

SYLLABUS

NT532–ADVANCED INTERNET OF THINGS TECHNOLOGIES

1. GENERAL INFORMATION

Course name: **Advanced Internet of Things Technologies**

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Tutors:

Credits: 3

Theory: 2 Lab: 1

Class hours: 30hours (1 academic hour: 45 minutes)

Labs: 30 hours

Self study: 30 hours

Prequisites courses/ Pre- known knowledge: Wireless embedded network systems

2. OBJECTIVES

This course provides to students the knowledge in different iots network protocol stacks, such as IEEE 802.15.4 WPAN/ZigBee, IEEE 802.15.1/Bluetooth,

RF4CE/RFID, 6LoWPAN, uIP/uIPv6,...This course also presentsd many iots network topologies and architectures: Star, Tree, Clustering, Bus, Ring, Chain, Sweep, Tributaries-Delta, Mesh, Grid. Through the course,students can get enough knowledge and skills to develop iots solutions and applications (Ambient-Assisted Living applications).

3. COURSE BRIEF CONTENTS

This course provides to students the following contents:

- IoTs network protocol stacks: IEEE 802.15.4 WPAN/ZigBee, IEEE 802.15.1/Bluetooth, RF4CE/RFID, 6LoWPAN, uIP/uIPv6,...
- IoTs network topologies and architectures: Star, Tree, Clustering, Bus, Ring, Chain, Sweep, Tributaries-Delta, Mesh, Grid.
- IoTs embedded devices, IoTs network devices: TelosB/MicaZ, SunSPOT, Development Kits from MEMSIC, Texas Instruments,...
- Open-source platforms to develop IoTs solutions and applications: TinyOS, ContikiOS, OpenWRT, Linux kernel networking.

4. OUTCOME STANDARD

Descriptions	Goals
Communications	G1(1.3.1)
Development of network applications	G2(1.3.2)
Design of wired and wireless mobile networks	G3(1.3.3)
Wireless embedded network systems	G4(1.3.9)
Survey of Print and Electronic Literature, Experimental Inquiry, Hypothesis Test and Defense	G5(2.2.2)
Thinking Holistically	G6(2.3.1)
Prioritization and Focus	G7(2.3.2)
Understanding Needs and Setting Goals	G8(2.4.1)

Development Project Management	G9(2.4.2)
Designing a Sustainable Implementation Process	G10(2.6.1)
Test, Verification, Validation and Certification	G11(2.6.2)
Training and Operations	G12(2.7.2)
Reading/Writing Technical Reports, Documents in English	G13(2.10.1)
New Technology Development and Assessment	G14(3.4.2)

5. COURSE CONTENTS

Periods	Contents	Goals	Activities
6	<p>Chap 1. IoTs network protocols</p> <p>1.1. WPAN 802.15.4/ZigBee</p> <p>1.2. 6LoWPAN</p> <p>1.3. WPAN 802.15.1/Bluetooth</p> <p>1.4. RF4CE/RFID</p> <p>1.5. uIP/uIPv6</p>	G1,G2, G3, G4, G6, G7	<p>Group formation.</p> <p>Teaching: lecturer gives instructions, demo, question</p> <p>Study in class: exchange related issues, problems.</p>
6	<p>Chapter 2: IoTs network topologies</p> <p>2.1. Flat vs. Hierarchical</p> <p>2.2. Clustering vs. Tree vs. Chain vs. Grid</p> <p>2.3. Tributaries-Delta, Sweep</p> <p>2.4. Ad-hoc routing protocols</p>	G1,G2, G3, G8,G9, G10	<p>Project allocation.</p> <p>Teaching: lecturer gives instructions, demo, questions, practical/motivation examples.</p> <p>Study in class: exchange related issues, problems.</p>

6	<p>Chapter 3: IoTs devices</p> <p>3.1. MEMSIC: TelosB, Micaz, MIB600,...</p> <p>3.2. Texas Instruments: 6LoWPAN Dev. Kit</p> <p>3.3. 802.15.4 Dev. Kit</p> <p>3.4. SunSPOT Dev. Kit</p> <p>3.5. WLAN APs/Routers, WLAN cards</p>	G4, G5, G10→ G14	<p>Teaching: lecturer gives instructions, demo, question</p> <p>Study in class: exchange related issues, problems.</p>
6	<p>Chapter 4: IoTs software development platforms</p> <p>4.1. TinyOS, ContikiOS, OpenWRT, Linux</p> <p>4.2. MEMSIC (MoteWorks/MoteView)</p> <p>4.3. TI/SunSPOT Software Dev. Kits</p>	G4, G5, G10→ G14	<p>Teaching: lecturer gives instructions, demo, question</p> <p>Study in class: exchange related issues, problems.</p>
6	<p>Chapter 5: nesC (Network Embedded System C) programming</p> <p>5.1. Programming concepts</p> <p>5.2. Linking & name spaces</p> <p>5.3. Interfaces & Modules</p> <p>5.4. Configurations & wiring</p> <p>5.5. Generic components</p>	G4→ G8, G11, G12	<p>Teaching: lecturer gives instructions, demo, questions.</p> <p>Discuss in pairs.</p>

	5.6. Design patterns	Study in class: exchange related issues, problems. Group discussion. Seminar
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6. TEACHING & LEARNING METHODOLOGY

Students attend lectures, do assignments and do presentations. Students are encouraged to be creative, to find the research topics and to practice problem solving skill.

7. EVALUATION

Format	Goals	Ratio (%)
A1. Projects/Seminar/Assignment	G4→G11	30%
A2. Mid-term		0%
A3. Lab	G4, G5, G11→G14	20%
A4. Final exam	G1, G2, G3,G4	50%

8. REFERENCE BOOKS

1. “Wireless Communications and Networks”, 2nd Edition, William Stallings. Pearson Prentice Hall; 2005.
2. “Handbook of Sensor Networks”, Ivan Stojmenovic, Wiley-InterScience. 2005.
3. “Wireless Sensor Networks: A Networking Perspective”, Jun Zheng and Abbas Jamalipour, Wiley. 2009.
4. **Quan Le-Trung**, Paal E. Engelstad, Tor Skeie, Frank Eliassen, and Amirhosein Taherkordi, (2011), "Mobility Management for All-IP Mobile Networks," *Book Chapter in "Emerging Wireless Networks: Concepts, Techniques and Applications"*, ISBN-10:1439821356 | ISBN-13:978-1439821350, CRC Press, Taylor & Francis, US, December 2011. [[table of contents](#)]

Các trang web tham khảo:

1. IEEE 802.15 WPAN™ Task Group 4 (TG4),
<http://www.ieee802.org/15/pub/TG4.html>.
2. IEEE 802.15 WPAN Task Group 1 (TG1),
<http://www.ieee802.org/15/pub/TG1.html>.
3. ZigBee Alliance, <http://www.zigbee.org/>.
4. Bluetooth technology, <https://www.bluetooth.org/>.
5. IPv6 over Low power WPAN (6lowpan),
<https://datatracker.ietf.org/wg/6lowpan/documents/>.
6. ZigBee RF4CE, <http://www.zigbee.org/zigbee-for-developers/network-specifications/zigbeerf4ce/>.
7. uIPv6, <https://www.sics.se/tags/uipv6>.
8. MEMSIC, <http://www.memsic.com/>.
9. Texas Instruments, <http://www.ti.com/>.
10. SunSPOT, <http://sunspotdev.org/products/index.html>.
11. TinyOS, <http://tinynos.net/>.
12. Contiki: Open Source OS for the Internet of Things, <http://www.contiki-os.org/>.
13. Linux Kernel Archives, <http://www.kernel.org/>.
14. OpenWRT, <https://openwrt.org/>.

9. SOFTWARE

1. Các hệ điều hành (nhúng) mã nguồn mở: TinyOS, ContikiOS, Linux, OpenWRT
2. Các Development Kits từ các hãng công nghệ: MEMSIC, TI, SunSPOT

Lecturer