

# Chapter 11

## Green Energy Harvesting and Energy–Efficient Routing Protocol in Internet of Underwater Things

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### **ABSTRACT**

*The ability to sustain communication between nodes as per Industry 4.0 standard within the waterways is still not mature enough. It is prudent to make use of natural resources that are abundantly found in the form of strong wind (wind energy) and underwater tidal waves generation (tidal energy). Climate change and environmental sustainability are now becoming more important for a sustainable smart world. This is discussed in detail along with the decentralized mode of crop management. In this chapter, it is shown that energy efficiency can lead to the selection of different system models for the internet of underwater things (IoUT) where systems are sustainable and can tap previously unexplored resources. This resource is useful as a reference to further explore IoUT and green energy harvesting techniques.*

### **INTRODUCTION: GREEN ICT FEATURES AND IOT NETWORKS**

Information and Communication Technology refers to the technology that is responsible for all types of communication between one transmitter to one receiver or from one transmitter to many receivers. It also refers to the vast amount of data processing that the whole communication infrastructure entails

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upon the end user. Green ICT refers to the convergence of several technologies towards energy efficiency whereby less energy is wasted and used more efficiently in hardware; however, it is strictly limited not only to hardware but software design and implementation is also considered. Big data technologies has been discussed with respect to green communication as in (Wu et al., 2016) which emphasizes the importance of IoT and green energy future.

## **Features of Green ICT**

In 2009, UN Secretary General launched a new group A Global Green New Deal consisting of business professionals and knowledge experts who consulted on energy and climate change challenges, identifying key issues to help combat climate change. As per the Green Economy post (2009), UN's five sectors key to sustainable recovery and the global green new deal, March 2009:

1. Improving the energy efficiency of old and new buildings
2. Increasing viability of renewable energy including wind, solar, geothermal, and biomass
3. Development of sustainable transport including hybrid vehicles as well as high speed rail and bus rapid transit systems
4. Preserving the planet's ecology including freshwater sources, forests, soils and coral reefs
5. Developing sustainable agriculture including organic production.

Points 1 to 3 are relevant to energy usage in which mainly green energy is of relevance. Point 4 is the closest one gets to green ecology based on underwater life and features while point 5 relates to the oldest settlement-based project that humans have adopted which is farming and crop management.

Although not directly evident green new deal involves delivery installation and use of ICT products. For buildings, the concept of Smart Grids to regulate renewable energy usage within and without consumer and commercial entities is of interest. For evaluating wind solar geothermal and biomass the infrastructure to regulate the battery power requires processing of storage and charging which requires heavy data usage and hence development of ICT services, applications and content. The concept of smart cities helps to understand smart transportation which aims to make use of hybrid electric as well as fossil fuel. For large scale infrastructure projects, the traffic management algorithm is intense and requires not only managing traffic for one type but multiple types. It also includes various traffic routing strategies, vehicle to vehicle technologies as well as vehicle to base station infrastructure technology.

## **IoT Networks**

IoT or the Internet of Things is an internetwork of sensors or 'things' connected via gateways and controllers to a LAN (local area network). IoT can be considered as a sub class of M2M (machine to machine which include transportation, energy, industrial, sales and payment, security, and healthcare can be regarded as pioneers before IoT systems. IoT networks would include an array of sensors, controllers, and routers. It is imperative to note that autonomous sensors are used to study the environment under sea, in the air and in remote areas where the presence of humans is poised for danger. IoT networks would eventually become more acceptable and noteworthy.

A key element to sustain industry 4.0 standard over the ocean water ways is still not mature enough. It is prudent to make use of natural resources which are abundantly found in the form of strong wind (wind

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