have been based on the study of a distributed control and control network using Ethernet technology to monitor a hybrid solar photovoltaic system and a diesel generator in a local power grid where direct communication links have been established between the hybrid system and the control center.
Some researchers have also been interested in developing a graphical user interface using LabView to develop a low-cost monitoring system using ZigBee technology to monitor real-time measurements such as voltage, current, and power per unit.
We note from these studies that the main focus is on the aspects of electrical engineering and electrical control using control and control networks based on the communication infrastructure and networking of the system with sensors and executive devices. But they did not build a specific architecture for the network but relied on the communications infrastructure, which is not considered the best solution because of the constraints or obstacles that may exist in deploying the system.



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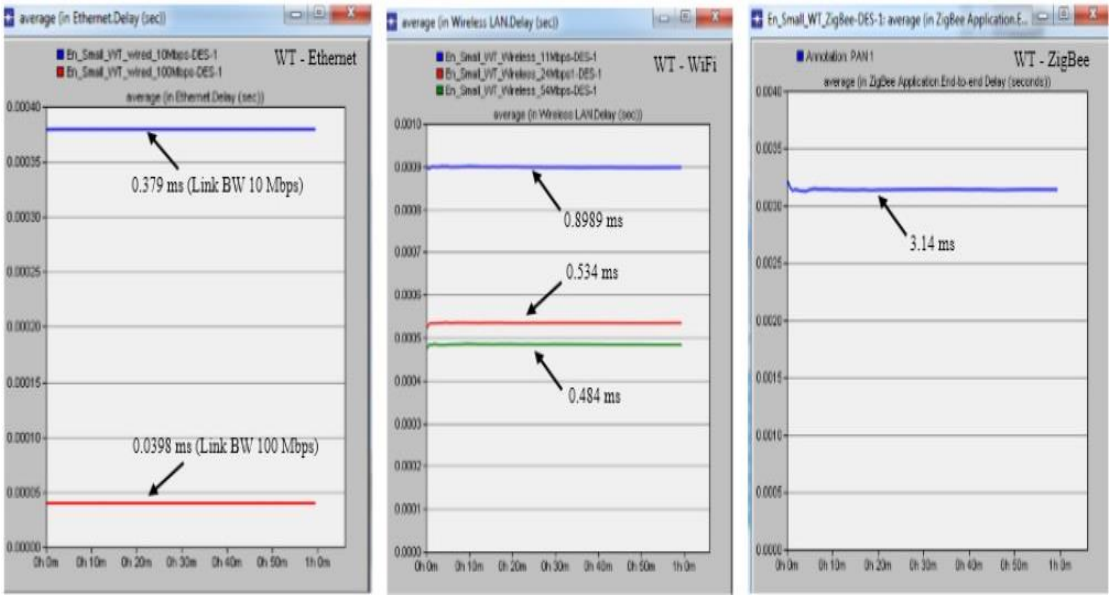

Response time of system WT