普通高校物联网工程专业规划教材

物联网专业英语

刘纪红 邓庆绪 李曼宁 等 编著

清华大学出版社

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内容简介

物联网产业是近年来国家确定的战略性新兴产业，并且物联网工程专业也是2012年起国家大力扶植的本科专业。本书意在通过趣味性强、易懂的资料将物联网专业英语相关内容介绍给广大读者。

本书主要内容包括物联网简介、物联网核心技术和物联网技术在各行业的应用三大模块。在介绍了物联网的基本知识后，分类介绍了万维网、条码、射频识别、无线传感器和云计算等物联网核心技术，最后系统地讲述了物联网在各个层面的应用，其中包括了当前热门的智能尘埃、智能家居、物联网医疗、供应链管理和社交物联网等方面的应用。经过仔细挑选，作者将一些具有代表性的、前沿的和难易适中的科研论文的部分资料作为案例组织在了一起，让读者既可以从中系统地学习物联网的基础知识及背景，同时也能提高专业英语的阅读理解及应用水平。

本书的阅读需要有一定的英语基础。三类读者将会从本书受益：①物联网专业本科学生（三、四年级）；②想了解物联网英语的IT从业者；③期待在国际刊物上发表研究成果的物联网相关专业的研究和工程技术人员。

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前　　言

物联网浪潮迅猛袭来，无论是工业界、学术界和作为热门的本科专业都成为人们瞩目的焦点，如果不能读懂国际上最前沿的物联网相关文章和信息那就无法迅速和国际上的领先技术接轨。物联网英语相对涵盖范围广、专业词汇量大，难以通过学习普通英语课程来代替。所以目前新开设的本科专业课程急需一本系统、内容丰富的物联网专业英语教材来弥补这一需要。同时，为了方便物联网专业的学者在国际刊物上发表自己的科研成果，本书可以作为一个简单易查的手册。最后，面对广大业界 IT 人士，为了紧跟物联网技术的前沿，非常有必要掌握基础的物联网专业英语，针对这个忙碌的群体，我们把教材设计得非常简单易懂、便于快速参照。这本书将同时对物联网技术爱好者自我提升和学习有很大帮助。

本书系统地选取和整理了一些优秀的物联网方向的科研文献，经过作者团队多重筛选和讨论后，确定了本书选用的参考文献。为适合学生学习，所有文章内容均有改写和删减。

本书包括：物联网简介、物联网核心技术和物联网技术在各行业的应用三大模块。本书在介绍了物联网的基本知识后，分类介绍了万维网、条码技术、射频识别、无线传感器和云计算等物联网核心技术，最后系统地讲述了物联网在各个层面的应用，其中包括了当前热门的智能尘埃、智能家居、物联网医疗、供应链管理和社交物联网等方面的应用。

本书汇集大量常用词汇，并结合其语境（包括前沿的国际学术发表、网站和新闻资讯），让广大读者都能从中最大程度的获益。本书适合物联网专业英语教材，研究生或学者撰写物联网相关领域的英文著作的手边参考和 IT 技术发烧友跟上技术前沿的必备手册。

全书内容由刘纪红、邓庆绪、李曼宁和潘铮撰写完成，并进行了相互审阅。刘纪红和李曼宁对全书进行了统稿。

感谢研究生张璐、张倩、赵新丹、侯捷和赵野在本书编写过程中协助完成的相关资料整理和绘图工作。

感谢研究所同仁提出的宝贵意见。

限于编者的水平，对本书中不妥和错误之处，殷切希望读者不吝指正。

编者于东北大学

2014 年 4 月

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PART I

INTRODUCTION

Unit One

History of the Internet of Things

Passage A. What is "The Internet of Things"?

The Internet of Things (IoT) is a novel paradigm that is rapidly gaining ground in the scenario of modern wireless telecommunications. The basic idea of this concept is the pervasive presence around us of a variety of things or objects, such as Radio-Frequency Identification (RFID) tags, sensors, actuators, mobile phones, through which unique addressing schemes, are able to interact with each other and cooperate with their neighbors to reach common goals. It is a vision where objects become part of the Internet: where every object is uniquely identified, and accessible to the network, its position and status known, where services and intelligence are added to this expanded Internet, fusing the digital and physical world, ultimately impacting on our professional, personal and social environments.

The main strength of the IoT idea is the high impact it will have on several aspects of everyday-life and behavior of potential users. From the point of view of a private user, the most obvious effects of the IoT introduction will be visible in both working and domestic fields. In this context, domotics, assisted living, e-health, enhanced learning are only a few examples of possible application scenarios in which the new paradigm will play a leading role in the near future. Similarly, from the perspective of business users, the most apparent consequences will be equally visible in fields such as, automation and industrial manufacturing, logistics, business/process management, intelligent transportation of people and goods.

Technology advances are expanding the boundaries of the Internet. Broadband

Internet connectivity is becoming cheap and ubiquitous, even in developing countries. Point in case, some of the regions in Africa are experiencing significant growth in access to fibre-based networks. Device processing power and storage capacity are increasing while the technology is making the devices smaller. Not only does this change the nature of the devices people access the Internet with, but enables a range of new opportunities. We are experiencing a shift away from the dominance of the PC as primary access mechanism in many countries towards mobile devices, whether these are smart phones, notebook or tablet computers.

The main concepts, technologies and standards are highlighted in Figure 1 and classified with reference to the IoT visions that they contribute to characterize best. From such an illustration, it is clear that the IoT paradigm is the result of the convergence of the three main visions: "Things"-oriented visions, "Internet"-oriented visions and "Semantic" -oriented visions.

As shown on the diagram (Figure 1), Devices are increasingly fitted with sensors and actuators; the combination of the above creating an environment where devices are connected to the network, has the ability to sense, compute, act and thus intelligently

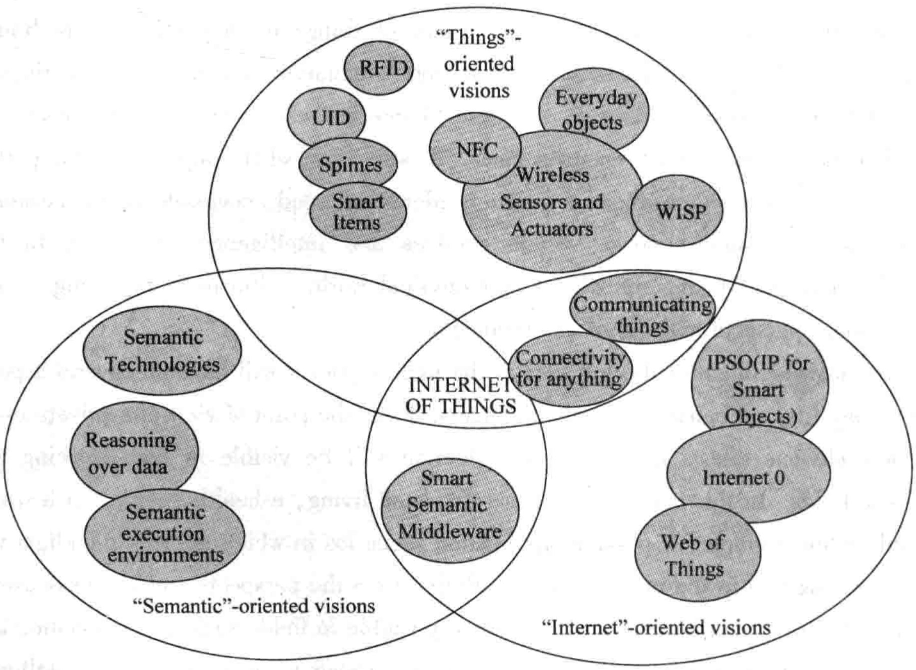

Figure 1 "Internet of Things" paradigm as a result of the convergence of different visions become part of the Internet. In addition, physical objects are increasingly fitted with tags which could be sensed or scanned by devices (e. g. the new generation smart phones containing embedded global positioning system (GPS) and/or RFID scanners or Quick Response Code (QR-code) readers). This combination links the physical world to cyberspace through the smart device, thus expanding the Internet into what has now been coined the "Internet of Things".

The IoT technology has also gained enormous attention from the International Telecommunications Union (ITU). In a 2005 report ITU suggested that the "Internet of Things will connect the world's objects in both a sensory and intelligent manner". By combining various technological developments, the ITU has described four dimensions in IoT:

- item identification ("tagging things")
- sensors and wireless sensor networks ("feeling things")
- embedded systems ("thinking things")
- nano-technology ("shrinking things").

The definition of "things" in the IoT vision is very wide and includes a variety of physical elements. These include personal objects we carry around such as smart phones, tablets and digital cameras. It also includes elements in our environments (be it home, vehicle or work) as well as things fitted with tags (RFID or other) which become connected via a gateway device (e. g. a smart phone). Based on the above view of "things" an enormous number of devices and things will be connected to the Internet, each providing data and information and some, even services.

Some people believe IoT is the same as Cyber-Physical System (CPS), while others do not think so. The concept that is closely related to IoT is CPS, defined as a system that integrates the 3C: Computation, Communication and Control, and realizes the interaction between the physical world and the cyber world. CPS can provide real-time sensing, dynamic control, information feedback, and other services.

Although both IoT and CPS are aimed at increasing the connection between the cyber space and the physical world by using the information sensing and interactive technology, they have obvious differences: the IoT emphasizes the networking, and is aimed at interconnecting all the things in the physical world, thus it is an open network platform and infrastructure; the CPS emphasizes the information exchange and feedback, where the system should give feedback and control the physical world in addition to sensing the physical world, forming a closed-loop system.

Passage B. Cases of IoT Application

Here are a few interesting cases we have collected from literature to give you a better picture of IoT:

Over the last twenty years innovative information technologies have brought significant changes in human civilization. For example, imagine that you were to give a speech in another city which is normally one hour away from where you live. Unfortunately, there was a traffic jam on the highway and you were expected to be late. If this happened 20 years ago, there was literally no way you can communicate the news to your audience. Nowadays, if you get stuck on the highway, you can simply use your cell phone to tell your audience. This is because cell phones and telecommunication service are affordable and available to almost everyone. Question: can technologies do better?

For the same example given earlier, imagine that you were to give a speech in another city and you got stuck on the highway. With the improvement in Machine-to-Machine (M2M) technology, your calendar and your car can communicate. If you are expected to be late, your smart phone will send a message to your audience automatically telling them approximately how much time they have to wait. Or even better, the calendar planner can look up the traffic condition in advance and suggests what time you should leave. Sensors can monitor the traffic conditions along the routes to your destination so that you are able to select the best route to get to the venue on time. There are many similar examples. The nexus of human needs and emerging computing and sensor technologies is bringing about a new digital revolution.

Food Security

The ability to measure and respond appropriately to issues affecting food security, such as droughts (even localised), pests, and lack of knowledge of proper farming methods in different circumstances may have a significant implication for food security. Interventions may take the form of large scale fusion of remotely sensed information mixed in with in-situ, cost effective sensors and the necessary information and communication infrastructures to alert a small scale farmer through, for instance, a mobile phone text message that certain portions of his land need particular attention. On the small scale, it may include "smart packaging" of seeds, fertiliser and pest control mechanisms that respond to specific local conditions and indicate actions by, for instance changing colour. Monitoring on a continuous basis the fertilisers and pesticides used on export-based products enables a small scale farmer to have their produce "certified" for an export market in a cost effective manner.

Natural Disasters

Through the combination of sensors and simulation, many a life could be spared if, for instance, the occurrence of land-slides may be predicted in time for villages to take appropriate actions. Often the remotely sensed data that may be used together with simulation tools (including PC based tools right up to supercomputer applications) do not provide the real-time information and resolution necessary to take appropriate action in time. Flash floods present another example where in-situ monitoring is very important.

Water

With the importance of water for both human and economic development in the region and its scarcity in many places, networks of sensors, tied together with the relevant simulation activities might not only monitor long term water interventions such as catchment area management, but may even be used to alert users of a stream, for instance, if an upstream event, such as the accidental release of sewage into the stream, might have dangerous implications.

The list can easily be extended to cover areas such as health, the environment, the state of road infrastructures and other areas of importance to the emerging and developing economies of the world.

These examples from literature help you gain a better understanding of what IoT can do for you in real life.

Ⅰ. Important Terms And Expressions

Terms & Expressions	Chinese Translation	Your Own Notes
actuator	n. 执行器	
Cyber-Physical System (CPS)	信息物理融合系统	
cyberspace	n. 网络空间	
device processing power	设备处理能力	
fibre-based network	基于光纤的网络	
Global Positioning System(GPS)	全球定位系统(GPS)	

续表

Terms & Expressions	Chinese Translation	Your Own Notes
Internet of Things (IoT)	物联网,亦被一些学者称为 Web of things, Cyber-physical systems.	
Machine-to-Machine (M2M)	机器对机器(M2M)	
nano-technology	纳米技术	
QR-code reader	QR 码阅读器. 注: QR 码(简称快速响应矩阵码 Quick Response Code)是一种类型的矩阵条码(或二维条码),最开始为日本汽车行业所用	
Radio Frequency Identification (RFID)	无线射频识别技术	
RFID scanner	RFID 扫描仪	
sensor	n. 传感	
shrinking thing	缩小的物体	
storage capacity	存储空间	
tag	n. 标签	

Ⅱ. Questions and Discussions

Q1. Do you agree with the author's opinion in passage A that IoT and CPS are different things? Research into similar topics and discuss why you agree or disagree with them.

Q2. Look up for the definitions of 'IoT' in literature. Make a list and discuss which one you think is the most appropriate? Give your reasons.

Q3. For the first case discussed in passage B, use your own words to discuss the application of IoT technologies in further detail. Envision what technologies might come next?

Q4. Have you experienced 'IoT' technology in your life? If yes, explain to the class in your own words what it is. If not, envision an example of what 'IoT' could do for us in real life.

Ⅲ. Exercises

Do some research on the Internet and using the library resources. Write a short essay of less than 1000 words explaining the history of the Internet of Things.

Unit Two

Structure of Internet of Things

Passage A. Introduction to the IoT Structure

With the widespread deployment of networked, intelligent sensor technologies, an Internet of Things (IoT) is steadily evolving, much like the Internet decades ago. In the future, hundreds of billions of smart sensors and devices will interact with one another without human intervention, on a M2M basis. They will generate an enormous amount of data at an unprecedented scale and resolution, providing humans with information and control of events and objects even in remote physical environments. The scale of the M2M Internet will be several orders of magnitude larger than the existing Internet, posing serious research challenges(Figure 1). As shown, there are four components in the M2M IoT architecture, including service, computation, communication and sensors.

From another viewpoint, we can examine the structure of IoT based on how the information is organized. Figure 2 demonstrates the refinement process of transforming large volume of raw data into information, knowledge and finally useful wisdom for accomplishing certain tasks such as managerial decision making. As shown in Figure 2, the simple devices are mapped to the virtual things.

Example 1

Pachube (https://pachube.com) is a good example of IoT with simple devices, where real-time data are collected from simple sensors and made available to the public. Real-time data are collected from simple sensors and made available to the public. As a social network site, any individuals can submit their sensory data to the site. Organizing