SUBPROJECT 4: SMART AND COGNITIVE COMMUNICATIONS AND NETWORKS-ADVANCED COMMUNICATIONS AND NETWORK TECHNOLIGIES FOR ITS

CONTENTS

III. (FORM 2) LIST OF WORKS, EXPENDITURES, MANPOWER, AND MATCHING SUPPORTS FROM THE PARTICIPATING INSTITUTES（REALITY）.

Serial No.: NSC 95-2752-E-09-014-PAE	Program Title: Smart and Cognitive Communications and Networks – Advanced communication and network technologies for ITS 智慧型之通訊及網路–ITS 前瞻通訊及網路技術之研發

Research Item (Include sub projects)	Major tasks and objectives	Expenditures (in NT$1,000)					Manpower (person-month)					Matching Supports from the Participating Institutes (in English & Chinese)
		Salary	Seminar/ Conference-related expenses	Project- related expenses	Cost for Hardware & Software	Total	Principal Investigators	Consultants	Research/ Teaching Personnel	Supporting Staff	Total	
Sub-project 4	Wireless/mobile access networks	192	90	25	0	307	3	0	36	0	39	Matching fund 480,000NT 學校補助配合款 480,000 元 Microelectronics & Information Systems Research Center provides space (≒960 m^2) for administration and measurement 電子與資訊中心提供計畫作業及實驗室空間約 960 m^2（＝290 坪）
Sub-project 4	Heterogeneous network integration and radio resource management	255	120	23	0	398	6	0	84	0	90	
Sub-project 4	Intelligent in-car human-machine interface	300	68	25	0	393	6	0	86	0	92	
Sub-project 4	All-optical ring-based network	1919	86	53	0	2058	3	0	30	24	57	
SUM		2666	364	126	0	3156	18	0	236	24	278	

IV. (FORM 3) STATISTICS ON RESEARCH OUTCOME OF THIS PROGRAM

LISTING		TOTAL	DOMESTIC	INTERNATIONAL	SIGNIFICANT[1]	CITATIONS[2]	TECHNOLOGY TRANSFER
PUBLISHED ARTICLES	JOURNALS	9/13	-	9/13	5/8		
		# of published papers/# of papers including accepted papers					
	CONFERENCES	21	1	21	9		
	TECHNOLOGY REPORTS						
PATENTS	PENDING	7	0	7			
	GRANTED	1	1				
COPYRIGHTED INVENTIONS	ITEM						
WORKSHOPS/CONFERENCES[3]	ITEM	2	2				
	PARTICIPANTS	300	300				
TRAINING COURSES (WORKSHOPS/CONFERENCES)	HOURS						
	PARTICIPANTS						
PERSONAL ACHIEVEMENTS	HONORS/ AWARDS[4]						
	KEYNOTES GIVEN BY PIS						
	EDITOR FOR JOURNALS	4		4			
TECHNOLOGY TRANSFERS	ITEM	2	1	1			
	LICENSING FEE	NTD 20,000	NTD 10,000	NTD 10,000			
	ROYALTY						
INDUSTRY STANDARDS[5]	ITEM						
TECHNOLOGICAL SERVICES[6]	ITEM						
	SERVICE FEE						

[1] Indicate the number of items that are significant. The criterion for "significant" is defined by the PIs of the program. For example, it may refer to Top journals (i.e., those with impact factors in the upper 15%) in the area of research, or conferences that are very selective in accepting submitted papers (i.e., at an acceptance rate no greater than 30%). Please specify the criteria in Appendix IV.
[2] Indicate the number of citations. The criterion for "citations" refers to citations by other research teams, i.e., exclude self-citations.
[3] Refers to the workshop and conferences hosted by the program.
[4] Includes Laureate of Nobel Prize, Member of Academia Sinica or equivalent, fellow of major international academic societies, etc.
[5] Refers to industry standards approved by national or international standardization parties that are proposed by PIs of the program.
[6] Reers to research outcomes used to provide technological services, including research and educational programs, to other ministries of the government or professional societies.

V. EXECUTIVE SUMMARY ON RESEARCH OUTCOME OF THIS PROGRAM

中文摘要

計畫 4 旨在開發運用於智慧型運輸系統之前瞻模擬軟體平台、開放式實體驗測車機平台、及相關通訊與網路前瞻技術；在模擬軟體平台方面，本計畫延續發展 NCTUns 模擬平台，該平台將網路資訊流模擬與道路/車輛行駛路徑模擬緊密結合，並於其上實現無線區域網路(WLAN)與無線都會網路(WMAN)之間異質網路整合與無線電資源管理技術等相關前瞻技術，有助於較大規模之 ITS 資通平台效能評估；在實體驗測車機平台方面，本計畫將開發前瞻開放式車機平台，基於下一代 IPv6 網路協定，達成包括車間通訊、車路間通訊等功能，並於其上整合高可靠度汽車環境語音辨識技術與嵌入式語音辨識模組作為人機介面。本分項計畫研究成果與車機資通平台及 ITS/VPS 應用服務直接相關，並且與國際前瞻技術發展趨勢相符。

關鍵字：智慧型運輸系統、NCTUns 模擬平台、異質網路整合、可靠語音辨識、開放式車機

ABSTRACT

The sub-project 4 investigates innovative, intelligent and high-performance multimedia mobile communications and networks for ITS. Here an advanced network simulator, an automotive telematics platform, and the smart communication/network technologies are proposed and developed. The proposed NCTUns simulator tightly integrates vehicle traffic flow and vehicular network data flow and provides real-time feedback loop between them. Several smart vertical handoff and scheduling algorithms to access wireless local area network (WLAN) and the wireless metropolitan area network (WMAN) will be proposed and developed on the NCTUns simulator. This enables performance evaluation on large-scale ITS networks and novel ITS researches in which a vehicle needs to change its moving speed or direction after receiving a message from another vehicle. As to the automotive telematics platform, it is developed by open hardware/software standards and IPv6-based networking/mobility protocols. Heterogeneous network devices, including IEEE 802.11b WiFi with MANET capability, GPRS, GPS, are integrated in the platform. The intelligent in-car human-machine interfacing by reliable speech recognition and text-to-speech modules are also developed and integrated in this platform for proof-of-concept testing. The achievements in sub-project 4 are not only highly related to the design and development of telematics and ITS/VPS services but also are adapted to international technology developing trend of ITS.

Keywords : intelligent transportation system, NCTUns network simulator, heterogeneous network integration, reliable speech recognition, automotive telematics

1. General Description of the Program

The Sub-project 4 investigates innovative, intelligent and high-performance multimedia mobile communication and network solutions for ITS. There are four main tasks in Sub-project 4, including development of and/or investigation on wireless/mobile access networks, heterogeneous network integration, intelligent in-car human-machine interfacing by reliable speech recognition, and advanced ITS information-communication platform for automotive telematics. In the first year, a convergent automotive telematics is architectured and designed for further integration of other sub-projects. A novel hybrid mobile access network, which combines WLAN-based MANET and commercially available 2.5G/3G cellular networks, is proposed and investigated. Considering heterogeneous network convergence, a mathematical model is developed to evaluate the possibility of cognitive radio (CR) network to resolve the opportunistic radio resource management and medium-access control issues for ITS. A speech recognition system is established on an embedded platform for human-machine interface to access remote traffic information and to easily control various in-car equipments.

2. Breakthroughs and Major Achievements

In the second year of this program, major achievements and breakthroughs are summarized as follows:

- **Heterogeneous Network Simulation**

A network simulator capable of simulating both vehicular network and traffic has been designed and implemented. When compared with other network simulators, our network simulator has several unique advantages:

(1). It can directly run real-world application programs during simulation. This means that developing application programs over our simulator can minimize the time and effort required to port such developed programs from the simulation environment to the real world.

(2). It tightly integrates vehicle traffic simulation and vehicle network simulation together and provides real-time feedback loop between them. This enables novel ITS research in which a vehicle needs to change its moving speed or direction after receiving a message from another vehicle.

(3). Since its release in Nov. 2002, as of Dec. 6, 2007, the number of registered users of this simulator has exceeded 10,251. These users come from 121

countries in the world and these numbers are still increasing.

- **Smart and Cognitive Communications and Netw orks**

(1). A method to design the optimal relay location is developed, aiming to maximize the system throughput in the two-hop wireless ITS systems. This method also suggests a relay selection rule to determine whether the data are delivered by two-hop transmissions. Based on the suggested relay selection rule, the throughput can be improved when the relays are deployed at the proper locations. In addition, we find the optimal relay location to maximize the system throughput.

(2). A scalable ring-based wireless multihop network for wide-area coverage is proposed. In multihop networks, inner users consume more power to relay traffic than others, thereby leading to the power-unfairness issue in the multihop network. We suggest designing the ring widths to achie ve power fairness and extend the lifetime of multihop network. We also apply an optimization approach to determine the optimal widths of the rings in a multihop network, aiming to maximize the cell capacity and coverage subject to the constraint of power fairness.

- **Intelligent in-car human-machine interface**

(1). The eASR system and the TTS system in a hand-held mobile device

We implement an embedded automatic speech recognition system (eASR) and a Text-to-Speech (TTS) system on a hand-held device. The eASR adopts the initial-final HMM-based approach. It uses the fixed-point partition Laplacian observation probability to model the RASTA-based MFCCs. The precision of the fixed point data used in the system was 32 bits (16*16 operations). The ASR system can be run in two modes: isolated-word recognition and keyword spotting. For an application of 1000 isolated words, the recognition rate is 93.9% in clean-speech environment. The recognition rate degrades slightly to 91.3% for a noisy car environment with 6 dB in SNR. The system response time is about 1.1 times of the recording time operating in 200MHz Arm9-based platform. The TTS system is a revised version of the one originally developed on SunPlus un'SP 6608 DSP by Prof. Shaw-Hwa Hwang of the Department of Electrical Engineering, National Taipei University of Technology. The system uses segment-based 411 base-syllables as synthesis units and adopts a recurrent neural network to generate prosody information. It can synthesize natural Mandarin speech for any input Chinese texts. The specifications of the eASR

and TTS systems are listed in the following table.

	eASR	eASR+TTS
OS	Microsoft Windows CE	
CPU	200MHz Samsung ARM9 base Soc	
ROM	1.4 MB	5 MB
Maximum RAM	< 2 MB	
Response time	< 1.1 times of recording time	
Recognition rate	95.8% (clean model) 93.9% (car model)	

- **Design and Prototyping of Automotive Telematics**

(1).An IPv6-based automotive telematics is developed to investigate IPv6 networking systems for ITS. Several advanced networking protocols, inc luding IPv6, Mobile IPv6, and NEMO protocols, are planned to be integrated in the platform. The prototype is made for field trials and performance evaluation purposes. The telematics hardware/software platform is based on an embedded hardware platform with an ARM-based microprocessor, graphic/vocal human-machine interfaces (HMI), and heterogeneous network devices (IEEE 802.11b WiFi with MANET capability, GPRS, GPS) are suggested. Telematics service prototypes, such as traffic information on demand and inter -vehicular driving assistance, are developed for proof -of-concept experiments.

(2). A 2-D geometric and adaptive relay node deployment method is proposed to minimize relay nodes for bridging all disconnected Road -Side Units (RSU), which are regarded as an enabling technology for vehicle -to-infrastructure (V2I) communications. This method only has polynomial -time complexity. In the method, the local optimum location of the relay node is discovered on a plane, which gives a much larger degree of freedom to c ompare with the traditional 1-D search algorithm. Besides, the method can also adapt to radio environments because that a sophisticated propagation model including large -scale path loss, shadowing, and multipath fading effects is used to estimate link conn ectivity. Simulation result validates its robustness and efficiency compared with related works.

3. Categorized Summary of Research Outcomes

1) Top Journals and Conferences

Most of the significant research outcomes have been published in top international journals and conferences. The top journals and conferences are selected according to the impact factor (IF), the rejection rate, and their influence on the associated research areas. They are listed below and also in Appendix III.

Top Journals

(1) IEEE Transactions on Wireless Communication (IF:1.184)
This journal is the most important journal for wireless communication.

(2) IEEE Transactions on Intelligent Transportation Systems (IF: 1.434)
This journal is accredited as the most important journal for novel and state-of-the-art intelligent transportation system technology.

(3) IEEE Transactions on Vehicular Technology (IF: 1.071)
This journal is the most important journal for vehicular technology. It also includes some related topics for communications theory and techniques.

Top Conferences

(1) IEEE International Conference on Communications (ICC)
This conference is the most important one for communications related area.

(2) IEEE WCNC (IEEE Wireless Communications and Networking Conference)
WCNC is one of the most important conferences for wireless communication and networking researchers. This conference is organized by the IEEE Communications Society and has great impact on wireless system domain.

(3) IEEE Vehicular Technology Conference (IEEE VTC)
IEEE VTC is the most important conference for vehicular technology. This conference is organized by the IEEE Vehicular Technology Society.

(4) IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)

2) Summary of the Research Outcomes

Task 1: Wireless/mobile access networks

1) The simulator integrates both vehicle traffic and vehicle network simulations and provides a feedback loop between them. Therefore, it enables advanced novel ITS research where the communication result may affect the movements of vehicles.

2) The simulator allows a user to easily construct a simulated road network and simulate vehicles moving on the simulated road. The moving behavior of a simulated vehicle on the road is controlled by a car agent program, which implements realistic car-following and lane-changing behavior. The message communication among cars is also implemented in the car agent program. Novel

advanced ITS communication network system/protocol designs can be tested and evaluated under this network simulator.

3) The simulator has been introduced to and published at 1st IEEE WiVec 2007 (International Symposium on Wireless Vehicular Communications), September 30 – October 1, 2007, Baltimore, MD, USA conference.

Task 2: Heterogeneous network integration and radio resource management

1) Optimal relay location design in two-hop wireless ITS systems: This project investigates the optimal relay location for wide-area coverage, aiming to maximize system capacity. We consider two relay selection rules to determine whether a two-hop transmission is necessary, including the signal strength-oriented and throughput-oriented rules. It is shown that the signal strength-oriented two-hop transmission may yield lower throughput than the one-hop transmission. The throughput-oriented rule can improve the throughput if the relays are deployed at the proper locations. For the throughput-oriented rule, we also determine the optimal relay location to maximize the system capacity.

2) Power Fairness in a ring-based wireless multihop network: This project develops a scalable ring-based wireless multihop network with power fairness. We investigate the overall tradeoffs of the ring-based multihop network in terms of power fairness, capacity, and coverage. In multihop network, inner users consume more power to relay traffic than others. By properly designing the ring widths, power fairness can be achieved and the lifetime of multihop network can be extended. An optimization approach is also applied to determine the optimal ring widths, aiming to maximize the cell capacity and coverage subject to the constraint of power fairness.

Task 3: Intelligent in-car human-machine interface

1) A real-time corpus-based Mandarin TTS system was developed. The study focuses on how to design a corpus and how to select best segments from the corpus. The system has four modules. Among them, three modules are inherited from our old system. They are the text analyzer (TA), the prosodic information generator (PIG), and the waveform synthesizer (WS). The other module, search-and-selection module (SS), is specially designed for the corpus-based approach. Its main function is to find all usable waveform segments in the corpus, and select the best combination to be directly concatenated for generating output speech.

2) Robust Speech Recognition: Robustness of automatic speech recognition (ASR) to various noisy environments is the most important issue for mass deployment of ASR-based applications. To take the advantage of noisy environment knowledge and, at the same time, alleviate the problem of unseen noisy environments, a reference model weighting (RMW) approach is proposed for fast online HMM adaptation. The basic idea is to first collects a set of HMMs from seen noisy environments in the training phase to represent the space of noisy environments, and then optimally (in the sense of maximum likelihood) synthesize a suitable HMM online for the unknown test noisy environment by interpolating the set of the pre-collected HMMs in the test phase.

Task 4: Convergent ITS information-communication platform for automotive telematics

1) A convergent information-communication automotive telematics platform has been developed with an ARM-based embedded systems. This platform integrates multiple radio communication technologies, including IEEE 802.11b WiFi, GPRS, and GPS, etc., for connecting heterogeneous wireless access networks.

2) The next-generation Internet protocol, IPv6 protocol, and several advanced mobility protocols, including mobile ad hoc routing protocol and mobile IPv6 protocol, have been developed and integrated in the telematics platform. These protocols fulfills future needs of inter-vehicular communications and mobile Internet access for ITS. For performance evaluation and demonstration purpose, an IPv6-based network platform for the auto-telematics is proposed.

3) We propose a relay node deployment method, which aims to minimize the total number of relay nodes for connecting RSUs effectively. In the method, the local optimum location of the relay node is discovered on a 2-dimensional plane. This method is better than related works (that are based on 1-D search algorithm) by nature since these relay nodes are allocated on a horizontal plane which gives a large degree of freedom. By considering radio propagation effect, a sophisticated propagation model including shadowing and multipath fading is employed in estimating link connectivity, which can reflect radio channel effects more properly to compare with the traditional model, the Unit Disk Graph model utilized by most of existing works.

4. Program Management

Through the establishment of an innovative, intelligent and high-performance multimedia mobile communication and network solutions for ITS, all the tasks are highly correlated as shown in Fig. 1. The integration of these tasks will be realized on either the advanced simulation platform (managed by task 1) or the proof-of-concept telematics platform (managed by task 4). The proposed simulation platform integrats vehicle traffic simulation and vehicle network simulation, which enables advanced novel ITS research where the communication result may affect the movements of vehicles. Selected schemes for heterogeneous network integration (designed by task 2) would be developed on the simulation platform for further performance investigation. Oh the other hand, the telematics has communication linkages using 2.5G/3G cellular, WLAN, and MANET for wide-area, hotspot, and inter-vehicle communications, respectively. For advanced human-machine interfacing for ITS applications, the intelligent in-car speech recognition technologies (designed in task 3) will be developed and integrated in the platform. Selected VPS services will also be developed to verify the capability of proposed telematics and wireless access technologies.

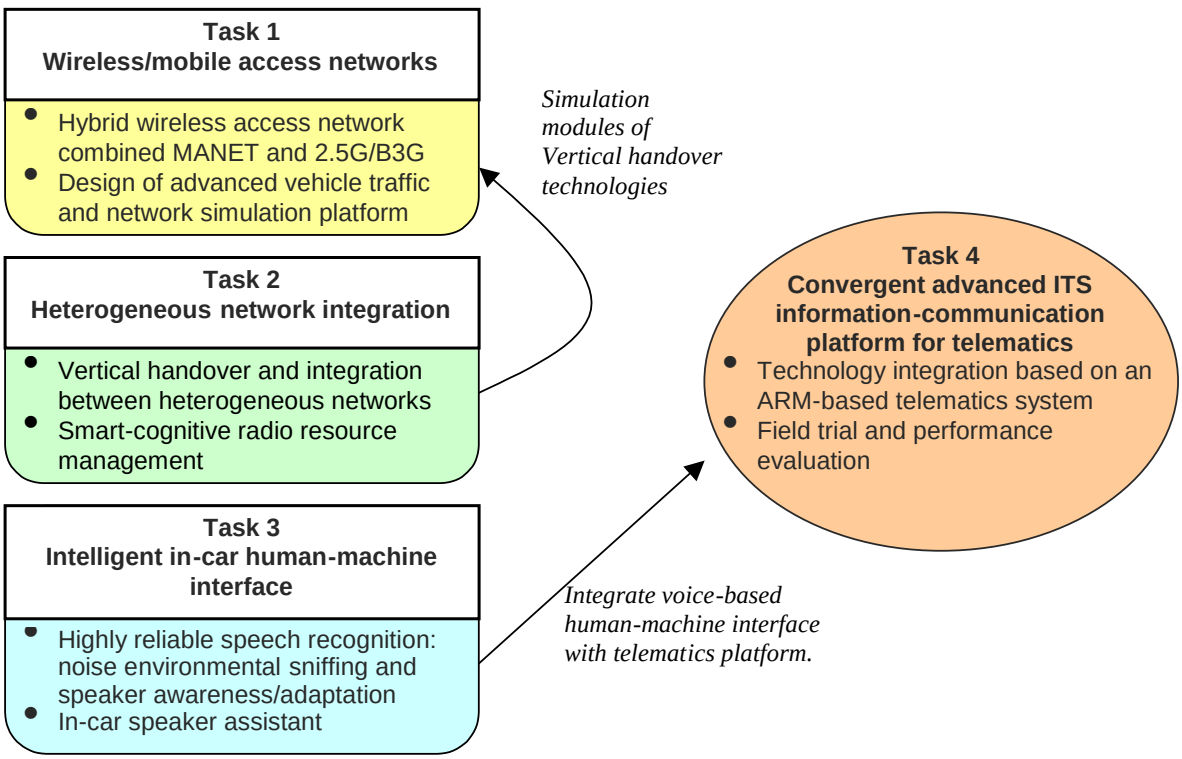

Figure 1. Objective and coherence among tasks in subproject 4

The research teams in this project worked very closely in the past years. In the second year, the research teams had their regular monthly meetings for discussing techical details, technical issues of achievement integration, and administration affairs. We have identified the system architecture and design goals of the overall system and key components. The development status was, therefore, well under control. The frequency of meetings will be adjusted based on the program requirement, especially when the system integration task starts.

5. A Summary of the Post-Program Plan

In the second year, the prototypes of system modules for integrating of in-car speech recognition on the convergent automotive telematics are developed. The functions of these modules are validated by field tests. Besides, the advanced simulation platform, which integrates data communication simulation and transportation traffic simulation, are developed. After that, the sub-project 4 will increasingly be devoted to not only the academic research on anticipated topics but also the large-scale system simulation, system integration and field-testing of these technologies. The system integration will be focused in the next year with specific topics as follows:

(1) Enriching the voice-based telematics services for further performance investigation. Performance improvement and field-testing of the in-car speech recognition and its applications will be investigated. Inter-subproject integration is also planned in following years.

(2) Developing the software modules of proposed heterogeneous network integration mechanism, i.e., vertical handover algorithm, on the NCTUns simulation platform. Based on the NCTUns platform, the performance of these mechanisms could be further evaluated in provisioned cases that represent the scenarios in real world.

6. International Cooperation Activities

(1).The *ATiC Australia ADI Limited* company has licensed our NCTUns network simulator for its tactic training simulations. This company is an international security system and weapon manufacturer, with more than 60,000 employees worldwide. It is an honor that this world-class international company recognizes the values of NCTUns and selects it for their project development.

(2).The speech processing group in National Chiao Tung University/ National Taipei University of Technology has a 3-year international collaboration program with Prof. Keikichi Hirose, the University of Tokyo from 2005 to 2008. Our joint interested topic is the speech prosody and especially Mandarin tone recognition.

(3).Prof. Yuan-Fu Liao and Yih-Ru Wang had visited the Prof. Hirose's laboratory in Feb. and July 2006. One Ph'D student had also been sent to Japan and stayed there from July to Sep. 2006. Recently, a joint paper had already been accepted by ICASSP'2007.

APPENDIX I: MINUTES FROM PROGRAM DISCUSSION MEETINGS

「ITS 卓越延續計畫」子計畫 4 第一次工作會議紀錄

時間：民國九十六年四月十七日(星期二) 上午 10：00

地點：交通大學工程四館 916 會議室

出席：張仲儒教授、王蒞君教授、王協源教授、陳信宏教授、黃建華、莊秉文

主席：唐震寰教授

1.第一年度審查意見計畫回覆討論：

a. 根據委員意見回覆

b. 根據委員要求積極準備實體展示

2. 討論計畫成果展示項目與方式

a. 決議根據總計畫之整體計畫整合構想，以展現智慧型路口之緊急事件通報服務

3. 與總計畫及其他分項計畫系統整合方式：

a. 本子項計畫以提供車機終端平台，並提出具備 multi-hop 功能之 DSRC 通訊系統

b. 其他子項計畫當需要於路口其他 RSU 進行資料交換時，可透過本子項計畫之 DSRC 通訊系統行之

c. 子計畫 5 之軟體模組可嘗試整合於該車機平台，執行車上需要之服務

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「ITS 卓越延續計畫」子計畫 4 第二次工作會議紀錄

時間：民國九十六年五月二十三日(星期三) 下午 4：00

地點：交通大學工程四館 916 會議室

出席：張仲儒教授、王蒞君教授、王協源教授、陳信宏教授、黃建華、莊秉文

主席：唐震寰教授

1. 討論計畫成果展示項目與方式

a. 工作項目 1 報告：將完成混合 vehicle traffic 與 vehicle network 模擬平台與相關網路通訊協定，並進行模擬展示

b. 工作項目 2 報告：將評估所發展之垂直換手機制於工作項目 1 模擬平台實現的方法

c. 工作項目 3 報告：將利用所開發之嵌入式語音辨識技術進行應用雛形實作

d. 工作項目 4 報告：將開發與設計以嵌入式系統為基礎之行動車機平台，規劃導入 IPv6 與嵌入式語音辨識技術，該車機平台預計作為後續年度 Proof-of-Concept 測試與整合之基礎

2. 初步討論計畫成果整合方式：

a. 各研究團隊評估成果整合於工作項目 1, 4 之可行性

3. 決議事項：

a. 下次會議提出進度報告與整合工作構想

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「ITS 卓越延續計畫」子計畫 4 第三次工作會議紀錄

時間：民國九十六年七月十日(星期二) 上午 10：00

地點：交通大學工程四館 820 會議室

出席：王蒞君教授、王協源教授、王逸如教授、黃建華、莊秉文

主席：唐震寰教授

1. 報告計畫經費執行情況：
   a. 各研究團隊報告經費執行情況
   b. 經費執行率符合預期

2. 預估計畫重要行政工作時程：
   a. 預計 2007 年底至 2008 年初需提出期末報告
   b. 預計 2008 年第一季可能進行校內自評

3. 討論計畫其他相關行政注意事項
   a. 討論可能參與之國際研討會與補助方式

聯絡人：梁麗君 03-5712121 ext. 54518
E-mail：elsa@mail.nctu.edu.tw

「ITS 卓越延續計畫」子計畫 4 第四次工作會議紀錄

時間：民國九十六年八月十日(星期五) 上午 10：00

地點：交通大學工程四館 820 會議室

出席：王蒞君教授、王協源教授、王逸如教授、黃建華、莊秉文

主席：唐震寰教授

1. 討論各工作項目研究目的與年度預期成果：
   a. 工作項目 1 報告：展示 NCTUns 結合 Traffic flow 與 Data flow 之模擬
   b. 工作項目 2 報告：已初步規劃 vertical handover 機制導入 NCTUns 之可能模式
   c. 工作項目 3 報告：已初步完成於 WinCE 平台之嵌入式系統前端辨識與合成模組
   d. 工作項目 4 報告：已初步完成行動車機嵌入式平台與嵌入式系統前端辨識、合成模組之應用整合，以及路口安全相關應用之測試與後續整合規劃

2. 決議事項：
   a. 考量與其他子項計畫整合之可行性
   b. 工作項目 2 可考量加速實作進而於下年度進行成果整合

聯絡人：梁麗君 03-5712121 ext. 54518
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「ITS 卓越延續計畫」子計畫 4 第五次工作會議紀錄

時間：民國九十六年八月三十日(星期四) 下午 2：00

地點：交通大學工程四館 820 會議室

出席：張仲儒教授、王協源教授、王逸如教授、黃建華、莊秉文、林經展、林志哲

主席：唐震寰教授

1. 討論各工作項目整合規劃：
   a. 工作項目 4 報告：行動車機已開發與車內設備之連線介面，有助於與車內 notebook、PDA 等設備整合
   b. 工作項目 1 報告：已初步完成 NCTUns 模擬案例之分析，除了仍持續進行除錯外，整合上需要進行後續與工作項目 2 的合作
   c. 工作項目 2 報告：考慮於計畫後期導入異質網路換手機制
   d. 工作項目 3 報告：已已協助完成車機與 WinCE 平台之嵌入式系統前端辨之整合然而需要另行開發應用服務

2. 決議事項：
   a. 預計本年度完成 1 項基於語音辨識與車機平台整合之車機服務
   b. 預計下年度完成混合 Traffic flow 與 Data flow 整合模擬平台與案例

聯絡人：梁麗君 03-5712121 ext. 54518
E-mail：elsa@mail.nctu.edu.tw

「ITS 卓越延續計畫」子計畫 4 第六次工作會議紀錄

時間：民國九十六年十月二十三日(星期二) 下午 4：00

地點：交通大學工程四館 820 會議室

出席：王蒞君教授、王協源教授、王逸如教授、黃建華、莊秉文、林經展

主席：唐震寰教授

1. 整合研究進度報告：
   a. 車機平台整合構想報告與討論
   b. 研發架構應考慮包括 WiMAX, IPv6 NEMO 等前瞻技術

2. 研究工作報告：
   a. 車機平台現階段雛形系統架構與技術報告
   b. Speech recognition & Text-to-Speech on embedded system 已完成，應用案例持續開發中

3. 決議事項：
   a. 計畫自評約於 2008 年 1 月初展開。
   b. 技術研發與系統整合 roadmap 規劃

聯絡人：梁麗君 03-5712121 ext. 54518
E-mail：elsa@mail.nctu.edu.tw

「ITS 卓越延續計畫」子計畫 4 第七次工作會議紀錄

時間：民國九十六年十一月二十七日(星期二) 上午 11：00

地點：交通大學工程四館 820 會議室

出席：張仲儒教授、王逸如教授、黃建華、莊秉文、林經展、林志哲

主席：唐震寰教授

1. 95 年度計畫報告討論：

a. 討論 TOP journals 之討論，可包含：

Journal:

IEEE Trans. on Intelligent Transportation System

IEEE Trans. on Vehicular Technology

IEEE Trans. on Wireless Communications

Conference:

IEEE International Conference on Communications

IEEE Wireless Communications and Networking Conference

IEEE Vehicular Technology Conference

IEEE International Conference on Acoustics, Speech, and Signal Processing

b. 各位研究團隊提供研究成果統計表

提供每個成果種類之項目，包含 number, significant/domestic/international, citation

2. 決議事項：

a. 各團隊於 2006 年 12 月 12 日(三)提供報告初稿。

子項計畫 4 聯絡人：梁麗君 03-5712121 ext. 54518

E-mail：elsa@mail.nctu.edu.tw

APPENDIX II

1. PUBLICATIONS

A1. Journal (Significant)

[1] C. J. Chang, R. G. Cheng, H. T. Shih, and Y. S. Chen, "A Maximum Freedom Last Scheduling Algorithm for Downlinks of DSRC Networks," IEEE Transactions on Intelligent Transportation Systems, Vol. 8, No.2, pp. 223 – 232, June 2007.

[2] C. Y. Liao, C. J. Chang, L. C. Wang, and Y. S. Chen, "A Joint Power and Rate Assignment Algorithm for Multi-rate Soft Handoffs in Mixed-Size WCDMA Cellular Systems," to be appeared in the IEEE Transactions on Vehicular Technology, Vol. 56, No. 3, pp, 1388-1398, May 2007.

[3] Chih-Wen Chang and Li-Chun Wang, "Effects of Subcarrier Power Allocation on An Interference Avoidance Code Assignment Strategy for Multi-Rate MC-DS-CDMA Systems," IEEE Trans. on Vehicular Technology, 2007 (in print) (SCI, EI)

[4] Li-Chun Wang, Anderson Chen and Shi-Yen Huang, "A cross-layer investigation for the throughput performance of CSMA/CA-based wireless local area with directional antennas and capture effect," IEEE Trans. on Vehicular Technology, vol. 45, no. 5, pp. 2756~2766, Sep. 2007 (SCI, EI)

[5] Li-Chun Wang, Chih-Wen Chang, and Howard C. Huang, "An Interference Avoidance Code Assignment Strategy for Multi-Rate MC-DS-CDMA with Time- and Frequency-Domain Spreading," IEEE Trans. on Wireless Communications, Vol. 6, No. 7, pp. 2508~2518, July 2007 (EI, SCI)

[6] S.Y. Wang, C.C. Lin, H.W. Chu, T.W. Hsu, and K.H. Fang, "Improving the Performances of Distributed Coordinated Scheduling in IEEE 802.16 Mesh Networks," IEEE Transactions on Vehicular Technology (accepted and to appear)

[7] C. C. Kuo, W. H. Sheen, C. J. Chang, and C. L. Hsiao, "On the Transmitter-based Pre-processing for 2-Dimensional OFDM-CDMA Forward-Link Systems over Time-Varying Rayleigh Fading Channels," accepted for publication in the IEEE Transactions on Vehicular Technology, Aug. 2007.

[8] C. H. Lee, C. J. Chang, and W. H. Sheen, "A Capacity Analysis Method for Uplinks in DS/CDMA Cellular Systems with Imperfect SIR-base Power Control and Multipath Fading," to be appeared in the IEEE Transactions on Wireless Communications, Vol. 7, No. 1, Jan. 2008.

A2. Journal (International)

[1] S.Y. Wang, C.L. Chou, C.C. Lin, "The Design and Implementation of the NCTUns Network Simulation Engine", Simulation Modeling Practice and Theory, 15 (2007) 57-81. (SCI)

[2] Chiung-Jang Chen and Li-Chun Wang, "Performance Analysis of Scheduling in Multiuser MIMO Systems with Zero-Forcing Receivers," IEEE Journal of Selected Area in Communication, Vol. 25, No. 7, pp.1435~pp.1445, Sep. 2007 (EI, SCI)

[3] Wei-Chih Kuo, Chen-Chung Ho, Xiang-Rui Zhong, Zhen-Feng Liang, Hsiu-Min Yu, Yih-Ru Wang, and Sin-Horng Chen, "Some Studies on Min-Nan Speech Processing," to appear in Computational Linguistics and Chinese Language Processing, 2007.

[4] Jenn-Hwan Tarng, Bing-Wen Chuang, and Fang-Jing Wu, “A Novel Stability-based Routing Protocol for Mobile Ad-Hoc Networks,“ IEICE Trans. on Communications, Vol. E90-B, No.4, pp. 876-884, 2007 (SCI)

[5] Jane-Hwa Huang, Li-Chun Wang, and Chung-Ju Chang, “Throughput-Coverage Tradeoff in A Scalable Wireless Mesh Network,” Journal of Parallel and Distributed Computing (submitted on Nov. 8, 2006, accepted on Oct., 2007) (SCI, EI)

[6] Chuan-Ming Liu, Chuan-Hsiu Lee, Li-Chun Wang, “Distributed Clustering Algorithms for Data-Gathering in Wireless Mobile Sensor Networks,” Journal of Parallel and Distributed Computing (accepted July, 2007) (SCI, EI)

B2. Conference (Significant)

[1] S.Y. Wang, “The Potential of Using Inter-Vehicle Communication to Extend the Coverage Area of Roadside Wireless Access Points on Highways”, IEEE ICC 2007 (International Conference on Communication 2007), June 24-28, 2007, Glasgow, Scotland, UK

[2] J. H. Huang, L. C. Wang, and C. J. Chang, “Power Fairness in A Scalable Ring-based Wireless Mesh Network,” Proc. of IEEE VTC’07, Fall, Baltimore.

[3] C. F. Tsai, C. J. Chang, F. C. Ren, and C. M. Yen, "Adaptive Radio Resource Allocation for Downlink OFDMA/SDMA Systems", Proc. of IEEE ICC 2007, pp. 5683 - 5688, June 2007.

[4] C. J. Chang, C. Y. Chang, and F. C. Ren, “Q-Learning-based Hybrid ARQ for High Speed Downlink Packet Access in UMTS,” Proc. of IEEE VTC 2007 -Spring, Dublin, Ireland.

[5] Li-Chun Wang, Wen-Shan Su, Jane-Hwa Huang, and Anderson Chen, “Optimal Relay Location in Multi-Hop Cellular Systems”, IEEE WCNC, Les Vagas, Mar. 2008.

[6] Wei-Chen Liu and Li-Chun Wang, “BER Analysis in A Generalized UWB Frequency Selective Fading Channel With Randomly Arriving Clusters and Rays,”IEEE International Conference on Communications, Glasgow, UK, June, 2007

[7] Li-Chun Wang, Cheng-Wei Chiu, Chu-Jung Yeh and Wern-Ho Sheen, “Coverage Performance Analysis of OFDM-based Spatial Multiplexing Systems,” IEEE Vehicular Technology, Spring, Dublin, Apr. 2007

[8] Li-Chun Wang, Anderson Chen, and Hung-Hsi Chen, “Network Selection with Joint Vertical and Horizontal Handoff in Heterogeneous WLAN and Mobile WiMax Systems,” IEEE Vehicular Technology, Spring, Dublin, Apr. 2007

[9] Chen-Yu Chiang, Xiao-Dong Wang, Yuan-Fu Liao, Yih-Ru Wang, Sin-Horng Chen, Keikichi Hirose, “ Latent Prosody Modeling Of Continuous Mandarin Speech,” Proc. of ICASSP 2007, Honolulu, USA, Vol. IV, pp. 625-628, March, 2007. (International Cooperation with Prof. Keikichi Hirose, Tokyo University, Japan)

B3. Conference (International)

[1] S.Y. Wang, C.L. Chou, Y.H. Chiu, Y.S. Tseng, M.S. Hsu, Y.W. Cheng, W.L. Liu, and T.W. Ho, “NCTUns 4.0: An Integrated Simulation Platform for Vehicular Traffic, Communication, and Network Researches,” 1st IEEE WiVec 2007

(International Symposium on Wireless Vehicular Communications), September 30 – October 1, 2007, Baltimore, MD, USA
[2] S.Y. Wang, "PC-CTS: A Power-Controlled-CTS MAC Scheme to Improve Spatial Reuse in Wireless Mesh Networks", IEEE ISCC 2007 (IEEE Symposium on Computers and Communications 2007), July 1-4, 2007, Aveiro, Portugal
[3] J. H. Huang, L. C. Wang, and C. J. Chang, "QoS Provisioning in Multihop Outdoor Public Access Networks with Asymmetric User Traffic," Proc. of IEEE Globecom'07, Washington, DC.
[4] J. H. Huang, L. C. Wang, and C. J. Chang, "Power Fairness in A Scalable Ring-based Wireless Mesh Network," Proc. of IEEE VTC'07, Fall, Baltimore.
[5] Y. H. Chen, N. Y, Yang, C. J. Chang, and F. C. Ren, "A Utility Function-based Access Selection Method for Heterogeneous WCDMA and WLAN Networks", Proc. of IEEE PIMRC 2007, pp. 1-5, Athens, Greece.
[6] C. F. Tsai, C. J. Chang, F. C. Ren, and C. M. Yen, "Adaptive Radio Resource Allocation for Downlink OFDMA/SDMA Systems", Proc. of IEEE ICC 2007, pp. 5683 - 5688, June 2007.
[7] C. J. Chang, C. Y. Chang, and F. C. Ren, "Q-Learning-based Hybrid ARQ for High Speed Downlink Packet Access in UMTS," Proc. of IEEE VTC 2007 -Spring, Dublin, Ireland.
[8] Li-Chun Wang, Wen-Shan Su, Jane-Hwa Huang, and Anderson Chen, "Optimal Relay Location in Multi-Hop Cellular Systems", IEEE WCNC, Les Vagas, Mar. 2008.
[9] Li-Chun Wang, Yin-Chih Lu, Chung-Wei Wang, David S. L. Wei, "Lantency Analysis for Dynamic Spectrum Access in Cognitive Radio: Dedicated or Embedded Control Channel? ' IEEE Personal, Indoors, Mobile, and Radio Communications, Athens, Greece, Sep. 2007
[10] Wei-Chen Liu and LI-Chun Wang, "BER Analysis in A Generalized UWB Frequency Selective Fading Channel With Randomly Arriving Clusters and Rays,"IEEE International Conference on Communications, Glasgow, UK, June, 2007
[11] Wei-Cheng Liu,"Universal Space-Time-Frequency Block Codes Design for the Multiband MIMO-OFDM Systems," 2007 IEEE AP-S International Symposium on Antennas and Propagation in Honolulu, Hawaii, USA, June 2007
[12] Li-Chun Wang and Chu-Jung Yeh,"On the Performance of Zero-Forcing Beamforming for MIMO Broadcast Systems," 2007 IEEE AP-S International Symposium on Antennas and Propagation in Honolulu, Hawaii, USA, June 2007
[13] Li-Chun Wang, Cheng-Wei Chiu, Chu-Jung Yeh and Wern-Ho Sheen, "Coverage Performance Analysis of OFDM-based Spatial Multiplexing Systems," IEEE Vehicular Technology, Spring, Dublin, Apr. 2007
[14] Li-Chun Wang, Anderson Chen, and Hung-Hsi Chen, "Network Selection with Joint Vertical and Horizontal Handoff in Heterogeneous WLAN and Mobile WiMax Systems," IEEE Vehicular Technology, Spring, Dublin, Apr. 2007
[15] Chen-Yu Chiang, Hsiu-Min Yu, Yih-Ru Wang and Sin-Horng Chen, "An Automatic Prosody Labeling Method for Mandarin Speech," Proc. of Interspeech 2007, pp. 494-497, Antwerp, Belgium, Aug, 2007.
[16] Jing-Jang Lin, Yih-Ru Wang and Yuan-Fu Liao, "The Embedded Mandarin Speech Recognition System in a mobile device, ", Proc. of CACS 2007.

[17] Hsiu-Min Yu, Lie-Shih Lo, Hsin-Te Hwang, Hsi-Chun Hsiao, and Sin-Horng Chen, "On Constructing Speech Corpus for Implementing Hakka Text-To-Speech Synthesis," to appear in OCOCOSDA, Dec. 2007.

[18] Jenn-Hwan Tarng and Bing-Wen Chuang, "Investigation of Vehicle-to-Infrastructure Communications based on IPv6-Based Automotive Telematics," 2007 IEEE International Conference on ITS Telecommunications, Sophia Antipolis, France, June. 2007.

B4. Conference (Domestic)

[1] Chi-feng Chen, Chen-yu Chiang, Yih-ru Wang, and Sin-Horng Chen, "A Study on Prosodic Modeling for Isolated Mandarin Words," Proc. of ROCLING 2007, Taipei, ROC. pp. 273-286, Sep. 2007.

C1. Book Chapters

[1] Jane-Hwa Huang, Li-Chun Wang, and Chung-Ju Chang, "Architectures and Deployment Strategies for Wireless Mesh Networks," Chap. 2, Wireless Mesh Networks: Architectures and Protocols, (edited by E. Hossain and K. K. Leung, published by Springer, in 2007 (ISBN: 978-0-387-68839-8).

2. PATENTS

A1. Granted (Domestic)

[1] S.Y. Wang, "A System, Method, and Storage for Improving the Network Performance of Wireless Communication Systems", No. 281329, Taiwan, ROC (from 2007 July to 2025 July), issued on May 11, 2007

B1. Pending (International)

[1] C. J. Chang, "Closed-Loop Power Control Method for a Code Division Multiple Access Cellular System," USA Patent in Progress.

[2] C. J. Chang, "A Q-learning-based Multi-Rate Transmission Control Scheme for RRC in WCDMA Systems," USA Patent in Progress.

[3] C. J. Chang, "Network Address Forwarding Table Lookup Apparatus and Method," Patent of USA in Progress.

[4] C. J. Chang, "Algorithm and Method for Providing Fast Handoff in a WLAN-Like Communication System using Active Neighboring Set," Patent of USA in Progress.

[5] Li-Chun Wang, Ming-Bing Chen, Paul Chen, and C. F. Lee, "Method for performing a network handoff in a wireless network environment", filed for the U.S. Patent.

[6] Li-Chun Wang, Anderson, "Method and device for cost-function based handoff determination using wavelet prediction in vertical networks," filed for the U.S. Patent.

[7] Li-Chun Wang, Kuang-Nan Yen, Ming-Bing Chen, Wei-Cheng Liu, Yu-Ren Yang, Ping-Jung Huang, "Cross-Layer Rate Adaptation Mechanism for WLAN," filed for the US patent with ITRI.

3. WORKSHOP, CONFERENCE, AND TRAINING COURSE

(1) 2007 NCTUns 4.0 workshop, July 16-17, 2007, Hsinchu, Taiwan (220 participants)

(2) Development and Innovation of VPS-ETC and Automotive Telematics, November 22, 2007, Institute of Transportation, MOTC, Taipei, Taiwan. (5 hours, 80 participates)

4. PERSONAL ACHIEVEMENTS

(1) Technical Editor, IEEE Communications Magazine, 2007（張仲儒）
(2) Associate Editor, IEEE Transactions on Vehicular Technology, 2007（張仲儒）
(3) Councilor and Vice Chair, IEEE Taipei Section, 2007-2008.（張仲儒）
(4) TPC member of the IEEE Wireless Communications and Networking Conference (WCNC), 2007 (張仲儒)
(5) TPC member of the IEEE High Performance Switching and Routing (HPSR), 2007 (張仲儒)
(6) Associate Editor, International Journal of Sensor Networks, 2006（王蒞君）
(7) Associate Editor, International Journal on Wireless Mobile Computing, 2006（王蒞君）
(8) Chapter Chair of IEEE Information Theory Society, Taipei Society（王蒞君）
(9) Board of Governor, Asia Pacific Wireless Communication Symposium, IEEE Vehicular Technology Society（王蒞君）
(10) Vice Program Chair, IEEE 4th Asia Pacific Wireless Communication Symposium (APWCS'07) Aug. 2007（王蒞君）
(11) Tutorial: Advances in Multiuser MIMO Systems
   — IEEE 65th Vehicular Technology Conference (Spring), Dublin, Ireland, April 23-25, 2007
   — IEEE 18th Personal, Indoor, Mobile and Radio Communication, Athens, Greece, Sep. 3 ~ 7, 2007
   — IEEE Vehicular Technology Conference (Fall), Baltimore, USA, Sep., 2007, Oct. 1 ~ 3, 2007
(12) 陳信宏，"2007 中國工程師學會傑出工程教授獎"。
(13) 陳信宏，中華民國計算語言學學會理事長

APPENDIX III: LIST OF PUBLICATIONS IN TOP JOURNALS AND CONFERENCES

Top Journals:

(4) IEEE Transactions on Wireless Communication (IF:1.184)

[1] Li-Chun Wang, Chih-Wen Chang, and Howard C. Huang, "An Interference Avoidance Code Assignment Strategy for Multi-Rate MC-DS-CDMA with Time- and Frequency-Domain Spreading," IEEE Trans. on Wireless Communications, Vol. 6, No. 7, pp. 2508~2518, July 2007 (EI, SCI)

[2] C. H. Lee, C. J. Chang, and W. H. Sheen, "A Capacity Analysis Method for Uplinks in DS/CDMA Cellular Systems with Imperfect SIR-base Power Control and Multipath Fading," to be appeared in the IEEE Transactions on Wireless Communications, Vol. 7, No. 1, Jan. 2008.

(5) IEEE Transactions on Intelligent Transportation Systems (IF: 1.434)

甲、 C. J. Chang, R. G. Cheng, H. T. Shih, and Y. S. Chen, "A Maximum Freedom Last Scheduling Algorithm for Downlinks of DSRC Networks," IEEE Transactions on Intelligent Transportation Systems, Vol. 8, No.2, pp. 223 – 232, June 2007.

(6) IEEE Transactions on Vehicular Technology (IF: 1.071)

[1] C. Y. Liao, C. J. Chang, L. C. Wang, and Y. S. Chen, "A Joint Power and Rate Assignment Algorithm for Multi-rate Soft Handoffs in Mixed-Size WCDMA Cellular Systems," to be appeared in the IEEE Transactions on Vehicular Technology, Vol. 56, No. 3, pp, 1388-1398, May 2007.

[2] Chih-Wen Chang and Li-Chun Wang, "Effects of Subcarrier Power Allocation on An Interference Avoidance Code Assignment Strategy for Multi-Rate MC-DS-CDMA Systems," IEEE Trans. on Vehicular Technology, 2007 (in pri nt) (SCI, EI)

[3] Li-Chun Wang, Anderson Chen and Shi-Yen Huang, "A cross-layer investigation for the throughput performance of CSMA/CA-based wireless local area with directional antennas and capture effect," IEEE Trans. on Vehicular Technology, vol. 45, no. 5, pp. 2756~2766, Sep. 2007 (SCI, EI)

[4] S.Y. Wang, C.C. Lin, H.W. Chu, T.W. Hsu, and K.H. Fang, "Improving the Performances of Distributed Coordinated Scheduling in IEEE 802.16 Mesh Networks," *IEEE Transactions on Vehicular Technology* (accepted and to appear)

[5] C. C. Kuo, W. H. Sheen, C. J. Chang, and C. L. Hsiao, "On the Transmitter-based Pre-processing for 2-Dimensional OFDM-CDMA Forward-Link Systems over Time-Varying Rayleigh Fading Channels," accepted for publication in the IEEE Transactions on Vehicular Technology, Aug. 2007.

Top conferences:

(1) IEEE International Conference on Communications

[1] S.Y. Wang, "The Potential of Using Inter-Vehicle Communication to Extend the Coverage Area of Roadside Wireless Access Points on Highways", *IEEE ICC 2007 (International Conference on Communication 2007)*, June 24-28, 2007, Glasgow, Scotland, UK

[2] C. F. Tsai, C. J. Chang, F. C. Ren, and C. M. Yen, "Adaptive Radio Resource

Allocation for Downlink OFDMA/SDMA Systems", Proc. of IEEE ICC 2007, pp. 5683 - 5688, June 2007.

[3] Wei-Chen Liu and Li-Chun Wang, “BER Analysis in A Generalized UWB Frequency Selective Fading Channel With Randomly Arriving Clusters and Rays,”IEEE International Conference on Communications, Glasgow, UK, June, 2007

(2) WCNC (IEEE Wireless Communications and Networki ng Conference)

[1] Li-Chun Wang, Wen-Shan Su, Jane-Hwa Huang, and Anderson Chen, “Optimal Relay Location in Multi-Hop Cellular Systems”, IEEE WCNC, Les Vagas, Mar. 2008.

(3) VTC (IEEE Vehicular Technology Conference)

[1] J. H. Huang, L. C. Wang, and C. J. Chang, “Pow er Fairness in A Scalable Ring-based Wireless Mesh Network,” Proc. of IEEE VTC’07, Fall, Baltimore.

[2] C. J. Chang, C. Y. Chang, and F. C. Ren, “Q-Learning-based Hybrid ARQ for High Speed Downlink Packet Access in UMTS,” Proc. of IEEE VTC 2007 -Spring, Dublin, Ireland.

[3] Li-Chun Wang, Cheng-Wei Chiu, Chu-Jung Yeh and Wern-Ho Sheen, “Coverage Performance Analysis of OFDM-based Spatial Multiplexing Systems,” IEEE Vehicular Technology, Spring, Dublin, Apr. 2007

[4] Li-Chun Wang, Anderson Chen, and Hung-Hsi Chen, “Network Selection with Joint Vertical and Horizontal Handoff in Heterogeneous WLAN and Mobile WiMax Systems,” IEEE Vehicular Technology, Spring, Dublin, Apr. 2007

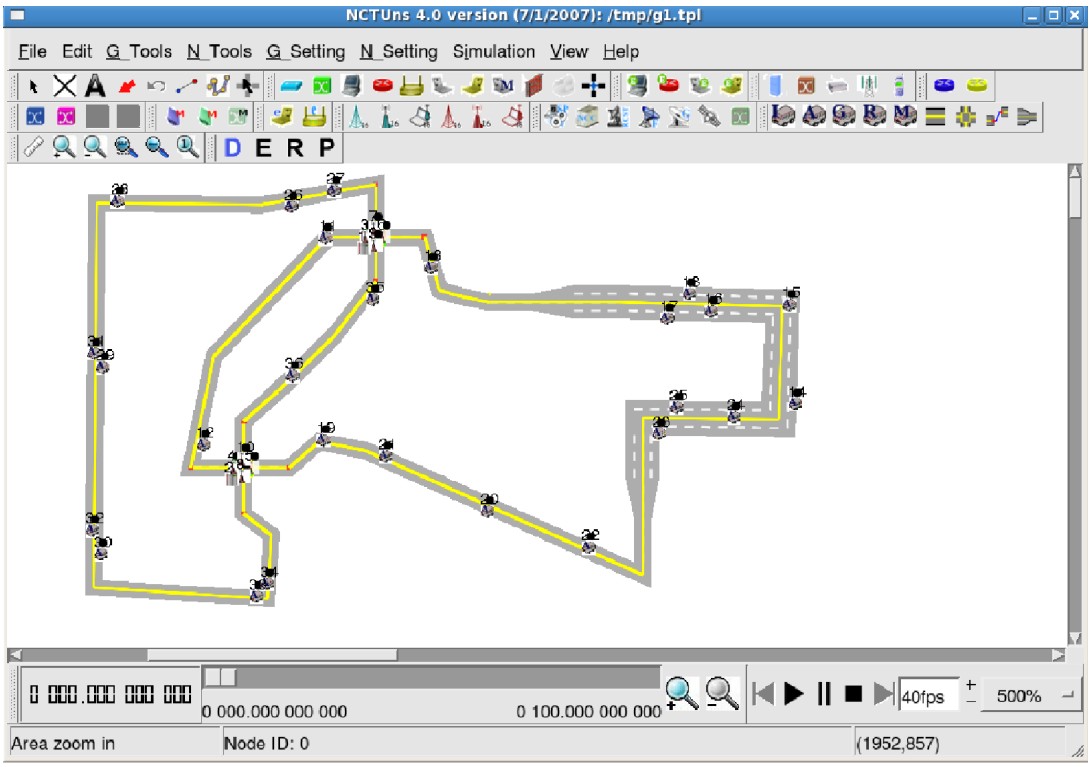
(4) IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)

甲、 Chen-Yu Chiang, Xiao-Dong Wang, Yuan-Fu Liao, Yih-Ru Wang, Sin-Horng Chen, Keikichi Hirose, “ Latent Prosody Modeling Of Continuous Mandarin Speech,” Proc. of ICASSP 2007, Honolulu, USA, Vol. IV, pp. 625-628, March, 2007. (International Cooperation with Prof. Keikichi Hirose, Tokyo University, Japan)

APPENDIX IV: SLIDES ON SCIENCE AND TECHNOLOGY BREAKTHROUGHS

1. Heterogeneous Network Simulation

The NCTUns network simulator tightly integrates vehicle traffic and vehicle network simulations and provides a feedback loop between them. It facilitates advanced and novel ITS research where a vehicle needs to change its moving behavior after receiving a message from another vehicle.

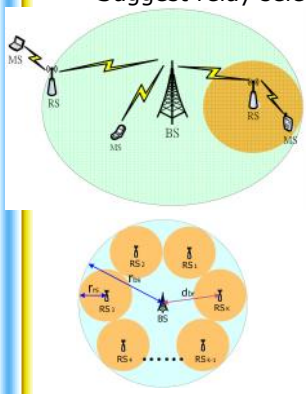


2. Smart and Cognitive Communications and Networks – Advanced communication and network technologies for ITS

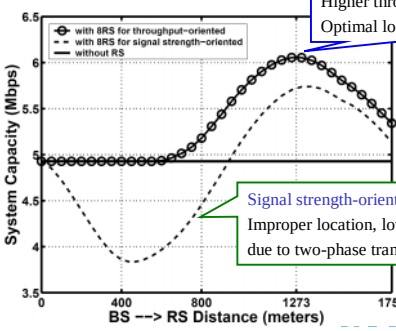
Optimal relay location design in two-hop wireless ITS systems: We compare two relay selection rules. According to throughput-oriented rule, relay is used if it can achieve higher effective throughput. By signal strength-oriented rule, relay is used when it can provide stronger signal strength. The throughput-oriented rule can improve the throughput if the relays are deployed at the proper locations. We also determine the optimal relay location to maximize the system capacity.

Design of Optimal Relay Location in Two-Hop Wireless ITS Systems

- Objectives-
  - Find the optimal relay location.
  - Suggest relay selection rule to maximize user throughput.



  - Achieved throughput v.s. relay location



Throughput-oriented :
Higher throughput.
Optimal location: 1273 m

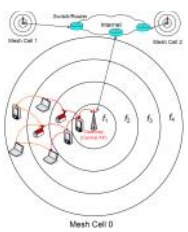
Signal strength-oriented:
Improper location, lower throughput due to two-phase transmission.

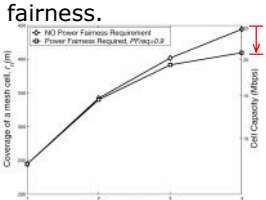
1

Power Fairness in a ring-based wireless multihop network: We suggest designing the ring widths to reduce the power consumption of inner users and then achieve the power fairness. It is shown that the goal of capacity enhancement with power fairness guarantee can be filled at the cost of coverage performance. In this example, when the cell coverage is reduced by 8%, the power fairness can be achieved and the lifetime of network can be increased by 32%.

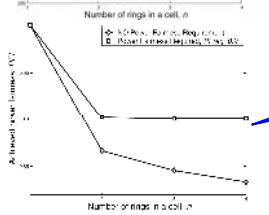
Power Fairness in a Ring-based Wireless Multihop Network

- Objectives-
  - Develop a scalable and power-fair multihop network architecture for ITS wireless systems.
  - Optimization approach to maximize cell capacity subject to the constraint power fairness.





Cell coverage is reduced by 8% to achieve power fairness, the network lifetime can be increased by 32%.

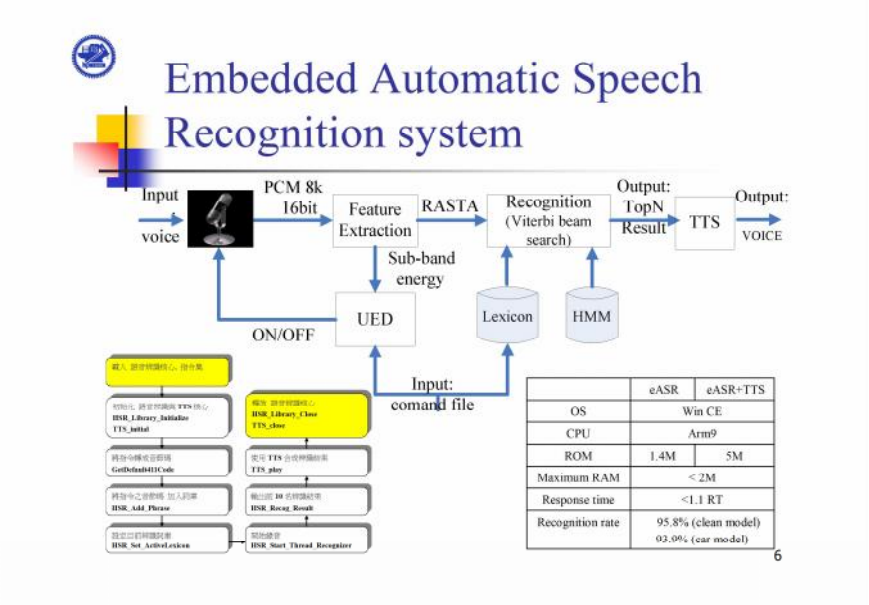


By properly designing the ring widths, power fairness index keeps at 0.9.

2

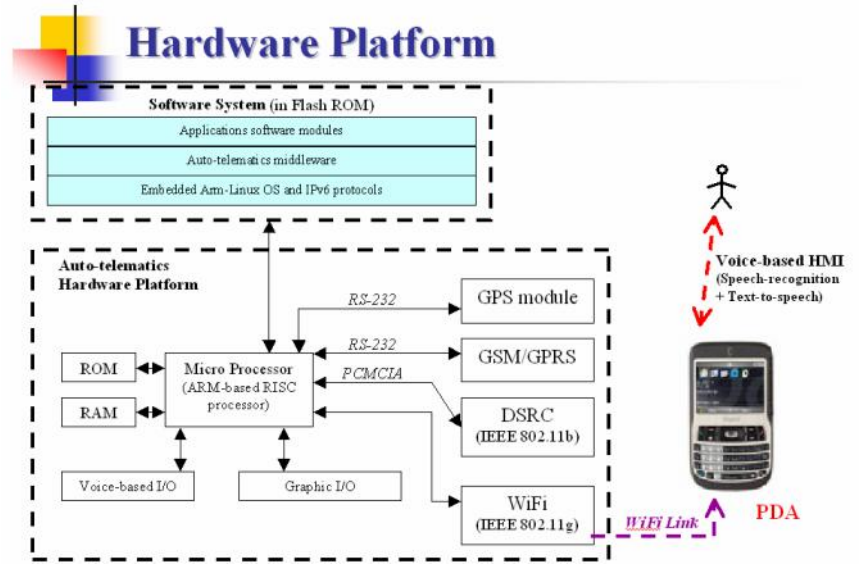
3.Real-time isolated-word recognition system in a hand-hold mobile device

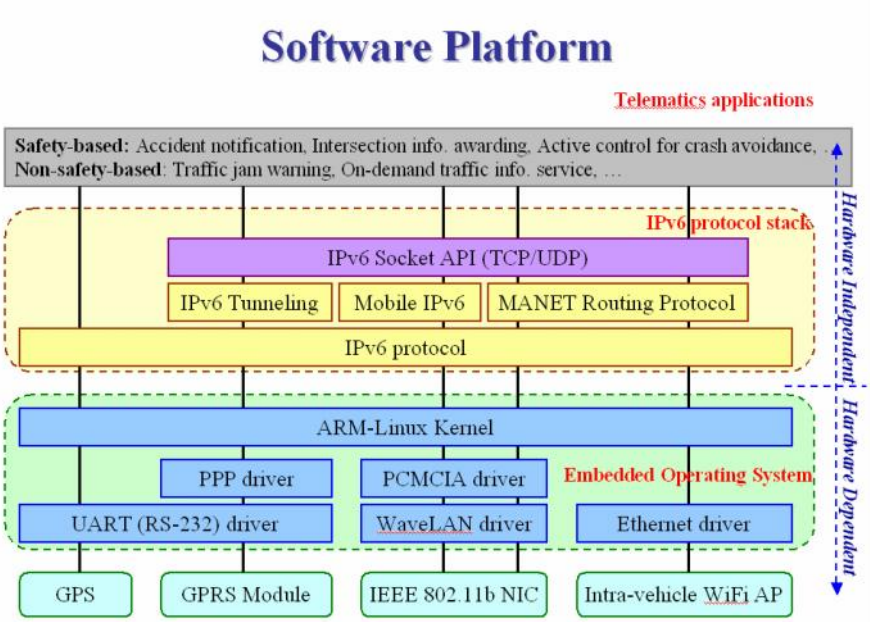
The embedded ASR system and TTS system was realized on a Wi ndows-CE based PDA. The user can give the lexicon he wanted by editing a BIG -5 file. When the user talked to PDA, the waveform was recognized and the recognize result was synthesized as 8kHz pcm. A simple API was designed such that the others applications can easily using the isolated Mandarin word recognition system implemented.



4. Embedded Design for Info-Com Platform of Intelligent Vehicle

A convergent information-communication automotive telematics platform has been developed with an ARM-based embedded systems. The next-generation Internet protocol, IPv6 protocol, and several advanced mobility protocols, have been developed and integrated in the telematics platform. These protocols fulfills future needs of inter-vehicular communications and mobile Internet access for ITS.


Hardware Platform
Software System (in Flash ROM)
Applications software modules
Auto-telematics middleware
Embedded Arm-Linux OS and IPv6 protocols
Auto-telematics
Hardware Platform
RS-232
GPS module
RS-232
GSM/GPRS
PCMCIA
DSRC
(IEEE 802.11b)
ROM
RAM
Micro Processor
(ARM-based RISC
processor)
Voice-based I/O
Graphic I/O
WiFi
(IEEE 802.11g)
WiFi Link
Voice-based HMI
(Speech-recognition
+ Text-to-speech)
PDA


Software Platform
Telematics applications
Safety-based: Accident notification, Intersection info. awarding, Active control for crash avoidance, …
Non-safety-based: Traffic jam warning, On-demand traffic info. service, …
IPv6 protocol stack
IPv6 Socket API (TCP/UDP)
IPv6 Tunneling
Mobile IPv6
MANET Routing Protocol
IPv6 protocol
ARM-Linux Kernel
PPP driver
PCMCIA driver
Embedded Operating System
UART (RS-232) driver
WaveLAN driver
Ethernet driver
GPS
GPRS Module
IEEE 802.11b NIC
Intra-vehicle WiFi AP
Hardware Independent
Hardware Dependent

Program for Promoting Academic Excellence of Universities (Phase II)

Midterm/Final Assessment

SUBPROJECT 4: SMART AND COGNITIVE COMMUNICATIONS AND NETWORKS-ADVANCED COMMUNICATIONS AND NETWORK TECHNOLIGIES FOR ITS

	Assessment Subject	Score (1~5, Low to High)
Program's Contents & Performance	Importance & Innovation of the Program's Major Tasks	5
	Clarity and Presentation of the Report	5
	Viability of the Program's Approaches & Methodologies	5
	Principal Investigator's Competence for Leading the Program	5
	Interface & Integration between Overall & Sub-Project(s)	4
	Interface & Integration among All Sub-Projects	4
	Manpower & Expenditures	5
Program's Results	Contribution in Enhancing the Institute's International Academic Standing	5
	Impact on Advancing Teaching or on Technology Development	5
Total Score		43

Reviewer's Comments & Suggestion:
Principle Investigator's Feedback: (Available)

Program Reviewer's Signature: J. H. Chu

Notes: The program reviewers are invited by the National Science Council.

Program for Promoting Academic Excellence of Universities (Phase II)

Midterm/Final Assessment

SUBPROJECT 4: SMART AND COGNITIVE COMMUNICATIONS AND NETWORKS-ADVANCED COMMUNICATIONS AND NETWORK TECHNOLIGIES FOR ITS

	Assessment Subject	Score (1~5, Low to High)
Program's Contents & Performance	Importance & Innovation of the Program's Major Tasks	5
	Clarity and Presentation of the Report	4
	Viability of the Program's Approaches & Methodologies	4
	Principal Investigator's Competence for Leading the Program	5
	Interface & Integration between Overall & Sub-Project(s)	4
	Interface & Integration among All Sub-Projects	4
	Manpower & Expenditures	5
Program's Results	Contribution in Enhancing the Institute's International Academic Standing	5
	Impact on Advancing Teaching or on Technology Development	4
Total Score		40

Reviewer's Comments & Suggestion:

加強說明分年目標．並設計「擬真」之情境，未來可以更實際的展示。

gateway之功能可再加強，以整合整群計畫之方式demo。

Principle Investigator's Feedback: (Available)

Program Reviewer's Signature: [signature]

Notes: The program reviewers are invited by the National Science Council.

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Midterm/Final Assessment

SUBPROJECT 4: SMART AND COGNITIVE COMMUNICATIONS AND NETWORKS-ADVANCED COMMUNICATIONS AND NETWORK TECHNOLIGIES FOR ITS

	Assessment Subject	Score (1~5, Low to High)
Program's Contents & Performance	Importance & Innovation of the Program's Major Tasks	4
	Clarity and Presentation of the Report	4
	Viability of the Program's Approaches & Methodologies	5
	Principal Investigator's Competence for Leading the Program	5
	Interface & Integration between Overall & Sub-Project(s)	4
	Interface & Integration among All Sub-Projects	4
	Manpower & Expenditures	4
Program's Results	Contribution in Enhancing the Institute's International Academic Standing	4
	Impact on Advancing Teaching or on Technology Development	4
Total Score		38

Reviewer's Comments & Suggestion:

1. Telematics Gateway已具雛形，建議針對車上網路環境，補強功能。
2. 建議針對總計畫需求，密切訂定技術研發方向。

Principle Investigator's Feedback: (Available)

Program Reviewer's Signature: 01/17/'08

Notes: The program reviewers are invited by the National Science Council.

Program for Promoting Academic Excellence of Universities (Phase II)

Midterm/Final Assessment

SUBPROJECT 4: SMART AND COGNITIVE COMMUNICATIONS AND NETWORKS-ADVANCED COMMUNICATIONS AND NETWORK TECHNOLIGIES FOR ITS

	Assessment Subject	Score (1~5, Low to High)
Program's Contents & Performance	Importance & Innovation of the Program's Major Tasks	4
	Clarity and Presentation of the Report	4
	Viability of the Program's Approaches & Methodologies	5
	Principal Investigator's Competence for Leading the Program	5
	Interface & Integration between Overall & Sub-Project(s)	4
	Interface & Integration among All Sub-Projects	5
	Manpower & Expenditures	5
Program's Results	Contribution in Enhancing the Institute's International Academic Standing	4
	Impact on Advancing Teaching or on Technology Development	5
Total Score		41

Reviewer's Comments & Suggestion:

本子系統之目的之開發可運用於智慧型運輸系統之前瞻模拟软体平台、開放式实体验证机平台以及把関之通讯与網路前瞻技術。目前已初步可將道路網路与其上之交通資訊結合。有関下一階段開放式車机平台之開発与其間車間通讯、車路間通讯等技術之研発，希能儘量考慮車間隊前瞻技術之引用，使通讯能量与品質等儘可能加強。

Principle Investigator's Feedback: (Available)

Program Reviewer's Signature: 林大惠

Notes: The program reviewers are invited by the National Science Council.