計畫編號：AE00-00
計畫名稱：電子化生活科技
計畫主持人：陳俊雄
計畫摘要(中)：

子計畫五努力的目標為經由研發新元件製作技術、新穎光電元件暨建立並應用先進的數值模型方法以追求光電技術領域的學術卓越，研究成果將經由在國際電機電子工程師學會與美國光學學會發行的重要光電期刊發表論文加以檢驗。本子計畫所研發的技術與製作的元件，大多將得以應用於新世代光纖通訊系統與網路中，並在「電子化生活科技」總計畫的範疇中扮演一重要角色。本子計畫發展摻鉻晶體光纖研製與超寬頻可調光纖雷射應用、矽光子發光結構與波導元件、光微機電元件等前瞻技術，並發展最新電磁數值分析模型用於各式元件設計。在晶體光纖研製方面，將研發超越目前在 1300 至 1600 奈米近紅外波長可調記錄的玻璃纖殼晶體光纖雷射以應用於未來超寬頻與隨處可用的全光光纖通訊，動態波長重組系統可因而實現。在矽光子技術方面，其一將研製高品質摻鉺矽奈米線陣列並探討其物理與光學特性，其二將探討以準分子雷射重塑以達成矽波導側邊更均勻的技術以製成超低耗損的波導，其三將設計製作數種矽波導功能元件以及一種將光由光纖導至矽光子線波導的高效率耦光結構。在光微機電元件方面，將設計製作高分子材料微機電可變形鏡、新穎具徑向垂直梳形驅動制動器的二軸掃瞄器、以及結合高阜數 1xN2 波長選擇開關的二軸掃瞄器。在電磁數值模擬與分析設計方面，將建立各式有效的頻域與時域方法，並在光子晶體、矽波導元件與相關結構方面深入探討。

計畫摘要(英)：

The goal of the proposed efforts in this sub-project is to pursue academic excellence in the areas of photonics technologies through working on new device fabrication techniques, novel photonic devices, and state-of-the-art numerical modeling methods with international competitiveness. The performance will be examined by publications of research results in prestigious international journals, in particular, LEOS/IEEE and OSA journals. Most of the technologies developed and devices fabricated in this sub-project will find applications in the

new-generation fiber communication systems and network and play an important role in the scope of the Main Project “Electronics-Based Living Technologies.” Development of advanced technologies for glass-clad chromium doped crystal fiber fabrication and ultra broadband tunable fiber laser applications, silicon-photonic light-emitting structures and waveguide devices, and optical micro-electro-mechanical-system (MEMS)-based devices will be performed. State-of-the-art and novel numerical electromagnetic analysis models will also be developed and applied to the design of different devices. In the topic of crystal fiber research, a glass-clad crystal fiber laser with unprecedented tuning range in near infrared wavelength, i.e. from 1300 to 1600 nm, for future ultra-broadband and ubiquitous (u2) all-optical fiber communications will be developed. Dynamic wavelength reconfigurable system can be realized. In the topics of silicon-photonics, first, high quality erbium-doped silicon nanowire arrays will be fabricated and their physical and optical properties investigated; second, sidewall smoothing for silicon waveguides by excimer laser reformation will be investigated to fabricate ultra-low loss waveguides; third, functional silicon waveguide devices and a high-efficiency coupling structure for coupling light from optical fibers into silicon photonic wires will be designed and implemented. In the topic of optical MEMS-based devices, MEMS polymer-based deformable mirrors, novel two-axis scanners with radial vertical combdrive actuators, and a two-axis scanner(s) incorporated high port-count 1xN2 wavelength-selective switch will be designed and fabricated. In the topic of electromagnetic numerical simulation, analysis, and design, several efficient frequency-domain and time-domain methods will be developed, and in-depth investigation of photonic crystals, silicon waveguide devices, and relevant structures will be conducted.

計畫編號：AE00-01
計畫名稱：前瞻微波及系統構裝整合科技
計畫主持人：吳瑞北
計畫摘要(中)：

資訊、電子為 21 世紀最重要的科技領域，目前世界重要國家莫不以主導該科技之

發展，作為保持其經濟與國防之優勢。台大資訊電子科技整合研究中心（資電中心）的相關同仁，在過去兩屆卓越計畫及數次整合基礎上，已建立堅強優異的研究團隊，並在資訊電子之數項次領域中，已有一些世界級的研究成果，而廣受國際學者專家的重視與肯定。為追求學術卓越，資電中心以卓越計畫之團隊為骨幹，另再結合其他優秀同仁，而組成一堅強的研究團隊，並特別對此優秀團隊，給予合力支援，使其能在未來三年中完成攻頂任務，成為真正的世界一流。

為達成此一目標，本中心將以「電子化生活科技」為主軸，另以「網路化技術」及「數位化技術」為重點，進一步強化並整合此優質研究團隊。希望在一個目標、一個主題、兩個重點之方向下，能大幅提升研究水準，締造突破性的研究成果，而使團隊實力達到世界一流。

本整合型研究計畫含總計畫及五項子計畫。總計畫負責行政協調及研究整合事項，而各子計畫的重點發展項目如下：

子計畫一將發展以 CMOS 或 III-V 為基礎的 MMIC 設計，並結合 LTCC 或 IPD 製程發展射頻系統構裝(SOP)技術，以及前瞻天線，以符合高達數兆位元(Gbps)資料傳輸率應用的需求。

子計畫二『Content 2.0：以使用者為中心之網際網路多媒體數位內容』將依據(A)媒體計算（Multimedia Computing） - 從資料到知識、(B) 專注計算（Attentive Computing）- 從被動使用者介面到主動使用者介面、以及(C) 人際網路計算（Social Computing） - 從個人到社群這三大研究主軸，進行後續三年的相關研究。

子計畫三（系統晶片技術研發）之目的在於克服系統晶片設計中兩個主要問題，即電子硬體設計及省電系統軟體設計。電子硬體設計之研究主題包括：線路收發系統晶片、寬頻無線通訊系統晶片、具彈性之電子電路系統。省電系統軟體設計包括：省電即時工作排程、可應用於多核心處理器之省電即時作業系統、系統晶片效能偵測及最佳化之工具、系統晶片合成及分析工具。

子計畫四將探討寬頻通訊網路以及普及優化應用之相關研究議題與技術。在寬頻通訊網路，我們將發展認知無線通訊、異質無線網路多媒體資料傳輸、以及尖端無線光傳輸與光通訊系統。在普及優化應用部分，將使用跨領域技術，以應用為導向，研究以人本精神為主之智慧呵護生活空間技術。

子計畫五將發展摻鉻晶體光纖研製與超寬頻可調光纖雷射應用、矽光子發光結構與波導元件、光微機電元件等前瞻技術，並發展

最新電磁數值分析模型用於各式元件設計。

計畫摘要(英)：

Information science and electronics are among the most important areas of science and technology in the 21st century. Presently, the major nations in the world strive to excel in these two fields so as to maintain superiority both in economy and defense. Based on the “Program for Promoting Academic Excellence of Universities” (PPAEU) supported by Ministry of Education (MOE, Phase Ⅰ) and National Science Council (NCS, Phase Ⅱ), and also under the foundation of “Integrated Project of Research-Oriented Universities” again supported by MOE, the “Center for Information and Electronics Technologies” (CIET) has established a very strong research team on these two fields and the corresponding research accomplishments are highly regarded both domestically and internationally.

With a goal of attaining the world-class standing, the CIET proposes an excellence research program on the important fields of information science and electronics so that the distinguished faculty members in the relevant fields, mainly from the team members of PPAEU, may effectively be integrated to conduct researches in a more focused and synergistic manner. The aim of this program is to strive for the promotion in research and to endeavor for the integration and inspiration among relevant research teams in CIET so as to generate breakthrough research results and to attain a leading place in the world.

The proposed integrated program will be focused on the development of “Electronics-Based Living Technologies”. Specifically, the key networked and digital living technologies will be emphasized with the goal of producing world-class research outcomes with pervasive social impact. This program has the main project as the core to integrate five related subprojects. These subprojects (SP) are:

SP1: Advanced Microwave and SOP Integration Technologies

SP2: Content 2.0: User-Centric Internet Multimedia

SP3: System-on-Chip Technology

SP4: Broadband Network Technologies and Applications for Dependable Ubiquitous Services

SP5: Advanced Photonics Technologies

The main project will manage the administrative affairs as well as program integration, and each subproject will be executed by a distinguished research team to carry out advanced and innovative research in its own area of expertise. The focus of each subproject will be briefly explained as follows.

The subproject 1 will develop MMIC design based on CMOS or III-V compounds, and the System-on-Package (SOP) integration technology by the low loss substrate of low temperature co-fired ceramics (LTCC) or Integrated Passive Device (IPD) for miniature, high-performance, cost- effective millimeter-wave circuits, packages, modules, antennas, and systems in multi-Gbps radio link applications.

With advances in digital technologies, digital content has become indispensable in our daily life. Therefore, the subproject 2, "Content 2.0: User-Centric Internet Multimedia", will focus on the following three research directions: (i) Media computing – from data to knowledge; (ii) Attentive computing – from retroactive UI to proactive UI; (iii) Social computing – from individual to community.

The subproject 3 aims to overcome two major difficulties in SOC design – electronic hardware design, in the areas of wireline transceiver SOC, broadband wireless communication SOC, and flexible electronics circuit/system; and energy-efficient system software design, including energy-efficient real-time task scheduling, energy-efficient real-time operating system on multi-core platform, and profiling, optimization, synthesis, and analysis SOC tools.

The subproject 4 will focus on the new research issues on advanced broadband communications networks and ubiquitous applications. We will develop key technologies for spectrum utilization with cognitive radio, multimedia delivery in heterogeneous wireless networks, wireless optical system, and advanced optical communication systems. In addition, we will propose attentive living space technologies to build a practical human-centric environment with an application-driven and interdisciplinary approach.

The subproject 5 will develop the advanced technologies for

Chromium doped crystal fiber fabrication and ultra-broadband tunable fiber laser applications, silicon-photonic light-emitting structures and waveguide devices, and optical MEMS-based devices. In addition, state-of-the-art and novel numerical electromagnetic analysis models will also be developed and applied to the design of different devices.

計畫編號：AE00-02
計畫名稱：content 2.0: 以使用者為中心之網際網路多媒體數位內容
計畫主持人：李琳山
計畫摘要(中)：

由於 CMOS 製程的進步，台灣在用矽材料製成低成本 MMIC 技術已逐漸居於領先。進一步結合以低損耗的 LTCC 或 IPD 製程為基礎的系統構裝(SOP)技術，研製微小化、高性能、成本效益高的射頻模組及系統，將有獨特機會發展毫米波科技的民生應用，符合未來高達數兆位元(Gbps)資料傳輸率的需求。一些相關標準及應用已經被提出來，例如 W-HDMI 以應用於消費電子及醫療用途，WPAN 及 P2P 以結合無線於 USB3.0, 數位站, Gbps Ethernet, PCIe 之應用等。

在數 Gbps 時代，UWB 已不敷使用，由於具高頻寬及免執照特性，60GHz 成為最有發展潛力的系統。然而 60GHz 射頻的 MMIC 設計、構裝、及天線的最佳化以符合點對點及點對多點的性能等等，均是重大挑戰。因此本分項計畫將針對數兆位元無線連線應用，發展各項射頻的 MMIC 設計與系統構裝整合關鍵技術，包含前瞻 MMIC 設計、矽基傳輸線及覆晶轉接特性擷取、SOP 被動組件設計、耦合雜訊抑制之 EMC 設計、寬頻及微小化平面天線、智慧天線應用、三維穿矽連通柱用於晶圓尺度構裝、以及開發新穎傳輸線以整合被動組件於 SoC 等，以期將可開發 MMIC、系統構裝、及智慧天線技術於民生應用。

此外，在執行本計畫中，也將進一步加強與專司晶圓代工的台積電、IPD 構裝的日月光、LTCC 模組的璟德、以及系統應用的南亞、英業達、鴻海等這些業界領導廠商合作，共同增加台灣的科技競爭力。

計畫摘要(英)：

Due to the advances of CMOS process technologies, Taiwan has been pioneering in the realization of low-cost monolithic millimeter-wave integrated circuits (MMIC) by silicon. In combination with the

system-on-package (SOP) approach based on low loss substrate by low temperature co-fired ceramics (LTCC) or Integrated Passive Device (IPD), this represents a unique opportunity to develop miniature, high-performance, cost-effective MMIC’s, modules and systems that could address the increasing demand in terms of multiple Giga bits-per-second (Gbps) data rate throughput of the emerging dense wireless communication systems. Several high date rate wireless standards with multiple Gbps radio link have been proposed to address the future demands in various applications, e.g., wireless HD media streaming (W-HDMI) for consumer electronics and medical surgery use, WPAN and Ad hoc P2P connections for wireless USB3.0, wireless docking stations, wireless Gbps Ethernet, wireless PCIe, and so on.

In an era where multi-Gbps data rate is desired, the UWB with limited throughput of 480Mbps is insufficient. It becomes promising to employ the 60GHz band since its wider spectrum enables multi-Gbps robust radio link and the worldwide license free spectrum exists. However, the design of low cost Si-based MMIC, the packaging of the 60GHz radio, and the antenna optimization for P2P or point to multi-points performance represents major challenges, among others. With the 10-fold increase in the data link, this also manifests the key enabling technology to the wired and wireless convergence in the 21st century communication systems for the electronics-based living technology.

In this integrated project, various related topics on the research of advanced microwave technology, MMIC design, and development of RF-SOP integration technologies for multi- Gbps radio link applications will be covered, such as Si-based and III-V compound MMIC’s design, measurement, modeling, and high-level integration transceivers, IPD transmission line and flip chip interconnects characterization, modeling of 3D packaging in Si, passive embedded SoC using novel transmission structures, SOP millimeter-wave passive components by LTCC or IPD, EMC deisgn for coupling noise reduction, advanced miniaturized broadband planar antennas design, and smart antennas design in seriously fading environment, thereby achieving main theme of exploring the

MMIC, SOP, and smart antenna technologies for civil applications.

In addition, strong academia and industry collaboration will be set up and pushed forward with TSMC for MMIC foundry and chip scale integration, ASE for IPD process, ACX for LTCC manufacture, and Nanya, Inventec, Foxconn for system applications, which are the flagships in Taiwan’s IC and packaging manufacturing and lead industrial researches in computing and consumer electronics, thus aiming to strengthen Taiwan’s competitiveness in science and technology.

計畫編號：AE00-03
計畫名稱：系統晶片 (SOC) 技術研發
計畫主持人：陳良基
計畫摘要(中)：

在數位內容的生命週期中，如何方便地使用數位內容，並進行迅速的管理與有效的組織，是相當值得研究的主題。另外，目前的使用者介面尚無法根據環境與使用者的狀態主動進行調整。此外，網路使用者開始透過網站分享各種資訊的潮流，不僅改變了人際網路的特性與型態，更進一步地提供了發掘群體知識與社群資源的新機會。因此，本計畫『Content 2.0：以使用者為中心之網際網路多媒體數位內容』將依據以下各方向進行研究：

(A) 媒體計算（Multimedia Computing） - 從資料到知識媒體計算將針對數位內容生命週期的每個階段 – 由取得，改良，分析到呈現 –設計出相關的理論與技術，以達到有效的媒體擷取，組織與利用功能。此外，還將開發有效的機器學習技術，作為相關研究的基礎。

(B) 專注計算（Attentive Computing）- 從被動使用者介面到主動使用者介面專注計算將針對使用者的各種動作與狀態進行分析，取得可探知使用者身體狀況與情緒狀況的關鍵資訊，進而提昇使用者效率，提供符合使用者期待的資訊。我們的研究將著重於互動式多解析度顯示系統以及視線與動作偵測系統。

(C) 人際網路計算（Social Computing）- 從個人到社群人際網路計算將著重於網際網路使用者與應用的三個面向 – 內容，內文以及社群，依據瀏覽，擷取，分析，探勘的階層架構進行研究。

計畫摘要(英)：

This sub-project, “Content 2.0: User-Centric Internet Multimedia”, will focus on the following three research directions: (i) Media computing – from data to knowledge; (ii) Attentive computing – from retroactive UI to proactive UI; (iii) Social computing – from individual to community. Each of the research directions will be briefly described below.

(i) Media computing:

For content acquisition, we will build camera prototypes for acquiring 4D lightfields to enable dynamic refocusing and stereo images. For content enhancement, we focus on detecting defected media and improving their quality, such as video stabilization and image deblurring. For media analysis, this project will develop algorithms for detection of generic concept and specific instance from media, such as semantic concept detection and efficient large-scale media retrieval. For content presentation, we will explore approaches for album visualization and presentation to enable effective and enjoyable album browsing and navigation experiences. In addition, to bridge the gaps between signal processing and knowledge discovery, we will develop efficient machine learning algorithms and tools as foundation for various applications, such as concept detection and media retrieval.

(ii) Attentive Computing

Researches on attentive computing will include the following subjects. For multi-resolution display, different systems will be designed and implemented so that the information density can be enhanced or decreased according to where the user attention is focused on. For screen-on-demand, the focus will be on developing an innovative display system which can appear in the air only upon requests and can provide free-hand interaction. In eye gaze tracking for UI, new technologies and systems essential to the applications of attentive computing will be explored. In free-hand input for human computer interaction, we shall investigate new techniques both on 2D-surface input and on 3D-gesture input, to allow users to communicate with the computing system, either on a 2D surface by directly using their hands and fingertips, or in the 3D space by using natural hand gestures, such as waving hands.

(iii) Social Computing

Social computing, as a research direction of this project, focuses on three perspectives: content, context, and community for the Internet research and applications, that is, from independent users and contents to complicated relations of users and contents and the whole community. The approaches we apply to social computing are layered, from browsing, retrieving, analyzing, to mining. For browsing, the opinion browsing structure and landmark clustering will be the main research topics and the results will be visual presentations or be research materials for other research. For retrieving, we will propose efficient techniques for landmark annotation, entities identification, and blog retrieval to support the upstream research. For analyzing, we will explore approaches for the opinion analysis, social role analysis, social tags analysis, and temporal information extraction. For mining, we will touch on much higher level knowledge or relationship structures. Effective and efficient algorithms will be developed for social network construction and landmark ontology construction. In addition, we will also construct benchmarks or test collections for the purpose of performance evaluation, and will release them to related research circles for fair performance evaluations.

計畫編號：AE00-04
計畫名稱：寬頻網路技術及可靠之優化服務應用
計畫主持人：吳靜雄
計畫摘要(中)：

系統晶片將不同電子原件集中到單一晶片藉以建構完整系統。優點包括高效能、低空間需求、低記憶體需求、高系統穩定度及低成本。應用包括多媒體、資訊娛樂系統（iPod）無線設備（手機及 WiFi 設備）本計畫包括電子硬體設計及省電系統軟體設計。前者包括線路收發系統晶片、寬頻無線通訊系統晶片、具彈性之電子電路系統。後者包括省電即時工作排程、可應用於多核心處理器之省電即時作業系統、系統晶片效能偵測及最佳化之工具、系統晶片合成及分析工具。

前瞻系統晶片硬體設計

過去三年來，台灣大學於 ISSCC 所發表的論文數高居全球所有大學的第一名。2007 年更超越 IBM、Intel、TI 等公司，成為世界上所有研究單位發表 ISSCC 論文最多者。同年亦獲得 2007 ISSCC

Beatrice Winner Award，這是歷史上台灣首度獲得此項大獎。面對來自全球各機構的激烈競爭，為維持台大 SOC 團隊的領先地位，本校優勢重點領域拔尖計畫的研究經費之持續挹注乃不可或缺。本 SOC 子計畫已鎖定以下三個極具挑戰性的研究主題作為努力的目標：

(1) 10-Gbps transceiver SOC for twisted pair
(2) Broadband 60-GHz wireless communication SOC
(3) TFT circuit/system for flexible electronics

前瞻系統晶片軟體設計

本研究主軸是以效能工程來改善系統服務品質的各種關鍵技術。目標是開發作業系統中的關鍵元件來支援有即時與省電節能需求的應用系統，包括系統或應用程式效能瓶頸的相關技術，多核心硬體平台即時效能與省電節能，動態電壓調整工作排程、漏電即時工作管理、動態功率管理、優先權反轉與省電節能的工作同步。

計畫摘要(英)：

“System on a Chip” (SoC) is an integration of electronic circuits into a single chip to perform complex functions as a complete system. The advantage of SoC approach includes high performance, smaller space requirement, lower memory requirement, higher system reliability, lower power consumption, and lower costs. Essentially Soc design has become a ubiquitous part of our life, in the form of multimedia, infotainment (e.g. i-Pod), and wireless devices (e.g. cellular phones and WiFi devices).

The “System-on-Chip Technology” sub-project aims to overcome two major difficulties in SoC design – electronic hardware design, in the areas of wireline transceiver SoC, Broadband wireless communication SoC, and flexible electronics circuit/system, and energy-efficient system software design, including energy-efficient real-time task scheduling, energy-efficient real-time operating system on multi-core platform, and profiling, optimization, synthesis, and analysis SoC tools.

Advanced SoC hardware design

NTU has done exceptionally well in the International Solid-State Circuits Conference, recently. NTU not only outnumbered all other universities in the world in the past three years (2005-2007) but also ranks first in 2007 among all companies and universities in the world

along with the winning of 2007 ISSCC Beatrice Winner Award for Editorial Excellence, which is awarded to Taiwan for the first time.

The SOC sub-project aims to continue the existing success and hence the continuing support from the Program for Excellence Research Teams of NTU is crucial to us. As such, we aim to conduct research in three major fields of fundamental significance: (1) wireline transceiver SoC for twisted pair and optical fiber, which will provide a crucial vehicle for carrying ever-growing internet traffic in business as well as residential environments; (2) Broadband wireless communication SoCs, which include both indoors short-range broadband (> 1Gbps) wireless communication and mobile communication up to 100 Mbps (so called 4G); (3) flexible electronics circuit/system, which will be essential in future electronics products, such as rollable displays.

Advanced SoC software design

Embedded software should provide good leverage on the performance of SoC IP’ s and be energy-efficient to lengthen the operating duration of embedded devices or to resolve heat dissipation problems. The main theme of this research is on the key technologies to improve system QoS based on performance engineering. Performance engineering is the systematic process for planning and evaluating a system's performance throughout the life cycle of its development and deployment. Our main objective is to develop key components in operating systems to support application systems with real-time and energy-efficient requirements. We consider multi-core development platforms and aim at several key techniques, such as task scheduling with dynamic voltage scaling, leakage-aware real-time task management, dynamic power management task synchronization with priority inversion and energy-efficiency considerations etc. We will also develop ESL tool sets for multi core SOC to verify and evaluate the innovative energy-efficient techniques. Our work will introduce new scheduling algorithms, OS components, synchronization protocols, middleware, tools, and hardware IP’ s conforming system performance engineering. We will also develop a prototype of a multi-casting-based walky-talky system to demonstrate good system performance engineering on real-time

performance, energy-efficiency, and scalability considerations.

計畫編號：AE00-05
計畫名稱：前瞻光子技術
計畫主持人：張宏鈞
計畫摘要(中)：

本子計畫中將以過去兩年設計與實作之成果為基礎，探討寬頻網路技術與可靠之優化服務應用的新議題。為了有效地提供人本智慧型互動服務，本計畫將設計普及優化應用，其可支援自然且友善之人機互動模式以得到所需資訊；並開發所需之寬頻網路技術，以將所需資訊在設備間高速傳輸。

本計畫欲開發之寬頻網路技術部分包括無線通訊，網路通訊、與光通訊。我們將發展具認知與合作特性之分散式無線通訊技術。此外，許多先進無線通訊技術，例如多收送天線技術、具頻道可適性之排程技術、可預測之調變與編碼技術、混合式自動回覆請求協定、Raptor 編碼、以及干擾避免技術，亦將於本計畫中探討。在網路通訊技術部分，我們將在異質無線網路中採跨層設計機制來提供多媒體服務，其中每個手持裝置將配有多個無線通訊介面，如 3G、WiMAX、以及 WiFi。所發展技術將支援多重速率、多重介面、以及多重網路連結之需求。在光通訊方面，我們將針對下一代光通訊網路設計尖端光通訊技術，以及都會與接取網路元件之關鍵技術。此外，我們亦將探討無線光通訊傳輸技術。

本計畫將以現有網路與資訊技術為基礎，秉持人本精神，研究開發可靠的智慧型生活環境，以提供普及優化服務。在可靠無線感測網路方面，我們將研究感測網路之可靠群播運作架構，以滿足健康照護和緊急監測等具有時效性的應用。在情境感知與經驗擷取技術部分，我們將透過具有感測器的行動裝置，將憂鬱症病人所經歷的人/事/位置之情境，轉化為運動量與社交活動的資訊，進而幫助病況的治療。在智慧呵護屋技術中，我們會利用意圖感知、情緒感知、知覺感知等技術，感應居住者的情境及狀況與居住者進行自然而適切的互動，以滿足居住者之真正需求。此外，關於多媒體處理與資源自動管理平台，我們將以位置知覺服務為基礎，建立一套自動化的資源管理環境，以提供最適切的使用者服務。對於家庭/社區/校園之智慧型學習環境，將大量但缺乏組織的資訊轉化為有系統的知識，並利用 U 化的學習平台建構家庭、社區、校園的創意學習生活空間之所需技術亦

會被探討。在U化醫院部分，會藉著結合寬頻無線通訊、感知網路與醫療資訊系統等技術，發展一個無所不在的U化醫院平台，進而提供一個全方位的健康生活照護服務。

除了設計與評估，本子計畫亦將模擬與實作所提出之解法，並探討實驗結果。由於寬頻網路與普及優化服務為未來社會中知識經濟之基礎，因此我們確信在這方面之研究成果將可增進本校之學術地位以及國際競爭力。

計畫摘要(英)：

In this sub-project, based on the system design and implementation prototype developed in last two years, we would like to study new issues in broadband network technologies and applications for dependable ubiquitous services. To provide human centered services in an intelligent, informative, interactive, and invisible way, we will develop ubiquitous applications that support a natural and friendly interface between human and various computing devices around us for information processing, and also the broadband communications networks that can connect these devices with no delay for the exchange of the required information.

This sub-project divides the broadband network technologies into wireless communications, networking, and optical communications. In wireless communications, we will focus on the cognitive, collaborative, and distributed coordinated radio. Topics on MIMO, channel-adaptive shared scheduling, predictive modulation and coding, hybrid ARQ, Raptor code, and interference avoidance will be specifically addressed. In networking, we aim at providing the cross-layer design for quality of multimedia service over heterogeneous wireless networks. We attempt to enhance multimedia service on multi-homed mobile devices with heterogeneous wireless interfaces including 3G, WiMAX, and/or WiFi. Related issues will then be extended to heterogeneous wireless networks with multi-rate, multi-radio, multi-hop transmissions. In optical communications, we will develop advanced optical technologies for next generation optical communication networks as well as the enabling technologies and key components for metro and access applications. We will also develop advanced wireless optical transmission technologies.

In the applications for dependable ubiquitous services, we will

research and develop a dependable human-centric environment for quality living based on the existing network and information technologies in the interdisciplinary manner. We will propose reliable and timely information gathering in wireless sensor networks for health care and emergency monitoring applications. In addition, we will study the context and persuasive technologies. To provide more information for psychologists, we will focus on the data collection from the location and activity sensors on a mobile device carried by a depressed patient to represent the patient’ s physical and social activity levels. Moreover, we will design a system for attentive home with intention-aware, emotion-aware, and sense-aware approaches to interact with the inhabitants according to the situational information in a natural and appropriate way. We will also propose the multimedia processing and recognition platform with the location-aware technologies to support online service integration. We will construct a universal knowledge learning platform, which makes unorganized information become organized knowledge, to create an intelligent living and learning environment. Finally, we will develop the technologies for ubiquitous hospital with the integration of broadband wireless communications, sensor networks, and medical information systems.

Implementation, testbed measurements, and system simulations will be employed to aid the design, evaluation, and analysis of the proposed solutions. Broadband communications networks and ubiquitous applications will be the basis of the modern society and knowledge economies in the future, and we thereby believe that the ability to achieve significant accomplishments in this area will lead to academic excellence with international competitiveness.