《现代通信新技术》 教学大纲

Modern Communication Technologies Subject Syllabus

一、课程信息 Subject Information

课程编号: Subject ID	3100113022	开课学期: Semester	6
课程分类: Category	专业教育 PA	所属课群: Section	专业基础 MF
课程学分: Credit Points	2	总学时/周: Total Hours/Weeks	32
理论学时: LECT. Hours	24	实验学时: EXP. Hours	8
PBL 学时: PBL Hours	0	实践学时/周: PRAC. Hours/Weeks	0
开课学院: College	东北大学 悉尼智能科技学院	适用专业: Stream	通信工程 CE
课程属性: Pattern	选修 Elective	课程模式: Mode	自建 NEU
中方课程协调人: NEU Coordinator	高军 GAO Jun	成绩记载方式: Result Type	百分制 Marks
先修课程: Requisites	通信原理 Communications Theory		
英文参考教材: EN Textbooks	单击或点击此处输入文字。		
中文参考教材: CN Textbooks	高军，WPAN 无线通信基础， 东北大学出版社，2018		
教学资源: Resources	沈连丰，通信新技术及其实验，科学出版社，2006 年		
课程负责人(撰写人): Subject Director	高军 GAO Jun	提交日期: Submitted Date	单击或点击此处输入日期。
任课教师(含负责人): Taught by	高军 杨光 GAO Jun, YANG Guang		
审核人: Checked by	韩鹏	批准人: Approved by	史闻博
		批准日期: Approved Date	单击或点击此处输入日期。

二、教学目标 Subject Learning Objectives (SLOs)

注：毕业要求及指标点可参照悉尼学院本科生培养方案，可根据实际情况增减行数

Note: GA and index can be referred from undergraduate program in SSTC website. Please add/reduce lines based on subject.

整体目标: Overall Objective	通过本课程的学习，使学员掌握蓝牙、ZigBee、RFID 等无线通信技术的工作原理，理解相关的通信协议，了解当前通信技术、通信网的发展现状及发展趋势。 Through the study of this course, students will master the working principles of wireless communication technologies such as Bluetooth, ZigBee, RFID, etc.,understand relevant communication protocols, and understand the current development status and trends of communication technology and communication networks .	
（1）专业目标: Professional Ability	1-1	掌握典型短距离无线通信技术的特点 Mastering the characteristics of typical short range wireless communication technologies
	1-2	了解短距离无线通信技术在 PWAN 中的应用 Understand the application of short range wireless communication technology in PWAN.
	1-3	ZigBee 的编程训练，培养工程实践能力 Programming training for ZigBee, Cultivate engineering thinking , Developing the ability to practice engineering
	1-4	了解物联网和 WSN 的相关技术，培养创新能力 Understand the relevant technologies of the Internet of Things and WSN, and cultivate the ability to innovate
（2）德育目标: Essential Quality	2-1	具有良好的团队协作意识和能力、较强的表达能力和人际交往能力 A strong sense and capability of teamwork, strong expression and interpersonal skills.
	2-2	具有良好的跨文化、跨领域沟通能力，能够在本专业相关领域进行有效的技术沟通和交流 Good cross-cultural and cross-field communication skills, able to carry out effective technical communication and exchange in the relevant field of the major.

课程教学目标与毕业要求的对应关系 Matrix of GA & SLOs

毕业要求 GA	指标点 GA Index	教学目标 SLOs
1、工程知识：能够将数学、自然科学、工程基础和专业知识用于解决复杂工程问题。	指标点 1-1：掌握数学、自然科学、工程基础和专业知识，并使用其建立正确的数学、物理学等模型以解释复杂工程问题	1-1,1-2,1-3，1-4

3、设计/开发解决方案：能够设计针对复杂工程问题的解决方案，设计满足特定需求的系统、单元或流程，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。	指标点 3-1：能够设计针对本专业相关复杂工程问题的解决方案，能够设计和开发实现特定功能、满足特定需求的信息传输、信号处理或网络通信系统	1-3,1-4
4、研究：能够基于科学原理并采用科学方法对复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	指标点 4-1：能够基于科学原理并采用科学方法，在本专业相关理论指导下对复杂工程问题设计实验进行研究	1,-2,1-3,1-4
	指标点 4-2：能够结合本专业知识对实验数据进行分析与解释，设计并优化实验方案，并通过信息综合得到合理有效的结论；	1-2,1-3,1-4
5、使用现代工具：能够针对复杂工程问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对复杂工程问题的预测与模拟，并能够理解其局限性	指标点 5-2：熟悉解决本专业相关复杂工程问题所需的技术和资源，能够运用现代信息技术进行文献检索和资料查询，获取专业解决方案；	1-2,1-3,1-4
9、个人和团队：能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。	指标点 9-1：能够认识团队协作的重要性，具有强烈的团队协作意识和能力、卓越的组织管理能力、较强的表达能力和人际交往能力；	2-1,2-2
		2-1,2-2
10、沟通：能够就本专业复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。具备一定的国际视野，能够在跨文化背景下进行沟通和交流。	指标点 10-2：熟练掌握英语，能够在本专业相关领域进行有效的技术沟通和交流。	2-2

三、教学内容 Content (Topics)

注：以中英文填写，各部分内容的表格可根据实际知识单元数量进行复制、扩展或缩减

Note: Filled in both CN and EN, extend or reduce based on the actual numbers of knowledge unit

(1) 理论教学 Lecture

知识单元序号: Knowledge Unit No.	1	支撑教学目标: SLOs Supported	1-1
知识单元名称 Unit Title	短距离无线通信技术简介 Introduction to Short Range Wireless Communication Technology		
知识点: Knowledge Delivery	蓝牙概述 Bluetooth Overview		
	ZigBee 技术概述 ZigBee Overview		
	WIFI 技术简介 Introduction to WIFI		
学习目标: Learning Objectives	了解: Recognize	典型短距离无线通信技术的优缺点 Advantages and Disadvantages of Typical Short Range Wireless Communication Technologies	
	理解: Understand		
	掌握: Master	蓝牙和 ZigBee 技术特点 Technical characteristics of Bluetooth and ZigBee	
德育目标 Moral Objectives	具有良好的团队协作意识和能力、较强的表达能力和人际交往能力 A strong sense and capability of teamwork, strong expression and interpersonal skills. 具有良好的跨文化、跨领域沟通能力，能够在本专业相关领域进行有效的技术沟通和交流 Good cross-cultural and cross-field communication skills, able to carry out effective technical communication and exchange in the relevant field of the major.		
重点: Key Points	蓝牙技术特性、ZigBee 的技术特点，不同的短距离无线通信技术对比 Bluetooth technology characteristics, ZigBee technology characteristics, and comparison of different short range wireless communication technologies		
难点: Focal points	蓝牙和 ZigBee 技术中的概念理解 Understanding the Concepts in Bluetooth and ZigBee Technology		

知识单元序号: Knowledge Unit No.	2	支撑教学目标: SLOs Supported	1-1
知识单元名称 Unit Title	蓝牙技术 Bluetooth technology		
知识点: Knowledge Delivery	蓝牙的基带系统 Bluetooth baseband system		
	语音传输 Voice transmission		
	数据传输 Data transmission		

	无线组网 Wireless networking	
学习目标: Learning Objectives	了解: Recognize	蓝牙基带系统，蓝牙协议及体系结构 Bluetooth baseband system, Bluetooth protocol and architecture.
	理解: Understand	蓝牙通信系统的安全性 Security of Bluetooth Communication System
	掌握: Master	差错控制编码原理，蓝牙扩频原理及算法 The principle of error control, the principle and algorithm of Bluetooth spread spectrum
德育目标 Moral Objectives	具有良好的团队协作意识和能力、较强的表达能力和人际交往能力 A strong sense and capability of teamwork, strong expression and interpersonal skills. 具有良好的跨文化、跨领域沟通能力，能够在本专业相关领域进行有效的技术沟通和交流 Good cross-cultural and cross-field communication skills, able to carry out effective technical communication and exchange in the relevant field of the major.	
重点: Key Points	蓝牙的基本概念和组网 Basic concepts and networking of Bluetooth	
难点: Focal points	蓝牙的协议 Bluetooth protocol stack	

知识单元序号: Knowledge Unit No.	3	支撑教学目标: SLOs Supported	1-2,1-3
知识单元名称 Unit Title	ZigBee 编程实践 Programming Practice of ZigBee		
知识点: Knowledge Delivery	CC2430\2530 芯片性能 Performance of CC2430 2530 chips		
	IAR 软件使用 Use of IAR software		
	CC2430 芯片基础编程 Programming of CC2430 chip		
学习目标: Learning Objectives	了解: Recognize	CC2430 芯片的技术指标 Technical specifications of CC2430	
	理解: Understand		
	掌握: Master	掌握IAR的编程环境和CC2430的程序编写编译过程 The usage of IAR programming environment and the programming and compilation process of CC2430	

德育目标 Moral Objectives	具有良好的团队协作意识和能力、较强的表达能力和人际交往能力 A strong sense and capability of teamwork, strong expression and interpersonal skills. 具有良好的跨文化、跨领域沟通能力，能够在本专业相关领域进行有效的技术沟通和交流 Good cross-cultural and cross-field communication skills, able to carry out effective technical communication and exchange in the relevant field of the major.
重点: Key Points	CC2430 芯片编程 Programming of CC2430 Chip
难点: Focal points	CC2430 芯片编程 Programming of CC2430 Chip

知识单元序号: Knowledge Unit No.	4	支撑教学目标: SLOs Supported	1-2,1-3,1-4
知识单元名称 Unit Title	无线传感器网络 WSN Wireless Sensor Network		
知识点: Knowledge Delivery	无线传感器网络基本概念 Basic Concepts of Wireless Sensor Networks		
	常见的无线定位技术 Common wireless positioning technologies		
	CC2431 芯片性能 Performance of CC2431 chip		
学习目标: Learning Objectives	掌握: Master	无线传感器网络概念 Concept of Wireless Sensor Networks	
		无线定位算法的应用 Application of Wireless Location Algorithm	
德育目标 Moral Objectives	具有良好的团队协作意识和能力、较强的表达能力和人际交往能力 A strong sense and capability of teamwork, strong expression and interpersonal skills. 具有良好的跨文化、跨领域沟通能力，能够在本专业相关领域进行有效的技术沟通和交流 Good cross-cultural and cross-field communication skills, able to carry out effective technical communication and exchange in the relevant field of the major.		
重点: Key Points	无线定位算法的应用 Application of Wireless Location Algorithm		
难点: Focal points	无线定位算法的应用 Application of Wireless Location Algorithm		

<table>
<tr><td>知识单元序号:
Knowledge Unit No.</td><td>5</td><td>支撑教学目标:
SLOs Supported</td><td>1-2,1-4</td></tr>
<tr><td>知识单元名称
Unit Title</td><td colspan="3">RFID 技术
RFID technology</td></tr>
<tr><td rowspan="2">知识点:
Knowledge Delivery</td><td colspan="3">RFID 技术标准
Technical standards for RFID</td></tr>
<tr><td colspan="3">RFID 技术选型
Selection of RFID technology</td></tr>
<tr><td rowspan="2">学习目标:
Learning Objectives</td><td rowspan="2">了解:
Recognize</td><td colspan="2">电子标签类型和技术特点
Classification and Technical Characteristics of Electronic Labels</td></tr>
<tr><td colspan="2">RFID 技术实际应用中存在的问题
Problems in the practical application of RFID technology</td></tr>
<tr><td>德育目标
Moral Objectives</td><td colspan="3">具有良好的团队协作意识和能力、较强的表达能力和人际交往能力
A strong sense and capability of teamwork, strong expression and interpersonal skills.
具有良好的跨文化、跨领域沟通能力，能够在本专业相关领域进行有效的技术沟通和交流
Good cross-cultural and cross-field communication skills, able to carry out effective technical communication and exchange in the relevant field of the major.</td></tr>
<tr><td>重点:
Key Points</td><td colspan="3">电子标签类型和技术特点
Types and Technical Characteristics of RFID</td></tr>
<tr><td>难点:
Focal points</td><td colspan="3">RFID 的选型分析
Analysis of RFID Selection</td></tr>
</table>

<table>
<tr><td>知识单元序号:
Knowledge Unit No.</td><td>6</td><td>支撑教学目标:
SLOs Supported</td><td>1-4</td></tr>
<tr><td>知识单元名称
Unit Title</td><td colspan="3">传感器技术简介
Introduction to Sensor Technology</td></tr>
<tr><td rowspan="2">知识点:
Knowledge Delivery</td><td colspan="3">传感器组成与分类
Composition and classification of sensors</td></tr>
<tr><td colspan="3">典型传感器的原理和应用
Principles and Applications of Typical Sensors</td></tr>
<tr><td>学习目标:</td><td>了解:</td><td colspan="2">传感器的组成</td></tr>
</table>

Learning Objectives	Recognize	Composition of sensors
		传感器的分类 Classification of sensors
		典型传感器的原理 Principle of typical sensors
德育目标 Moral Objectives	具有良好的团队协作意识和能力、较强的表达能力和人际交往能力 A strong sense and capability of teamwork, strong expression and interpersonal skills. 具有良好的跨文化、跨领域沟通能力，能够在本专业相关领域进行有效的技术沟通和交流 Good cross-cultural and cross-field communication skills, able to carry out effective technical communication and exchange in the relevant field of the major.	
重点: Key Points	电阻式传感器、电容式传感器、电感式传感器 Resistive sensors, capacitive sensors, inductive sensors	
难点: Focal points	光电传感器、压电传感器 Photoelectric sensors, piezoelectric sensors	

知识单元序号: Knowledge Unit No.	7	支撑教学目标: SLOs Supported	1-3,1-4
知识单元名称 Unit Title	物联网工程简介 Introduction to IoT Engineering		
知识点: Knowledge Delivery	物联网技术简介 Introduction to IoT Technology		
	物联网项目分析 Analysis of IoT projects		
学习目标: Learning Objectives	了解: Recognize	物联网项目的实际开发设计过程 The actual development and design process of IoT projects	
德育目标 Moral Objectives	具有良好的团队协作意识和能力、较强的表达能力和人际交往能力 A strong sense and capability of teamwork, strong expression and interpersonal skills. 具有良好的跨文化、跨领域沟通能力，能够在本专业相关领域进行有效的技术沟通和交流 Good cross-cultural and cross-field communication skills, able to carry out effective technical communication and exchange in the relevant field of the major.		
重点:	物联网工程的现状及实际项目分析		

Key Points	The Current Situation and Actual Project Analysis of IoT Engineering
难点: Focal points	物联网工程中各种技术的融合及方案的选择 The Integration of Various Technologies and the Selection of Solutions in IoT Engineering

(2) 实验教学 Experiments

注：可根据实际情况增减行数。实验类型可分为验证性、设计性、综合性，实验性质可分为选做、必做。

Note: Please add/reduce lines based on subject. The Type contains Verify, Design, and Comprehensive, while the Pattern contains Required and Elective

序号 No.	实验项目名称 Experiment Topic	学时 Hours	每组人数 MPG*	实验类型 Type	实验性质 Pattern
1	数字基带仿真实验和Zigbee软件程序与硬件安装与LED灯闪烁实验 Digital baseband simulation experiment, Zigbee software program and hardware installation,andLED flashing experiment	2	2	验证性 Verify	必做 Elec
2	数据传输实验与Zigbee按下按键点亮对应的LED实验 Data transmission experiment anZigbee pressing the button to light up the corresponding LED experiment	2	2	验证性 Verify	必做 Elec
3	语音传输实验与 Zigbee 利用定时器实现 LED 闪烁 Voice transmission experiment and Zigbee's use of a timer to achieve LED flashing	2	2	验证性 Verify	必做 Elec
4	无线多点组网实验与简单无线网络中计算机与模块通信的实验 Wireless Multipoint Networking Experiment and Computer Module Communication Experiment in Simple Wireless Networks	2	2	验证性 Verify	必做 Elec
	总计 Total	8			

*MPG: Members per group

实验项目序号: Experiment No.	1	支撑教学目标: SLOs Supported	1-1,1-2,1-3
每组成员: Members per Group	2	指导教师: Tutor	杨光
实验名称: Experiment Title	数字基带仿真实验和Zigbee软件程序与硬件安装与LED灯闪烁实验Digital baseband simulation experiment, Zigbee software program and hardware		

	installation,andLED flashing experiment
实验内容: Content	蓝牙基带包的差错控制技术，包头检查（HEC）用于保证包的完整性，数据有效载荷信息的循环冗余校验，包的前向纠错控制。 Bluetooth baseband packet error control technology, packet header check (HEC) is used to ensure packet integrity, cyclic redundancy check of data payload information, and forward error correction control of packets.
	蓝牙系统的跳频原理，查询状态的跳频原理；查询扫描状态的跳频原理，连续状态的跳频原理 The frequency hopping principle of Bluetooth system and the frequency hopping principle of querying status; Frequency hopping principle for querying scanning status and frequency hopping principle for continuous status
	数据流的加密与解密，蓝牙加密技术（常规密钥体制的加密和解密），RSAG 公开密钥密码体制的加密与解密过程。 The encryption and decryption of data streams, Bluetooth encryption technology (encryption and decryption of conventional key systems), and the encryption and decryption process of the RSAG public key cryptosystem.
	以 LED 灯为外设，用 CC2430 控制简单外设时，应将 I/O 设置为输出。实验现象是 LED 点亮。 When using LED lights as peripherals and using CC2430 to control simple peripherals, I/O should be set to output. The experimental phenomenon is that the LED lights up.
学习目标: Learning Objectives	理解通信系统特别是无线通信系统对基带信号的处理方法和目的。通过操作数字基带仿真软件、认真完成实验，实验者可以理解并掌握通信系统的基带传输中诸如差错控制、扩频通信以及保密通信的基本概念、原理和方法。 Understand the processing methods and objectives of baseband signals in communication systems, especially wireless communication systems. By operating digital baseband simulation software and completing experiments diligently, experimenters can understand and master the basic concepts, principles, and methods of baseband transmission in communication systems, such as error control, spread spectrum communication, and secure communication. 本次实验目的是让学生学会使用 CC2430 的 I/O 来控制外设，本例以 LED 灯为外设使用。用 CC2430 控制简单外设时，应将 I/O 设置为输出。实验现象为 LED 点亮。 The purpose of this experiment is to help students learn to use the I/O of CC2430 to control peripherals. In this example, LED lights are used as peripherals. When using CC2430 to control simple peripherals, I/O should be set to output. The experimental phenomenon is that the LED lights up.

教学要求: Requirements	通过操作数字基带仿真软件、认真完成实验，实验者可以理解并掌握通信系统的基带传输中诸如差错控制、扩频通信以及保密通信的基本概念、原理和方法。自行编码并通过 Zigbee 模块验证其结果正确与否。 By operating digital baseband simulation software and completing experiments diligently, experimenters can understand and master the basic concepts, principles, and methods of baseband transmission in communication systems, such as error control, spread spectrum communication, and secure communication. Self coding and verifying the correctness of the results through the Zigbee module.
实验场地: Location	综合楼 1114；comprehensive building 1114
实验软硬件设备: Software/Hardware	计算机/Zigbee 模块/数字基带仿真实验软件 Computer/Zigbee module/Digital baseband simulation experimental software

实验项目序号: Experiment No.	2	支撑教学目标: SLOs Supported	1-1,1-2,1-3
每组成员: Members per Group	2	指导教师: Tutor	杨光
实验名称: Experiment Title	数据传输实验与 Zigbee 按下按键点亮对应的 LED 实验 Experimental verification of Thevenin theorem and Norton theorem		
实验内容: Content	协议体系结构 protocol architecture		
	表示会话层 Represent the session layer		
	数据链路层 data link layer		
	面向连接与面向无连接的服务 Connection oriented and connectionless oriented services		
	自环与广播 Self loop and broadcasting		
	检测对应位 I/O 口，如果有按键按下则改变 LED 状态 Detect the corresponding I/O port, and if a button is pressed, change the LED status		
学习目标: Learning Objectives	理解协议层次概念，上下层与对等层的概念，物理信道与逻辑信道的概念，面向连接的服务和面向无连接的服务；并且可以根据需要让学生利用提供的数据传输平台，按照指导自行设计并编程实现一种数据传输协议，加深对设计协议各种考虑因素以及实现方法的认识。理解数据传输过程中的流量控制，了解几种常用的数据传输层协议。 Understand the concept of protocol hierarchy, the concepts of upper and lower layers and peer layers, the concepts of physical channels and		

	logical channels, and the concepts of connection oriented services and connectionless services; And students can use the provided data transmission platform as needed to design and program a data transmission protocol according to the guidance, deepening their understanding of various considerations and implementation methods for designing the protocol. Understand the flow control during data transmission and understand several commonly used data transmission layer protocols. 了解轮询机制，掌握 CC2430 按键控制 Understand the polling mechanism and master the CC2430 button control
教学要求: Requirements	会话层连续发送大量数据和发送少量数据的时候分别观察数据链路层 LLC 子层的连续 ARQ 协议的发送流程上的区别。考虑增多滑动窗的窗口数或减少滑动窗窗口数对系统性能的影响，考虑增加或减少窗口的意义及其应用场合。本实验数据链路层帧的编号 0-7（8 个一组编号），发送和接受窗口大小可以定为 1-7 When the session layer continuously sends a large amount of data and sends a small amount of data, observe the difference in the transmission flow of the continuous ARQ protocol of the LLC sublayer of the data link layer. Consider the impact of increasing or decreasing the number of sliding windows on system performance, and consider the significance and application scenarios of increasing or reducing windows. The number of data link layer frames in this experiment is 0-7 (8 frames in a group), and the size of sending and receiving windows can be set as 1-7 观察会话层的数据包与数据链路层传送的帧之间的联系，考虑会话层 MRU 对数据链路层的影响，思考 MRU 在实际应用中是应当设置较大值还是较小值，以及其合适的取值，并说明理由 Observe the connection between the session layer data packets and the frames transmitted by the data link layer, consider the impact of the session layer MRU on the data link layer, consider whether the MRU should be set to a larger value or a smaller value in practical applications, and its appropriate value, and explain the reasons 了解轮询机制，掌握 CC2430 按键控制 Understand the polling mechanism and master the CC2430 button control
实验场地: Location	综合楼 1114；comprehensive building 1114
实验软硬件设备: Software/Hardware	计算机/Zigbee 模块/数据传输实验软件 Computer/Zigbee module/data transmission experimental software

实验项目序号: Experiment No.	3	支撑教学目标: SLOs Supported	1-1,1-2,1-3
每组成员: Members per Group	2	指导教师: Tutor	杨光

实验名称: Experiment Title	语音传输实验与 Zigbee 利用定时器实现 LED 闪烁 Voice transmission experiment and Zigbee's use of a timer to achieve LED flashing
实验内容: Content	脉冲编码调制（线性、A 律 PCM） Pulse code modulation (linear, A-law PCM)
	连续可变斜率增量（CVSD）调制原理 Principle of Continuous Variable Slope Delta (CVSD) Modulation
	随机错误和突发错误的观察分析 Observation and Analysis of Random and Sudden Errors
	蓝牙设备的 ACL 链路和 SCO 链路分析 Analysis of ACL and SCO links in Bluetooth devices
	蓝牙设备的身份切换 Identity switching for Bluetooth devices
	蓝牙设备的内部通话与数据传输的工作过程 The working process of internal calls and data transmission on Bluetooth devices
	定时器开始运行在正计数/倒计数运行模式 Timer starts running in forward/backward counting mode
学习目标: Learning Objectives	理解蓝牙支持的三种语音编码方式（即线性 PCM 编码、A 律 PCM 编码和 CVSD 编码）异同；分析并理解语音传输与数据传输的工作过程的区别和联系；理解通信技术中随机错误和突发错误的概念 Understand the similarities and differences between the three speech encoding methods supported by Bluetooth, namely linear PCM encoding, A-law PCM encoding, and CVSD encoding; Analyze and understand the differences and connections between the working processes of voice transmission and data transmission; Understand the concepts of random and sudden errors in communication technology 使用 CC2430 定时器实现 LED 灯的间隔闪烁 Use CC2430 timer to achieve interval flashing of LED lights
教学要求: Requirements	为什么实际应用中通常采用非均匀量化，而不是均匀量化，试定性的比较 PCM 和 CVSD 的性能 Why is non-uniform quantization usually used in practical applications instead of uniform quantization? Try to qualitatively compare the performance of PCM and CVSD 使用定时器编程实现 LED 灯的间隔闪烁 Using Timer Programming to Realize Interval Flashing of LED Lights
实验场地: Location	综合楼 1114；comprehensive building 1114
实验软硬件设备: Software/Hardware	计算机/Zigbee 模块/语音传输实验软件 Computer/Zigbee module/Voice transmission experimental software

实验项目序号: Experiment No.	4	支撑教学目标: SLOs Supported	1-1,1-2,1-3
每组成员: Members per Group	2	指导教师: Tutor	杨光
实验名称: Experiment Title	无线多点组网实验与简单无线网络中计算机与模块通信的实验 Wireless Multipoint Networking Experiment and Computer Module Communication Experiment in Simple Wireless Networks		
实验内容: Content	启动，配置，组网，单播，组播，广播 Start, configure, network, unicast, multicast, broadcast 编写代码，下载到 zigbee 模块实现用一个 CC2430 作为无线发射节点，向指定节点发送数据，另一个节点进行接收数据，并将接收的无线数据发送到串口，由串口发送到 PC 机上显示。 Write code and download it to the Zigbee module to use a CC2430 as a wireless transmitting node to send data to the designated node, and another node to receive data. The received wireless data is then sent to the serial port, which then sends it to the PC for display.		
学习目标: Learning Objectives	学生利用已有多个设备组网，理解点对点的网络、Ad hoc 网络多跳转接的拓扑结构、组网过程、简单的路由协议以及广播和组播的概念 Students use existing multiple devices to network and understand the topology of peer-to-peer networks, ad hoc networks with multi hop switching, networking processes, simple routing protocols, and the concepts of broadcasting and multicast 掌握 CC2430 无线通信寄存器组成与设置，学会 CC2430 点对点无线通信 Master the composition and settings of CC2430 wireless communication registers, and learn CC2430 point-to-point wireless communication		
教学要求: Requirements	互相之间自行组网完成信息的组播和广播过程 Self networking between each other to complete the process of information multicast and broadcasting 组播具体如何实现？路由器如何知道相应的组播目的节点在哪一方向？如何减小无用组播数据的传播以及形成环路的情况 How to implement multicast specifically? How does a router know which direction the corresponding multicast destination node is in? How to reduce the propagation of useless multicast data and the formation of loops 自行编写程序，选择 TX 发送，选择 RX 接收，LED 交替实现发送和接收情况 Write your own program, select TX to send, RX to receive, and LED to alternate between sending and receiving situations		

实验场地: Location	综合楼 1114；comprehensive building 1114
实验软硬件设备: Software/Hardware	计算机/Zigbee 模块/无限多点组网实验软件 Computer/Zigbee module/Infinite multipoint networking experimental software

四、教学安排 Teaching Schedule

注：可根据实际情况增减行数

Note: Please add/reduce lines based on subject.

教学内容 Teaching Content	学时(周) Hour(Week)			
	理论 LECT.	实验 EXP.	课外实践 PBL	实践 PRAC.
短距离无线通信技术简介 Introduction to Short Range Wireless Communication Technology	4			
蓝牙技术 Bluetooth technology	4	4		
ZigBee 编程实践 Programming Practice of ZigBee	6	4		
无线传感器网络 WSN Wireless Sensor Network	4			
RFID 技术 RFID technology	2			
传感器技术简介 Introduction to Sensor Technology	2			
物联网工程简介 Introduction to IoT Engineering	2			
总计 Total	24	8		

五、教学方法 Teaching Methodology

注：可根据实际情况增减行数或修改内容

Note: Please add/reduce lines or revise content based on subject.

勾选 Check	教学方法与特色 Teaching Methodology & Characters
☑	多媒体教学：基于信息化设备的课堂教学 Multi-media-based lecturing
☑	实践能力传授：理论与行业、实际案例相结合 Combining theory with industrial practical problems
☑	课程思政建设：知识讲授与德育相结合 Knowledge delivery with ethic education

□	PBL 教学：问题驱动的分组学习与交流 Problem-based learning
□	其他:单击或点击此处输入文字。 Other:单击或点击此处输入文字。

六、成绩评定 Assessment

注：可根据实际情况增减行数或修改内容

Note: Please add/reduce lines or revise content based on subject.

考核环节: Assessment Content	平时 Behavior	环节负责人: Director	高军
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	5
考核方式: Measures	满分 100 分。考勤一次满分 10 分，作业一次满分 20 分，根据不同考勤和作业次数调整占比权重，最后总分不超过 100 分，不低于 0 分。每次考勤根据上课表现给分，缺勤不得分，缺勤五次及以上取消考试资格。每次作业根据作业正确性给分，抄袭、给他人抄袭或未交作业不得分。		

考核环节: Assessment Content	实验 Experiment	环节负责人: Director	杨光
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	25
考核方式: Measures	满分 100 分，实验成绩不及格（低于 60 分）不得参加期末考试。通过课堂表现及实验报告记录学生成绩，实验报告 50 分，课堂操作 50 分。抄袭、给他人抄袭或未交实验报告不得分，缺席一次或多次实验无实验成绩。最后总分不超过 100 分，不低于 0 分。		

考核环节: Assessment Content	期末 Final	环节负责人: Director	高军
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	70
考核方式: Measures	试卷满分 100 分，通过批阅期末考试试卷给出学生成绩。期末试卷成绩占最终考核成绩 50%		

七、改进机制 Improvement Mechanism

注：未尽事宜以教学团队以及学院教学指导委员会商定为准。

Note: Matters not covered in this file shall be determined by TAB of SSTC, NEU.

教学大纲改进机制 Subject Syllabus Improvement Mechanism			
考核周期(年): Check Period (YR)	4	修订周期(年): Revise Period (YR)	4
改进措施:	课程负责人根据课程教学内容与人才培养目标组织课程团队讨论		

Measures	并修改教学大纲，报分管教学工作副院长审核后由执行院长批准。 The subject coordinator shall be responsible for the syllabus discussion and improvement, and the revised version shall be submitted to deputy dean (teaching affairs) for reviewing then to executive dean for approval		
成绩评定改进机制 Assessment Improvement Mechanism			
考核周期(年): Check Period (YR)	1	修订周期(年): Revise Period (YR)	1
改进措施: Measures	课程负责人根据课程教学内容、课堂教学效果以及成绩分布，对课程教学方法和成绩评定环节进行改进，并同步优化评定办法。 The subject coordinator shall revise the syllabus based on the teaching content, effect and result distribution while optimize the assessment measures.		