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Internet of Things Role in the Renewable Energy Resources

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Abstract

The concept of Smart Cities is becoming a reality as it evolves from conceptual models to developmental stages. Resilient, reliable, efficient and seamless energy and electrical power flow are essential parts to energize and power the services of smart cities such as smart hospitals, smart buildings, smart factories, smart traffic and transportations. All of these smart services are expected to run without interruptions by the use of smart energy and electrical power grids which are considered among the most important pillars for such cities. To keep the services of smart cities interconnected and in sync, the Internet of Things (IoT) and cloud computing are key in such transfers. The paper presents the role of IoT in renewable energy resources integration to electricity grid.

1. Introduction

The World Wide Web is evolving from a traditional host that contains text, images, audios and videos to a physical host that enables users to control physical objects. Home appliances, remote CCV cameras and factory floors can be monitored and controlled using the Internet of Things (IoT) as communication media. The physical web concept is emerging nowadays. For example, smart energy frameworks utilizing IoT were reported to automate and control energy in buildings [1]. An IoT communication network is utilized in energy generations and consumptions in residential areas. The authors built an IoT-based experimental prototype that led to saving energy and left a positive impact on sustainability. Smart energy meters are used to allow for communication between

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consumers and utility command centers to exchange messages about energy and electrical consumption as well as well the status of home appliances [2]. This study extended to smart water and gas meters. The authors concluded their presentation with a set of guidelines for utilizing smart meters in smart energy monitoring and control systems. Figure 1 illustrates a broader picture of how energy and power from an essential part of smart cities [3]. As described in [3] real-time operation data from different objects such as smart electricity, gas and water meters, smart surveillance, smart transportation, smart environment and smart waste management systems are collected. The data then is forwarded to a smart cluster head (SCH) and the later transmits this information to local smart fusion nodes (SFN. As a result, an IoT-based smart decision is taken, and a control enabler center collects and exchanges the data for monitoring and controlling this scalable architecture [3]. A closer look at this conceptual smart city model shows how vital renewable energy resources and fossil fuel/coal energy as well as nuclear energy are in smart cities.

A smart grid consists of three major layers namely; system of systems, communication networks and applications layers [4-8]. Renewable energy resources are utilized as distributed generation (DG) units and installed nearby where the energy is converted and consumed. This kind of installation will reduce the need for long transmission lines, power losses and power substations [4-5]. Many reported literature showed the most popular renewable energy resources are solar energy, wind energy and hydroelectric energy [6-8].
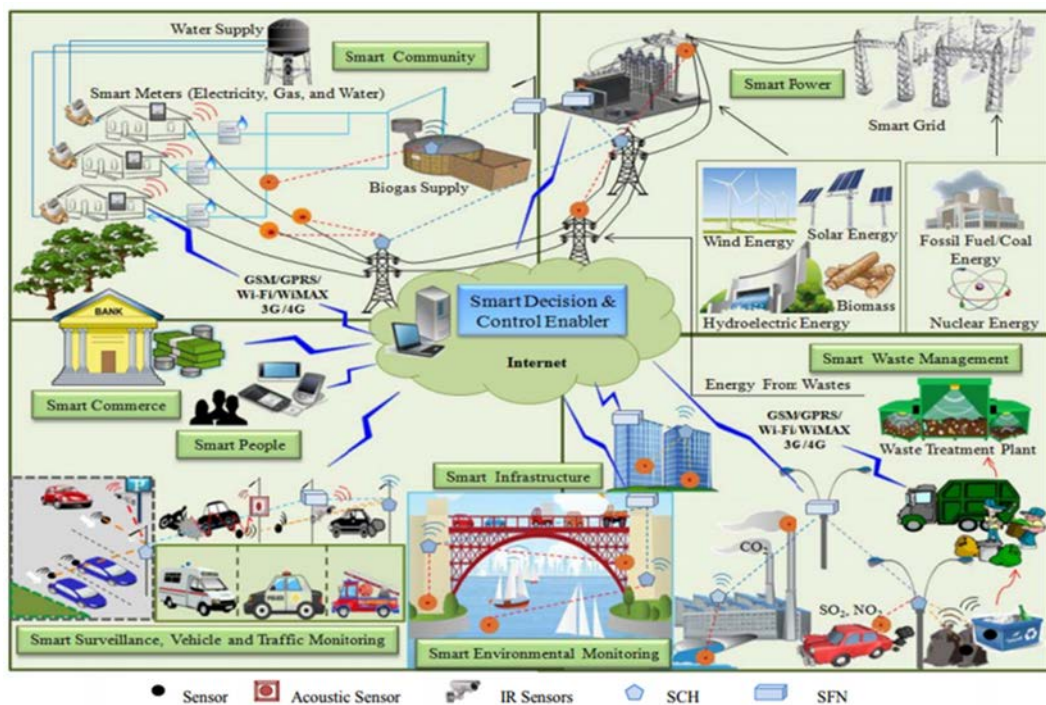

Fig. 1. Conceptual implementation of architecture in Smart Cities [3].

2. Internet of Things Concepts

The world is shifting toward more interconnectivity and more conductivity. It has become an integrated global community through multiple technologies, and numerous areas of applications and services. IoT concepts are leading to a world where real, digital and virtual things are converging to make our cities smarter and more intelligent. Nowadays, traditional web technology is empowered by IoT to connect physical objects (things) such as home appliances and smart grid devices with a unique address for each thing [10-11]. This has been made possible