

# 情境感知無所不在學習環境 的建置與教學策略

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# Learning in the In-Class age

- Mass education
- Print technology
- Textbook
- Learning as knowledge transmission



# Learning in the computer/Internet age

- Individual learning
- Computer technology
- Virtual learning environment
- Learning as knowledge construction



# Learning in the mobile/ubiquitous age

- Mobile learning
- Handheld wireless technology
- Virtual+Real learning environment
- Learning as conversation in context







# Definition of mobile learning

- learning with portable technologies
  - focusing on the portable technology
  - could be in a fixed location, such as a classroom
- learning across contexts:
  - focusing on the mobility of the learner
  - interacting with portable or fixed technology
- learning across locations
  - taking advantage of learning opportunities offered by portable technologies (e.g., accessing web contents at any place)

# Characteristics of U-learning

(Chen et al., 2002; Curtis et al., 2002; Hwang, 2006)

## □ 永久性(Permanency)

- 學習者永遠不會遺失曾擁有的學習成果
- 學習過程可持續不斷地被記錄下來

## □ 可用性(Accessibility)

- 學習者可以在任何場所存取教材或資料
- 系統依據學習者的詢問或要求提供對應的資訊，故學習是主動的

## □ 即時性(Immediacy)

- 學習者可在任何場所即時地獲得想要的資訊
- 問題可被快速的解答，或是先記錄下來，等待稍後再尋求解答



## □ 互動性(Interactivity)

- 學習者與老師或同儕經由同步或非同步方式進行互動與交流
- 拉近與專家間的距離且知識的獲取更加地容易

## □ 情境式的教學活動(Situating of instructional activities)

- 學習可以融入在我們每天的生活中
- 在自然且真實(authentic)的環境遇到學習問題，所提出的問題及獲得的解答將更貼近日常生活

## □ 適性化(Adaptability)

- 學習者可得到正確的資訊，在正確的地方，以正確的方式(Learners can get the right information at the right place with the right way.)



# M-Learning vs. U-Learning

## ■ M-Learning

- emphasizing on the portability of the learning device and the mobility of the learner.

## ■ U-Learning

- Focusing on functionalities (e.g., accessibility 可用性 and Immediacy 即時性) of the learning environment.

- Basically, m-learning is one of the way to achieve u-learning.



# Mobile Technologies

- Wearable devices
  - Watch, GPS, organizer, music player, thermometer, barometer
- Mobile phones
  - Phone, music player, camera, organizer, games
- Handheld computers
  - Organizer, wireless web, email, video, messenger, games
- Pen tablet computers
  - Multimedia computer, notepad
- Laptop computers

# Computing with Natural Interfaces

## ■ IBM & CITIZEN WatchPad 1.5





# Wearable computers



# Wearable computers



# Wearable computers

眼球追蹤影像與鏡頭影像被擷取後，會將紀錄的影片數據資料儲存於DVCR磁帶，此方法可確保解析度不會降低。DVCR的磁帶紀錄時間為75分鐘，電池在完整充電下可操作130分鐘，接著便將這些資料傳輸到系統的PC內，進行影像分離、分析並建立鏡頭與游標的重合影片，取樣頻率是25/30Hz。



## Mobile Eye應用

- 認知研究
- 市場研究
- 醫學研究
- 人因研究
- 網頁設計
- 駕駛研究
- 虛擬實境
- 運動訓練
- 動物行為
- 閱讀研究
- 訓練模擬器
- 嬰幼兒行為
- 老人行為
- EEG整合





# SmartPhones (e.g., Sprint PPC 6700)

<http://www.microsoft.com/windowsmobile/articles/ppc6700.msp>



# SmartPhones (e.g., HTC Desire HD)

<http://www.sogi.com.tw/product/productInfo.aspx?pno=7721>

## HTC Desire HD



2402 人說讚。快免費註冊來查看你的朋友對什麼說讚。

產品介紹

產品規格

產品寫真

評測報告

討論列表

價格資訊



- ▶ 作業系統(平台) Android 2.2
- ▶ 內建相機畫素 800萬畫素
- ▶ 相機功能 自動對焦,LED 閃光燈,相片座標記錄
- ▶ 實用工具 FM收音機,世界時鐘,日曆,數位指南針
- ▶ 進階功能 GPS(衛星導航) **G-sensor**
- ▶ 機身設計 直立式,隱藏式天線,旋轉式螢幕,立體聲喇叭,3.5 mm 耳機孔,外LED閃燈
- ▶ 平均報價: **NT\$19700**
- ▶ 上市日期: 2010年11月

加入車拼

# Pen Tablet Computers

<http://www.rentacomputer.com/rentals/tablet-pc.asp>





# iPAD Tablet Computers


[http://orzhd.com/briian/2010/AppleiPad\\_AD79/003.jpg](http://orzhd.com/briian/2010/AppleiPad_AD79/003.jpg)



# Features of Mobile/Ubiquitous Learning

- Learner centred
- Individualised
- Collaborative
- Situated (處境的)
- Ubiquitous
- Lifelong





# Mobile/Ubiquitous Learning Strategies



# Situated learning

- Learning is a process of social participation
- Knowledge should be presented in authentic contexts
- Learners participate within a community of practice
- Problem-based (or enquiry-based) learning
  - Explore problems rather than test mastery of skills
  - Students refine and examine problems and develop solutions
  - Assessment is authentic and performance based



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# The Ambient Wood Project

- It was designed to enable children
  - to switch from their experiences of the physical world (e.g. observing a butterfly drinking nectar (花蜜) from a thistle (薊類植物))
  - to reflect upon the ecological processes that lie behind this interdependency, eg. pollination(授粉)



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# The Ambient Wood Project

- Learning experience was designed that encouraged children to explore and hypothesize about different habitats (棲息地) found in a woodland.
- Mobile devices was provided for the children to access and share contextually relevant digital information when indoors and outdoors.



# Probe tool



- designed to enable children to collect real-time measurements of light and moisture in the area
- PDA display as dynamic visualizations
- stored all the readings and the location

# Ambient horn



- a handheld device the children held to their ears to hear the sounds
- triggered via location pingers, according to the children's location, but was under the children's control.



# Wireless speakers

- hidden in sections of the woods
- realistic sounds of animals in the habitat and abstract sounds that represented various plant processes
- pinger technology was used to deliver the sounds and trigger the ambient horn

# Visualization tools



- enable students to reflect upon their outdoor discoveries in indoor settings
- reconstruct what they had seen, collected, and heard

# Mixed-Reality Learning MyArtSpace project

- Aim: to make school museum visits more engaging and educational
- Combines
  - personal space (mobile phones)
  - physical space (museum, classroom)
  - virtual space (online store and gallery)



# Mixed-Reality Learning MyArtSpace project

- Children as curators, create their own interpretations
- They use mobile phones to collect content, take photos, make recordings, share notes
- They create, share and publish their own online collections
- Full-scale deployment in test sites over one year







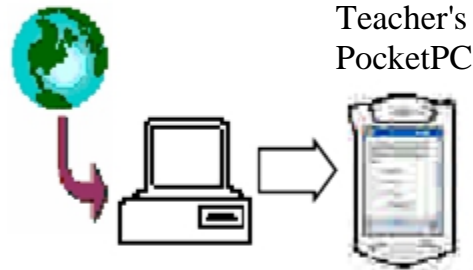
# Collaborative learning

- Learning through technology-mediated collaboration
- Mobile Computer-supported Collaborative Learning (MCSCCL)
- Communication between handhelds assists and structures communication between learners

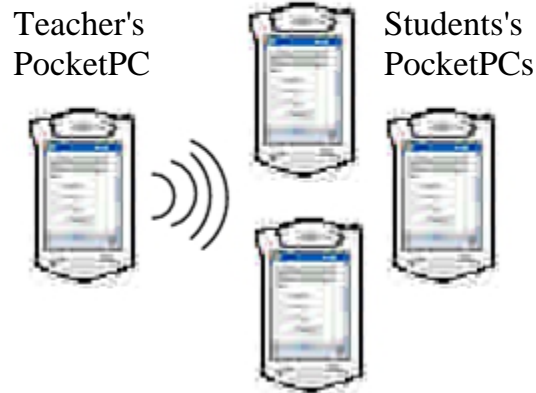
# Collaborative learning example

- MCSCL developed by Pontificia Universidad Católica de Chile
- Tested in four schools and at teacher training college
- Wireless handheld computers

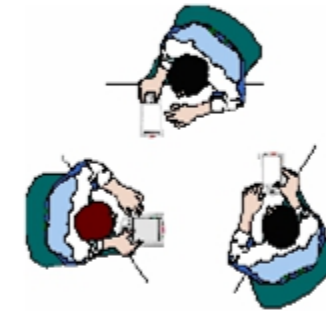




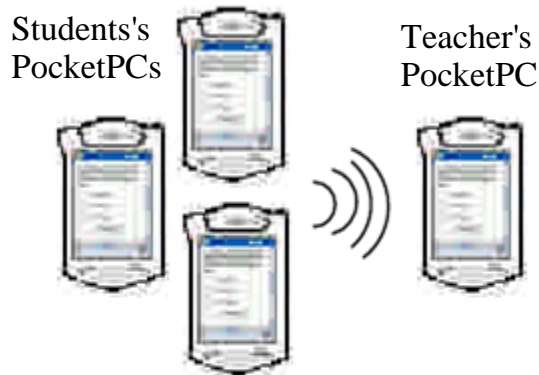
**1.** The teacher downloads the activity from the project website to his PocketPC.



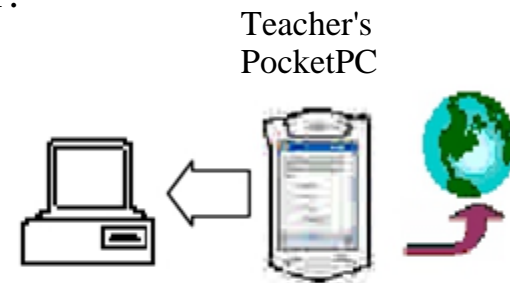
**2.** In the classroom, the teacher transmits the activity to the students using the MANET.



**3.** The collaborative activity is launched by the teacher and the students are assigned to teams that work collaboratively.



**4.** When the class is finished, the teacher's PocketPC collects the students' work.



**5.** The teacher downloads the data collected on to the school's PC and analyzes it. Additionally, this data is available, when up loaded, on the Internet.



# Ubiquitous Computing & Context-Aware Technologies



# Ubiquitous Computing (u-computing) Technologies

- 在1988年美國Mark Weiser，首先提出u-computing的觀念
- 小型電腦將嵌入我們周遭日常用品裡，不需人類主動操控，即可感知我們的行為與可能的需求，並作出反應。
- 又稱為「寧靜技術」(Calm Technology)。

# 各國推動的u-computing計畫

美國	Intel	Proactive Computing
	IBM	Pervasive Computing
德國	漢諾瓦大學資訊系 系統工程中心	Organic Computing
歐洲	歐盟	Ambient Intelligence
日本	日本政府	U-Japan
南韓	南韓政府	U-Korea
	三星(Samsung)	U-City
新加坡	新加坡政府	Connected Singapore
台灣	台灣政府	U-Taiwan/M-Taiwan



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# Relevant Technologies of U-Computing

- Proactive Computing - working towards environments in which networked computers proactively anticipate our needs and, sometimes, take action on our behalf.
- Pervasive computing - imploding processors, sensors, and actuators into small devices and appliances, or large scale walls, buildings and furniture, and combined with new visualization devices via high-speed networks.
- Organic computing –Components and subsystems of the system are well coordinated in a purposeful manner, such as to be able to meet upcoming challenges by goal-oriented reactions.



# Features of U-computing

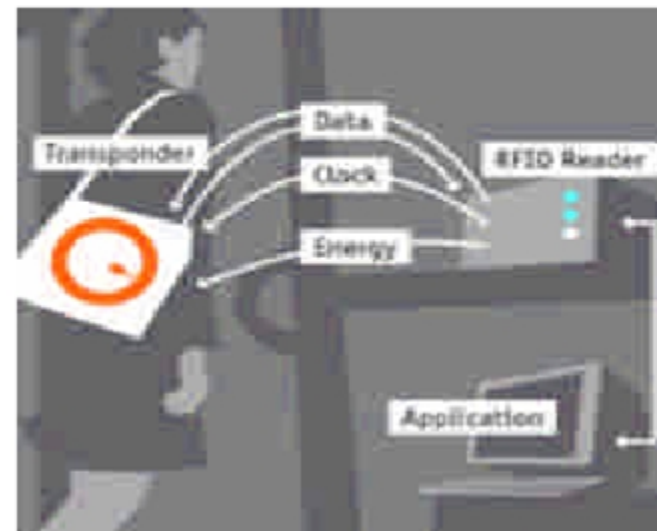
- Computing with Natural Interfaces
- Context Aware Computing
- Automated Capture and Access to Live Experience
- Everyday Computing
- Social Implication and Evaluation



# Context Aware Computing

■ minimal set of necessary context:

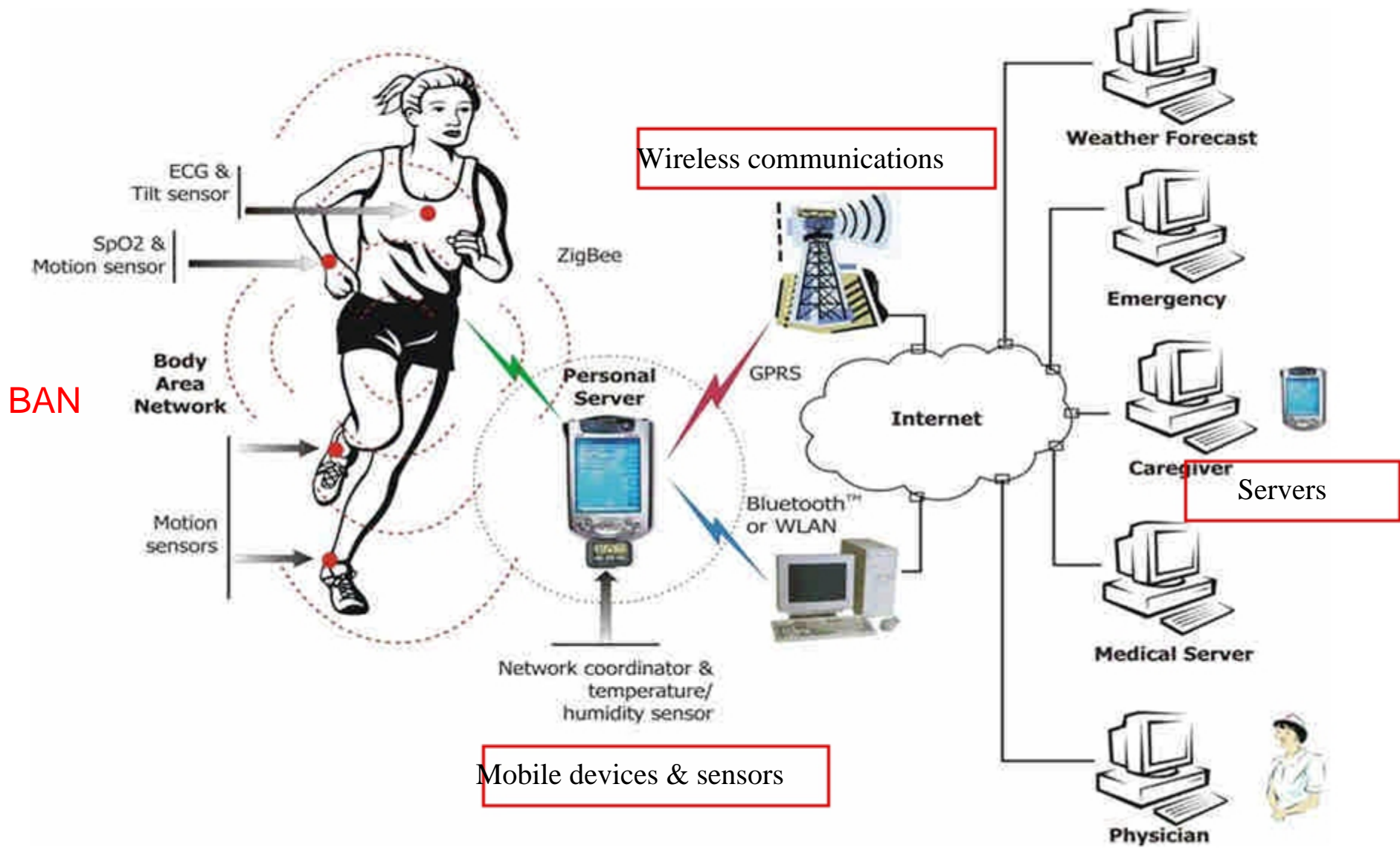
- *Who* : User and other people in the environment.
- *When* : User activity relative changes in time.
- *Where* : The physical location of the user.
- *What* : Interpretations of user activity.
- *Why* : Understanding the activity of the user.





# Automated Capture and Access to Live Experiences

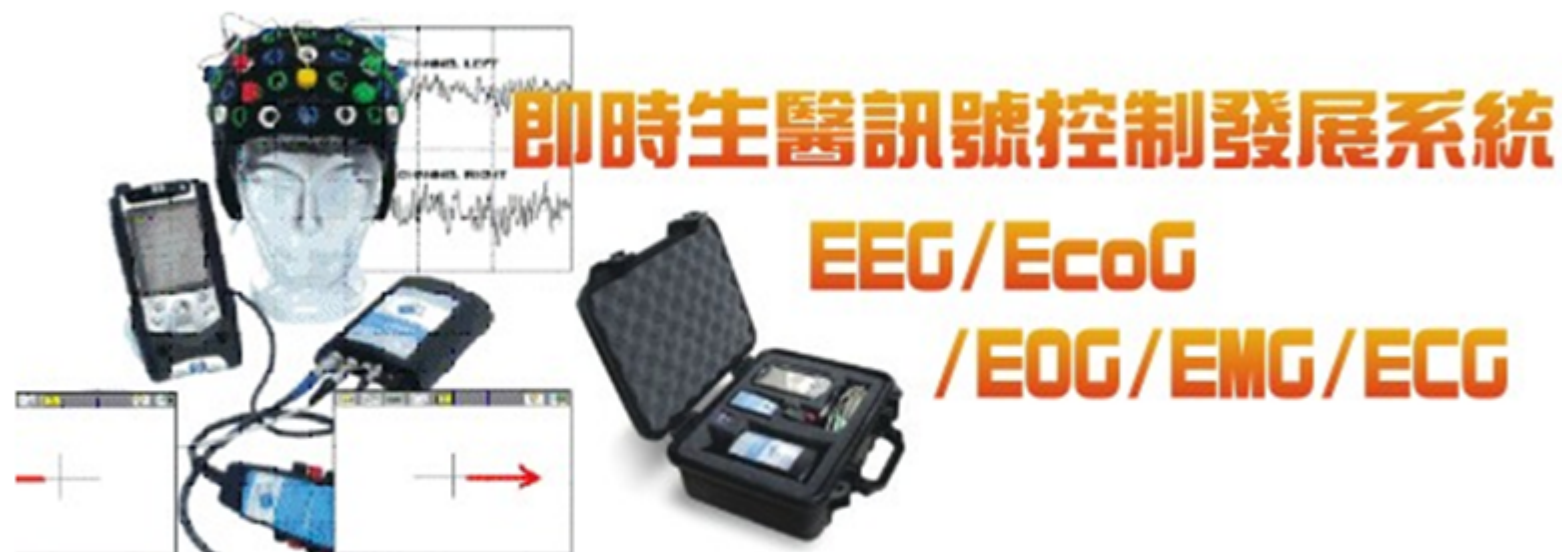
- Not only trying to remember the important pieces of information
- Tools to support automated capture and access to live experiences
- Remove the burden of doing something humans are not good at (i.e., recording) so that they can focus attention on activities they are good at (i.e., indicating relationships, summarizing, and interpreting).



# 運動用品－結合科技 運動更easy



## g-tec可攜式腦波系統



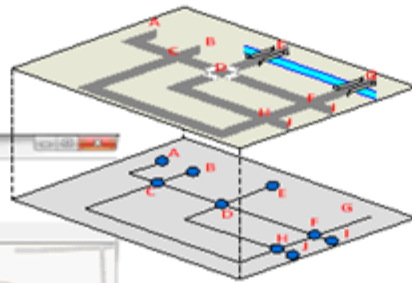
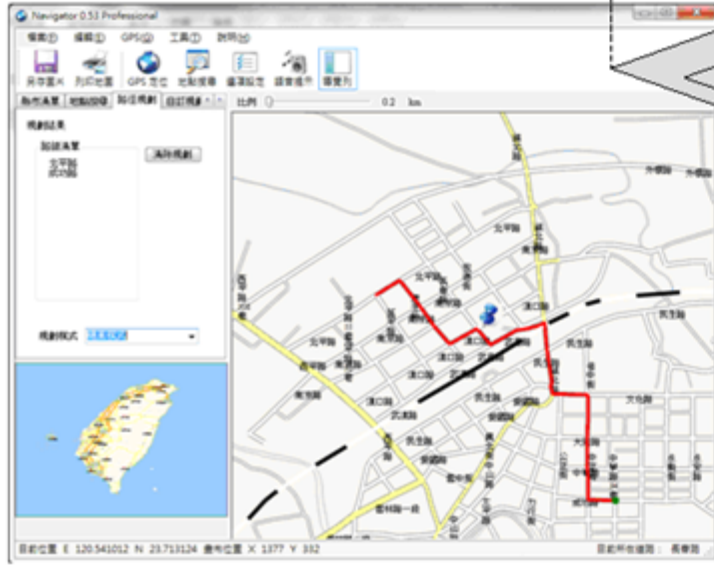
### 特色：

- ▲ BCI即時控制系統
- ▲ 專為研究單元設計之生醫訊號系統
- ▲ 具有低價位的藍芽可攜式系統
- ▲ 可做即時腦波圖樣分析
- ▲ 可整合MATLAB/Simulink



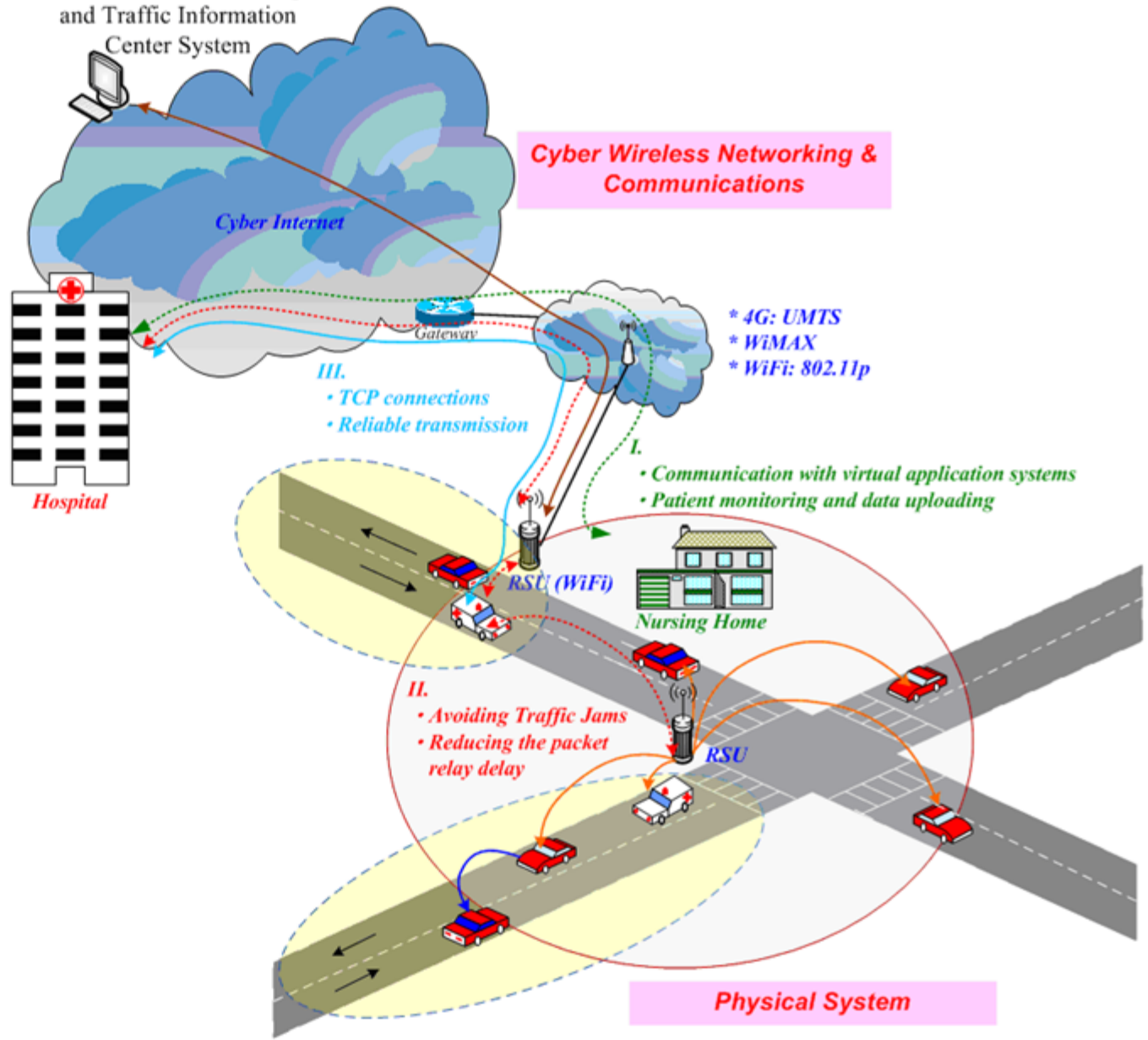


**Virtual Application System**



Virtual VANET Routing and Traffic Information Center System

**CPS: Cyber-Physical System**



**Cyber Wireless Networking & Communications**





- \* 4G: UMTS
- \* WiMAX
- \* WiFi: 802.11p

- III.
- TCP connections
  - Reliable transmission

- I.
- Communication with virtual application systems
  - Patient monitoring and data uploading

- II.
- Avoiding Traffic Jams
  - Reducing the packet relay delay

**Physical System**

 : Road Side Unit (RSU)  
 : Gateway  
 : RSU range  
 : VANET range

# 物聯網

- 物聯網(Internet of things)就是把感測器裝到電網、鐵路、橋樑、隧道、公路、建築、供水系統、大壩、油氣管道以及家用電器等各種實物上，通過網際網路連接起來，進而運行特定的程序，達到遠端控制或者實現物與物的直接通訊。
- 物聯網，透過裝置在物體上的RFID，感測器、二維條碼等，經過介面與無線網路相連，從而給物體賦予「智能」，實現人與物體的溝通和對話，也可以實現物體與物體互相間的溝通和對話，這種將物體連接起來的網路被稱為「物聯網」。

# Everyday Computing

- 每天日常生活所需的科技
- 持續不斷的提供與生活互動所需的移動技術，屬於小範圍的、小size的，融合於環境當中








# How u-computing technologies benefit learning activities?

- A u-computing environment is able to sense personal behaviors in the real world
  - It is able to provide more information to support adaptive learning
  - It is able to guide the learner in the real world
  - It is able to judge the learner's behaviors in the real world is correct
  - It is able to more actively provide necessary information to the learner



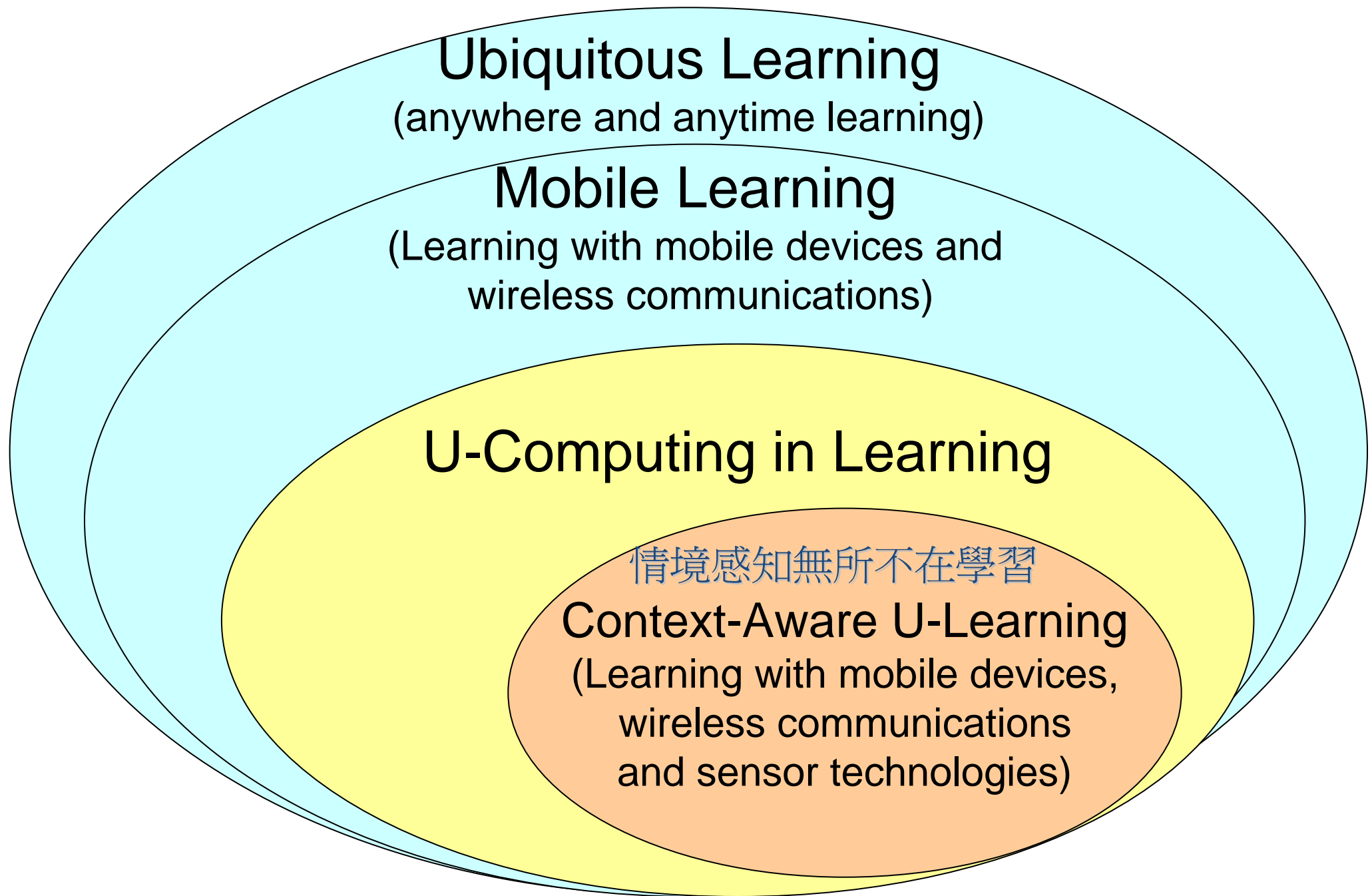
# U-learning ≠ U-Computing in Learning

## ■ U-learning

- E-learning support is available in any place at any time
- U-computing technology is not a necessary criterion


## ■ U-computing in learning

- Applying the u-computing technology to the learning process
- Context awareness belongs to such a category: context-aware u-learning



# Examples of Context-Aware U-Learning

Ogata & Yano(2004)	建置JAPELAS和TANGO兩套系統，以支援語言學習的U-Learning環境
Rogers et al.(2005)	藉由U-Learning整合室內(indoor)及室外(outdoor)森林實地考察的學習經驗
Hwang et al.(2006)	以U-Learning概念規劃並建置一套單晶X光繞射研究人員訓專家系統
Joiner et al.(2006)	以聲境技術 (SoundScape Technology)設計情境教育的探索




# Four steps of providing context-aware u-learning system services

- Setting instructional requirements for each of the learner's learning actions
- Detecting the learner's behaviors
- Comparing the requirements with the corresponding learning behaviors
- Providing personal support to the learner

# Context-Aware u-learning vs M/U-Learning

<b>M/U-Learning</b>	<b>Context-Aware U-Learning</b>
understands the learner's situation by accessing the <b>on-line database</b> .	In addition to access the on-line database, it is able to <b>sense</b> the learner's situation <b>in the real world</b> .
<b>Learners</b> need to actively access the system via wireless networks.	<b>System</b> can <b>more actively</b> provide personalized information or services to the learners based on real world context
Learning portfolio records the <b>on-line behaviors</b> of the learner.	System can record <b>the real world information</b> of the learner.





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# More parameters in a context-aware u-learning portfolio


- **Personal situation in the real world:** learner's location, time of arrival, temperature, heartbeat, blood pressure, etc.
- **Environmental situation :** the sensor's ID and location, the temperature, humidity, air ingredients, and other parameters of the environment around the sensor
- **Feedback from the sensor :** the sensed values of the target, e.g. PH value of water.
- **Personal data in the database :** learner's profile and learning portfolio, such as the predefined schedule, starting time of a learning activity, the longest and shortest acceptable time period, place, learning sequences.
- **Environmental data in the database :** equipment in the lab, the rules of using the lab, the time table of using the lab



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# Minimal Requirements for building a context-aware u-learning environment?

- A set of readers (or sensors) that sense the situation (at least location) of the learner (e.g., RFID readers)
- A set of tags that can be used to identify each learner
- A server that can access the user's situation from the readers
- A mobile device that can display the messages from the server



# RFID (Radio Frequency Identification)

## - an available sensor

- RFID系統包含標籤(Tag)、閱讀器(Reader)、天線(Antenna)與應用軟體(Application System)。
- RFID的基本特性可以區分為以下六大項
  - 數據的讀寫(Read Write)機能
  - 容易小型化和多樣化的形狀
  - 耐環境性
  - 可重複使用
  - 穿透性
  - 數據的記憶容量大



# RFID TAG

## ■ 被動式Tag

- 接收讀取器所傳送的能量，轉換成電子標籤內部電路操作電能，不需外加電池
- 優點：體積小、價格便宜、壽命長、數位資料可攜帶。

## ■ 主動式Tag

- 使用電池推動
- 優點：訊號發射的距離遠優於被動式Tag





# RFID TAG Reader

## ■ 讀取器(Reader):

- 利用高頻電磁波傳遞能量與訊號，電子標籤的辨識速率每秒可達50個以上。可以利用有線或無線通訊方式，與應用系統結合使用。
- 被動式TAG、主動式TAG工作頻率不同，同一Reader無法同時讀取

頻 率	應用案例	通信距離	電波法	備 註
135 KHz 以下	送洗衣物及動物 ID、賭場的代幣	2 公尺(世界共通)	全世界大致為同一規格	易於適用於金屬
13.56 MHz	貨盤/品項管理及圖書館的出入管理	1.5 公尺(世界共通)	全世界大致為同一規格	會受到金屬的影響
860M~960M Hz	貨櫃管理	日本 2005 年開始使用；美國是 7 公尺、歐聯是 3 公尺	美國是 4W 以內、歐聯是 0.5W 以內	通信距離最長，會受到水分的影響
2.45 GHz	停車場中汽車/卡車的出入管理	日本是 1 公尺、美國是 2 公尺、歐聯則是 0.7~2 公尺	日本是 0.1~1W、美國是 4W 以內、歐聯則是室外 0.5W/ 室內 4W 以內	標籤尺寸最小，會受到水分的影響





# When should the context-aware technology be applied?

- Do the learners need supports from the system?
- Do we need personalized instructions?
- Do the instructions or supports need to be given actively?
- Do the learners need to move from places to places during the learning process?
- Do the learners need to learn in the real world?
- Does the context (e.g. location or environmental temperature) of the learner affect the learning

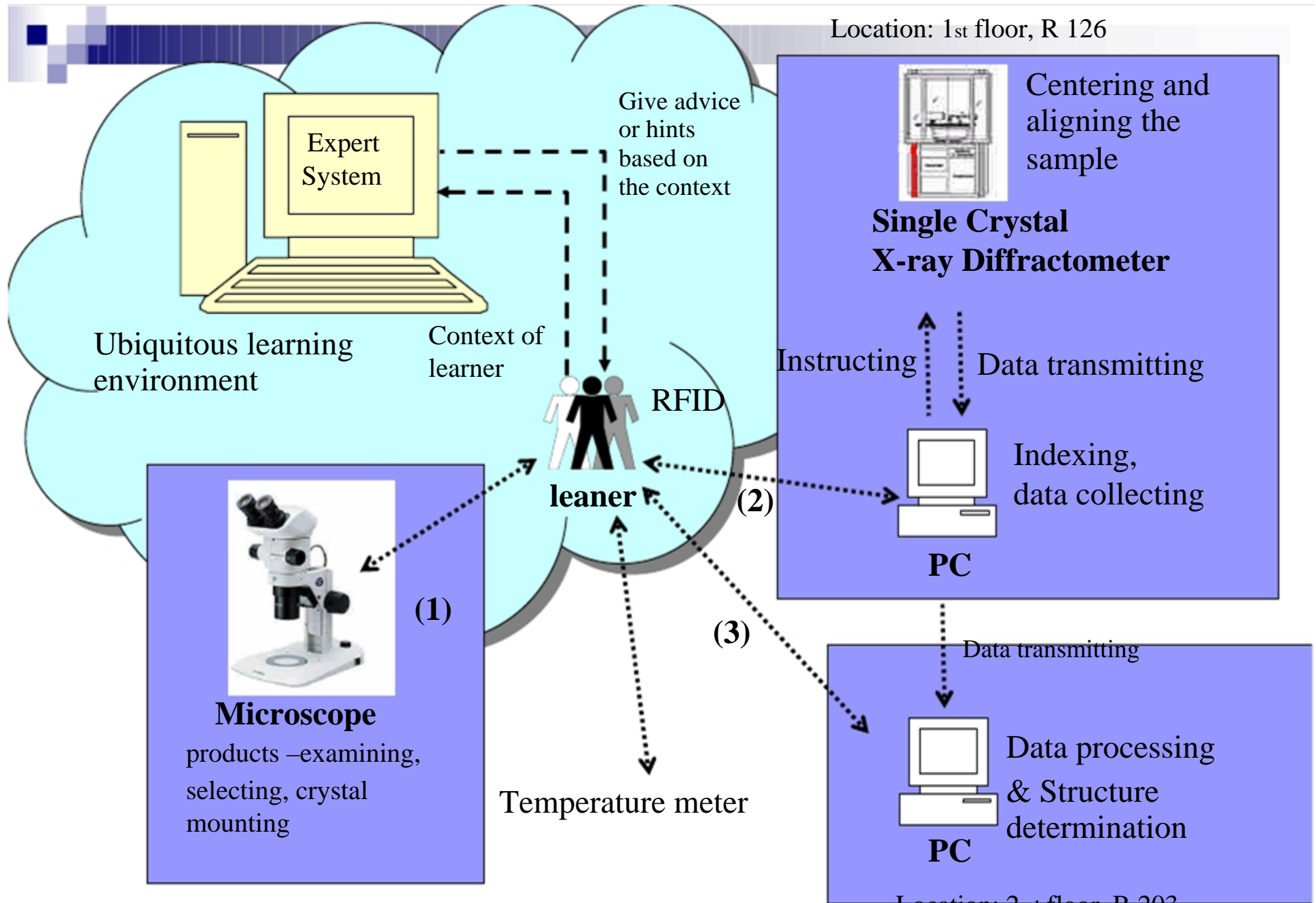


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# Case Study on Training Single-Crystal X-ray Diffraction Researchers

- Single-Crystal X-ray Diffraction is the most effective method for **analyzing 3D structure of compound materials**
- The researchers need to **move from places to places** to operate different equipment
- It is time-consuming to train a new researcher (usually 1-2 years)
- The operations could be dangerous, and hence the learner requires full-time guidance during the training process

Location: 1st floor, R 126



Location: 2nd floor, R 204

黃國禎

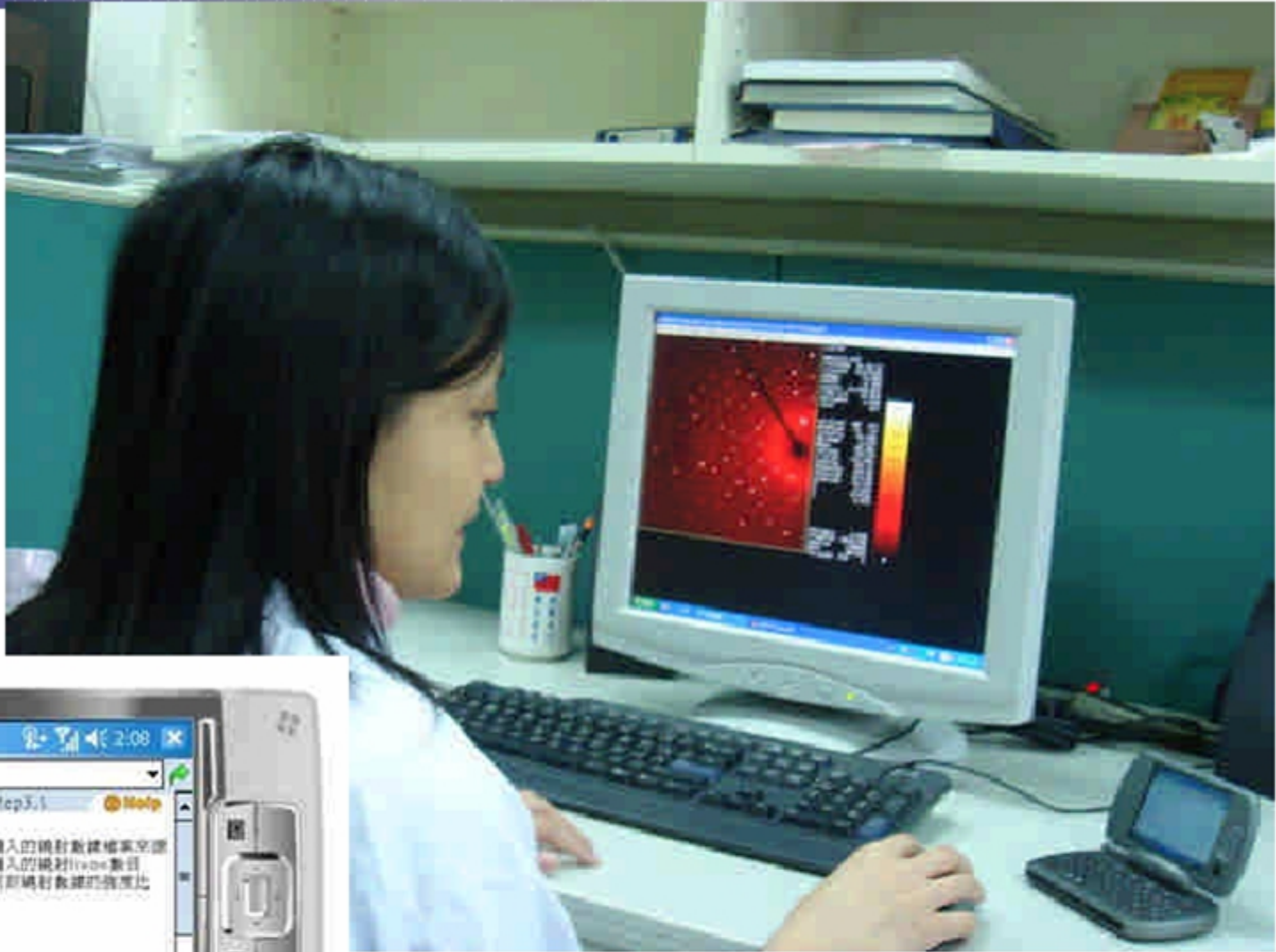
情境感知無所不在學習環境的建置與教學策略

Location: 2nd floor, R 203









- 台南縣成功國小蝴蝶標本展示館
- 實施年級及課程：五年級蝴蝶本位課程





# 蝴蝶學名測驗



a.學名式測驗

b.答題錯誤細部特徵提示

c.再次答題錯誤更正

# 蝴蝶特徵測驗



a. 特徵式文字測驗



b. 細部特徵式圖示測驗



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# Potential Applications of Mobile/Ubiquitous Learning

- 美勞-寫生
- 體育-運動技能
- 語文-識字、會話、作文
- 自然科-動植物及生態觀察
- E-training-工廠作業流程
- 音樂欣賞



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# Thank You!!