Internet of Things (IoT): Definitions, Challenges and  
Recent Research Directions  
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ABSTRACT  
In this paper, we seek to highlight the concept of Internet of  
Things (IoT) in general, as well as reviewing the main  
challenges of the IoT environment by focusing on the recent  
research directions in this topic. Recently, IoT has emerged  
as a new technology that is used to express a modern  
wireless telecommunication network, and it can be defined  
as an intelligent and interoperability node interconnected in  
a dynamic global infrastructure network, also it seeks to  
implement the connectivity concept of anything from  
anywhere at anytime. Indeed, the IoT environment  
possesses a large spectrum of challenges has a broad impact  
on their performance, which can be divided into two  
categories, namely, i) General challenges: such as  
communication, heterogeneity, virtualization and security;  
and ii) Unique challenges: such as wireless sensor network  
(WSN), Radio Frequency Identification (RFID), and finally  
Quality of service (QoS) that is considered as a common  
factor between both general and special challenges. In  
addition, this paper highlights the main applications of the  
IoT.  
Keywords  
IoT; heterogeneity; virtualization; WSN; RFID; QoS.  
1. INTRODUCTION  
Today, we are living in the era of smart technologies which  
represents a "ubiquitous computing" or “web 0.3”. Internet  
of Things (IoT) has emerged strongly as a more prosperous  
area to express this kind of a new technology. It is not the  
first technology in this field, but also the cloud computing  
technology has been used to represent the ubiquitous  
computing world. In the seventh in the series of ITU  
Internet Reports originally it was launched in 1997 under  
the title “Challenges to the Network” [1], and it was first  
coined by Kevin Ashton in the RFID journal 1999 [2], In  
2005 this name was changed to “Internet of things“. The  
vision of IoT according to Kevin’s vision was to enable  
networked devices to propagate their information about  
physical world objects through the web. In recent years, the  
most of the IoT proposed architectures are used, web  
semantic to publish information through the social  
networks; for instance, the iPhone has innovated service is  
Nike + iPod to record information and published it on the  
social networks and the social network friends [3].  
Actually, the definition of IoT varies based on who you  
talk, but formally, it can be defined as a dynamic global  
network infrastructure with self-configuration and  
interoperable communication. Simply, IoT means the  
ability to make everything around us starting from (i.e.  
Machine, Devices, Mobile phone and Cars) even (Cities  
and Roads) are expected to be connected to the Internet  
with an intelligent behavior and taking into account the  
existence of the kind of autonomy and privacy. Meanwhile,  
the IoT environment contains a huge number of the  
different objects/things can be classified into two types  
namely; i) Things rechargeable batteries things: the most of  
them are mobiles (e.g. Laptop, tablets and mobile phone),  
and ii) Things are non-rechargeable things: these things are  
static from the mobility point of view [4]. Generally, IoT  
includes three main demands are: the first, a shared  
understanding of the situation of its users and their  
applications. Secondly, software architecture and pervasive  
communication networks to cover and process contextual  
information, and lastly, the analytics tools in IoT that aims  
for autonomous and intelligent behavior [5].  
Considerably, can be expressed the principle idea of IoT is  
promoting the communication between anything from  
anywhere at anytime through context-aware applications.  
Accordingly, IoT has relied on RFID and sensor network  
technologies in the implementations. For instance, IBM  
company used IoT in Norwegian Sea oil platforms, by  
deploying sensors at seabed that are used to collect real  
information to make decision drill in the sea [3].  
On the other hand, the IoT environment like many networks  
suffering from the set of challenges which significantly  
affect their performance some of them are common and  
others, are special; the paper divides these challenges into  
two categories, namely, i) General challenges: which  
include common challenges between IoT and traditional  
network such as communication, heterogeneity, QoS,  
scalability, virtualization, data mining and security; and ii)  
Special challenges: such as RFID and WSN.  
The main objective of this paper provides an overview  
about IoT, its definition, its architecture, and discusses the  
differences between IoT and the traditional Internet; then  
highlighting the challenges of IoT and the recent research  
directions to solve them. Finally, the rest of this paper is  
summarized as follows: section II, introducing an overview  
about IoT concept, its history and its inception also  
discussing the differences between IoT and the traditional  
Internet; section III, focusing on the challenges and recent  
research directions to address them and section IV,  
reviewing a set of the most popular applications in IoT  
2. Related Work  
In this section, the paper seeks to offer a brief overview  
about IoT, its definition, its history and its inception also  
highlight the architecture design of IoT that is relied on  
three dimensions called “IoT infrastructure”; and the final  
part in this section discusses the similarities and differences  
between both IoT and traditional Internet.