

Renewable Energy Resources with Internet of Things

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Abstract: This paper introduces the new way of using the internet of Things in renewable energy resources in smart city like smart buildings, smart hospital, smart traffic, smart factories and transportations. All of above smart services are expected to run without any interruptions by using help of smart energy and electrical power grid. To maintain the services of smart cities run without interruption Internet of Things and cloud computing are very important in such transfers. The paper presents the role of Internet of Things (IoT) in renewable energy resources association in electricity grid.

Keywords: Internet of Things, Smart Grid, Cloud Computing HAN, BAN, IAN.

INTRODUCTION

The traditional host of World Wide Web text, pictures, audio, and video are incorporating to the physical host that providing user to control physical objects. Home Things, remote CCTV cameras floors of factory are monitors and controlled using the Internet of Things (IoT) as media of communication. The physical web is concept is adapting nowadays. For example, to control energy in buildings an internet of Things are use [1]. This paper in introduce the IoT based experimental prototype which save the energy and provide the positive impact. For communication between consumers and utility command points to exchanges energy and electrical consumption, smart meters are use [2]. This paper extended to smart gas meters and smart water meters. In this paper we provide the guideline for utilization of smart meters in smart energy monitoring and control systems. Figure 1 shows the wide image of how power and energy from an essential part of smart cities [3].

As illustrates in [3] real time operation data from different objects like smart electricity, water and gas meters, smart surveillance, smart transportation, smart waste management and smart environment systems are collected. After it the data is provided to a smart cluster Head (SCH) and then transmits this data to local smart fusion nodes (SFN). As a result, IoT based smart decision is taken and control enabler center collects and interchange the data for monitoring and controlling this architecture [3].

A smart grid having mainly three layers, which are system of systems, communication networks and applications, layers [4-8]. Many literatures illustrate the popular renewable energy resources are solar energy, wind energy and hydroelectric energy [6-9].

I. Mechanism of Internet of Things

Nowadays this world is moving to more interconnectivity and more conductivity. It has become an integrated global community using multiple technologies and various area of applications and services. IoT concepts are moving to a word where real, digital and imaginary thing are converging to

makes our cities smarter and more intelligent. Traditional web technology is empowered by IoT to connect physical objects (Things) such as home appliances and smart grid Things with a unique address form each device [10-11]. This has been possible by using the IPV6 protocol which has 2^{128} IP address as compared to IPv4 protocol which contains 2^{32} IP addresses. By using IPV6 billions of Things are connected, monitored and controlled at the same time [12-14].

Due to popularity of IoT nowadays, professional of industrial and academics are divided it into two part or categories one is Consumer Internet of Things (CIoT, also IoT) and Industrial Internet of Things (IIoT) [15-16]. The most popular application are smart phones, wearable, TVs and appliances and most popular IIoT applications are smart factories, grids, machines, cities and cars. Following figure shows IoT and IIoT popular application.

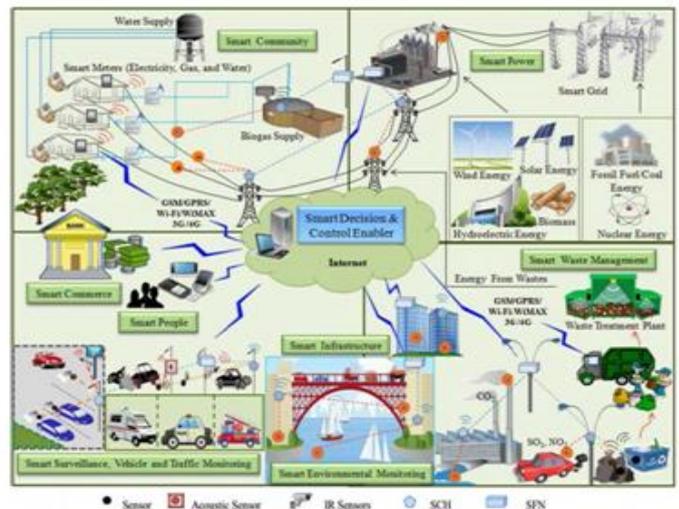


Fig.1. The implementation concept of architecture in smart cities [3]

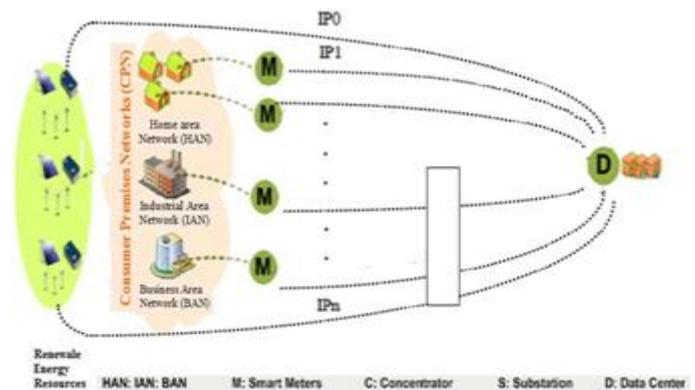


Fig.2. Categories of Internet of Things [14]

II. Propose Protocol

Consumption Domain is one of the domains of National Institute of Standard and Technology (NIST) smart grid conceptual model. Consumption domain is essential and primary candidate for agglomeration and installation of renewable energy resources. As illustrate in figure 3, mainly three types of consumers, which are residential, commercial and industrial. For all type of consumer renewable energy resources such solar, wind and hydro are installed. The consumption domain is divided into three different type of networks: Home Area Network (HAN), Business Area Network (BAN) and Industrial area network (IAN) [18-19].

In this network so many communication protocols are utilizing such as ZigBee, PLC, Z-Wave, WiFi, WiMax, 3G/GSM and LET. The figure number 3 represent the protocols of communication networks which use at the same time within one grid [19]. As we already mention in section III, there are two categories IoT and IIoT. This paper proposes the way of using the single network protocol to utilization of both to integrate three different consumer communication networks to the smart grid networks.

The resources of renewable energy is considered as an object and each object is the smart grid network unique IP is assigned. To monitor each object, bidirectional communication is use as control is done via its unique IP address. This proposes protocol eliminates the need multiple communication protocol in the same grid.



Fig.3. Consumers with multiple network protocol [18]

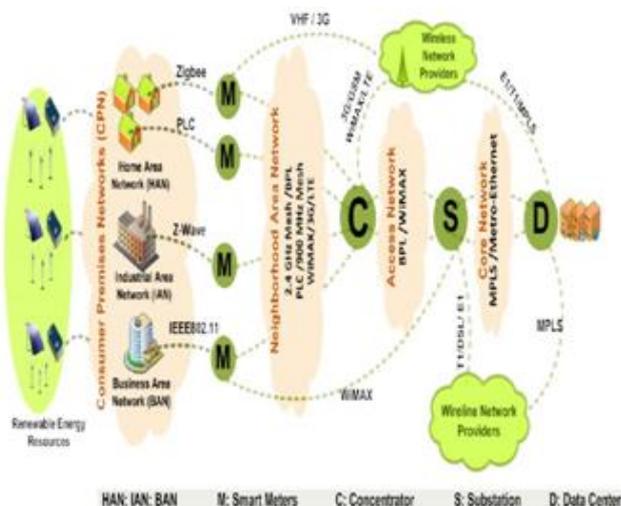


Fig.4. Propose Consumers Network with one network protocol utilizing Based on IoT concept

Communication protocol 6LowPAN is use to utilize IP protocol, which is based on IPv6. This communication protocol has 127 bytes frame size which proved more space for a payload of 65-75 bytes [14]. The use of 6LowPAN communication protocol, make the network faster and scalable. Scalable feature enable the networks to add more devices and appliances such as local batteries, smart meters and home appliance, in the existing network as an object and each object have unique IP address. With this unique IP address of each object we control and monitor remotely using the internet.

Furthermore, same can be extended to adding more other devices such as circuit breaker, capacitor banks, relays and phase measurements units of electricity grid.

CONCLUSIONS

This paper proposes an IoT/IIoT conceptual model to integrate renewable energy resources with one common network protocol instead of using the multiple protocol.

Different from the use of multiple communication protocol in the consumer communication network this paper introduce the use of single communication protocol by assigning the unique IP address to each electric grid devices as an object based on IoT. Using of single protocol is providing more reliable and scalable network which can control and manage remotely with the help of Internet.

IV. FUTURE WORK

The propose prototype is work on consumption domain but it is also extends on distribution and generations domains of energy.

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