

2006



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Innovation for Better Life



香港中文大學
The Chinese University of Hong Kong

2006



Innovation for
Better Life

Table of Content

Excellence in Research and Technology Transfer 卓越研究與科技轉移	5
Preface 序言	6-7
Commerce and Industry 工商應用	8
A Ubiquitous Digital Writing System Using MEMS Motion Sensing Technology 一種應用微機電(MEMS)運動傳感技術的通用數碼書寫系統	9
Computer-Aided Analysis of Shoe Fitting 計算機輔助鞋形分析	10
Development of Cost Effective Millimeter Scale Machine Tools 發展有成本效益毫米級機床	11
Development of Optical Pickup Chipsets for Blue Laser DVDs 開發用於藍色激光DVD的光獲取芯片組	12
Development of Ultra-Low-Power Alcohol Vapor Sensors Based on Functionalized CNT Sensing Elements 利用功能性碳納米管為材料研製的低功率酒精測試器	13
Expert Label Pattern Design System 標籤設計專家系統	14
Face Recognition 人臉識別	15
Follow me Robot 跟我走機械人	16
Imaging System for Three-Dimensional Reconstruction of Surface Profiles 重建三維表面影像系統	17
Intelligent Office Assistant 智能辦公助手	18
Intelligent Omni-directional Hybrid Electric Vehicle (IOHEV) 一種新型的環保汽車：混合動力，全方位及智能化	19
Mobile Network Performance Measurement 流動通訊網絡表現測試	20
Network Coding Theory 網絡編輯理論	21
Plug-and-play Data Security Platform 隨插即用數據保密平臺	22
Precision Positioning of Hard Disk Drives Using Piezoelectric Actuators 利用壓電促動器精確為硬碟定位	23
RFID Tag and Reader Technologies at UHF band for Logistic Management. 用於物流管理的UHF波段無線射頻識別標籤及閱讀設備的技術	24
Smart Dampers for Suspension Systems 應用於懸浮系統的智能阻尼器	25
The Chinese University Plagiarism Identification Engine (CUPIDE) 剽檢通	26
Digital Entertainment 數碼娛樂	27
Augmented Reality Computing Arena for Digital Entertainment (ARCADE) 擴充現實數碼娛樂運算環境	28
ChineseStyle Video Game Authoring ToolKit - "Curvair" 中國化電子遊戲開發工具 - '弧飛'	29
Transparent Real-time Video Transcoder for 3G Mobile Networks 用於3G流動網絡即時視像轉碼器	30
Virtual Cycling 虛擬腳踏車	31

Environment	
生態環境	32
Air Ventilation Assessment System	33
空氣流通評估方法	
An Auralized 3-Dimensional Traffic Noise Assessment Tool	34
會發聲的立體交通噪音評估工具	
Building and Operating a Ground Receiving Station of the ENVISAT Radar	35
Remote Sensing Satellite for All-weather Environmental Monitoring	
建立和運行全天候環境監測的ENVISAT雷達遙感衛星地面接收站	
Mushroom Remediation	36
環保菇法	
Studies on Salt Tolerance of Soybean	37
大豆耐鹽研究	
Medicine and Health	38
生物科技	
A high-yield One-step Purification Method for Recombinant Proteins Fused with Maltose-Binding Protein	39
一種高回產率、一步法的純化方法 --- 用於重組麥芽糖結合蛋白(MBP) 融合蛋白的純化	
An Orange Fluorescent Protein from Tube Anemone	40
管葵橙色螢光蛋白	
Authentication and Quality Assessment of Chinese Medicinal Materials by DNA and Chemical Technologies	P 41
中藥材的分子和化學鑑別及品質檢定	
Biosensor Arrays Based on Surface Plasmon Resonance Phase Imaging	
基於表面等離子波動表面相差影像的生物傳感陣列	42
Buffered Propranolol Sublingual Tablet for Treatment of Atrial Fibrillation and Situational Anxiety	P 43
普乃洛爾舌下緩衝含片治療心房顫動以及社交焦慮症	
Centre for Clinical Trials - An Academic CRO for drug and device development	44
臨床實驗中心 - 學術承辦研究組織	
Centre for Protein Science and Crystallography	45
蛋白質科學與晶體研究中心	
Chinese Medicine Research and Further Development	46
中醫中藥研究與發展	
Development of Novel Phthalocyanine-Based Photosensitizers for Photodynamic Therapy	47
用於光動力治療的新型酞菁光敏劑的研究	
Photocatalytic Technology	P 48
光催化技術	
UGC Area of Excellence: Plant and Fungal Biotechnology Program	P 49
教資會卓越學科領域：植物與真菌生物科技	
Real-Time Visualization of Chinese Visible Human	50
中國可視人實時可視化	
Restriction Enzymes: The Scissors for Genetic Engineering	51
內切酶: DNA的剪刀	
Stem Cell and Tissue Regeneration Research in CUHK	52
於中文大學進行的幹細胞及組織再生研究	
Technological Improvement in Radiation Therapy for Nasopharynx Cancer	53
鼻咽癌放射治療之科技改進	
The Development of Cuffless Devices for the Noninvasive Measurements of Arterial Blood Pressure	54
無袖帶式動脈血壓測量裝置的研發	
The International HapMap Project	55
國際人類基因組單體型圖計畫	
Using the Fruitfly Drosophila to Identify and Validate Traditional Chinese Medicine	56
利用果蠅測試中醫藥	
Virtual Acupuncture	57
虛擬針灸	
Virtual Neuroanatomy	58
虛擬腦部解剖	



**Excellence in Research and
Technology Transfer**
卓越研究與科技轉移

Research Excellence and Technology Transfer

卓越研究與科技轉移

The Chinese University of Hong Kong (CUHK) is a leading comprehensive research university in the region. It is engaged in research over a broad ranges of disciplines. The University places great emphasis on technology transfer. In corporation with local industries and businesses, CUHK has developed many practical innovative technologies and products, directly benefiting the community. CUHK is also engaged in deep research collaboration with renowned mainland and overseas institutions, in order to create new knowledge and improve the quality of life.


香港中文大學是區內卓越的綜合研究型大學，匯聚頂尖教研人員及各界專才的力量，就不同學術領域進行深入研究。中大重視科技轉移，與區內工商業界緊密合作，開發各樣先進的技術及產品，造福社會。中大亦與著名國內及海外機構合作進行多項研究計劃，共同為創造新知識及改善人類作出貢獻。

Distinguished Spin-off Companies

優秀科技公司

Numerous cases of the University's research result have been put into practical uses successfully through technology transfer. Over the years, CUHK have pushed forward the setting up of many spin-off companies to commercialize the technologies. Some examples are:

中大不少科研成果都已轉移到實際應用。中大歷年帶動多間科技公司成立，從而將科技商業化。以下為一些例子：


Colisa Ltd.
香港康利佳醫療科技有限公司


Dinastech Holdings Limited


e-jing Technologies Limited
易經科技有限公司


IgGENE Technology Company Limited
康因科技有限公司


iXTech Limited
互聯通有限公司


Netxis Limited


Plasmagene Biosciences Limited
Qualigencis Medical Limited
Satellite Devices Corporation
衛科創業有限公司


Sengital Ltd.


Sky and Capture Aerial Image Company Limited
天域高空圖像製作有限公司


SurfIT Systems Limited
Vast Audio Pty Limited


Wisers Information Limited
慧科訊業有限公司

Zensis Limited
昇科有限公司

Successful cases

成功個案

One of the spin-off companies, **Wisers Information Limited**, is remarkably successful. Wisers Knowledge Management and Content Service System developed by CUHK, has received the Innocation Award of the China Computer Federation. The Award is set up by the China Computer Federation on behalf of the Ministry of Science and Technology to recognize important technological discoveries and breakthroughs in basic and applied research in computer engineering.

其中一間科技公司—**慧科訊業有限公司**的成就更為表表者。由香港中文大學研發的「慧科知識管理與內容服務系統」獲「中國計算機學會創新獎」。該獎項由中華人民共和國科學技術部批准設立，以獎勵計算機領域中基礎研究和應用研究的重大技術發明或技術突破。

Today Wisers Information Ltd. employs over 150 staff throughout China. WiseNews, one of the company's most successful products, distributes up-to-date information from over 1,500 sources across the Asia-Pacific region. 今天，慧科擁有深入彙集各種資訊來源的能力與技術，在大中華區內市場提供完備的情報。其資訊來源包括多達 1,000 家報社、500家網站、大中華區內所有頂級資訊頻道，以及享負盛名兼具影響力的新聞機構。

Zensis Ltd., another CUHK spin-off company founded by two 2002 Engineering graduates, Mr. Jason Ho and Mr. Picco Chu, is also an outstanding case. They won the Gold Award in the SME product category of IT Excellence Awards 2004 by the Hong Kong Computer Society with their first product PhotoRite, an automatic digital photo enhancement software. The judges remarked that the company 'skilfully deployed technology to capture a huge niche market'.

由2002年工程系畢業生朱凱頌先生及何應輝先生成立的科技公司—**昇科有限公司**是另一個成功個案。於2004年，他們在中大研發的「快理相」自動數碼相片修正軟件獲得由香港電腦學會頒發「資訊科技卓越成就獎」金獎（中小企業組）。評審委員會將此項科技評為「潛力極大」，且「能有技巧地利用科技獲取龐大的市場供求缺口」。

Key Areas of Strategic Research

策略性研究重點領域

Five key research areas led by CUHK researchers have been chosen as major thrusts of the University's development. They are **Chinese Studies**, **Biomedical Science**, **Information Sciences**, **Economics and Finance** as well as **Geoinformation and Earth Sciences**. The University has attained a high level of excellence in these areas.

由中文大學教師領導研究的五個重點領域被選定為中大重點發展項目。其中包括**中國研究**、**生物醫學科學**、**訊息科學**、**經濟與金融**及**地球訊息與地球科學**。中大在這些主要領域上已達到很高水平。

Chinese Studies

中國研究

To revitalize Chinese tradition with modernity in a global age. To promote world-class scholarship on China's culture and society through a perspective that is interdisciplinary, long-term, holistic and humanistic.

在全球化趨勢下振興具有現代特色的中國傳統。透過跨學系、長遠性、全面及以人為本的角度在國際級學術界宣傳中國文化及社會。

Biomedical Science

生物醫學科學

To solve the increasingly complex health problems in modern society through fresh synergies of clinical disciplines and basic science.

引用臨床方面及基本科學嶄新方法解決現代社會日趨複雜的健康問題。

Information Sciences

訊息科學

To create and disseminate knowledge in Information Sciences and Engineering technologies in ways that impacts the direction of field, industrial practice, and human society as a whole.

建立及傳達訊息科學及工程技術知識，從而正面影響領域發展、工業上應用及人類社會整體的方向。

Economics and Finance

經濟與金融

To provide professional advice relating to economics and finance to both government and private sector. To nurture caliber contributing to Hong Kong development as a business and financial hub.

為政府和私營機構就經濟和金融事務提供專業意見。培育優秀專才以貢獻香港，使它發展為商業及金融樞紐。

Geoinformation and Earth Sciences

地球訊息與地球科學

To become a national leader and global hub for the research, application and technology transfer of remote sensing by advancing scientific knowledge of remote sensing and maximizing the benefits of such technology through research, teaching and public service.

成為中國遙感研究、應用、技術轉移和國際系統的南方中心，致力於提升遙感科學研究素質及通過研究、教學和社服務，使遙感科學發揮最大的效用。



Commerce and Industry
工商應用

A Ubiquitous Digital Writing System Using MEMS Motion Sensing Technology 一種應用微機電(MEMS)運動傳感技術的通用數碼書寫系統

Prof. LI Wen Jung (Centre for Micro and Nano Systems)
李文榮教授 (微納米系統中心)

Funded by Innovation & Technology Fund
由創新及科技基金資助
Collaboration with DAKA Development Limited
合作夥伴為特嘉發展有限公司

We develop a Ubiquitous Digital Writing System based on MEMS sensing and low-power wireless circuit technologies. The system will compose of a Digital 3D Motion Pen and a Digital Eraser, which, if combined with a mobile computing host, will become a completely new solution for mobile digital data input media. This system will allow users to have total freedom to use the technology ubiquitously.

Applications

- Electronic whiteboard System
- Remote Education
- Net Meeting

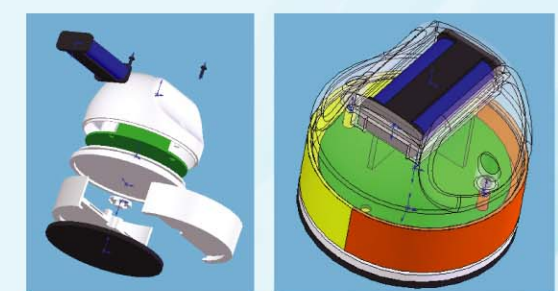
Outstanding Features

- Digital Writing system based on MEMS sensing technologies
- Advanced signal processing based on navigation techniques
- Low power wireless sensor network techniques

Target Users

- Education
- Business and Training
- Home users

通用數位書寫系統的研發採用了基於微機電(MEMS)傳感和低能耗之無線電技術。該系統包含一個數碼三維運動筆和一個數碼橡皮擦。再結合移動計算主機，它將提供一種移動數位數字輸入的全新方案。這個新穎的系統將提供終端用戶廉價的產品，並讓他們在使用該項通用的範本技術時具有完全的自由。例如，他們可在任何地方、任何表面，不需借助任何特製的紙張或白板便可以使用該系統。



Digital Eraser
數碼橡皮擦

應用範疇

- 電子白板系統
- 遠端教育
- 網路會議

特點

- 基於微機電(MEMS)傳感技術的通用數位書寫系統
- 基於導航系統的先進信號處理技術
- 低功耗無線感測器網路技術

目標用戶

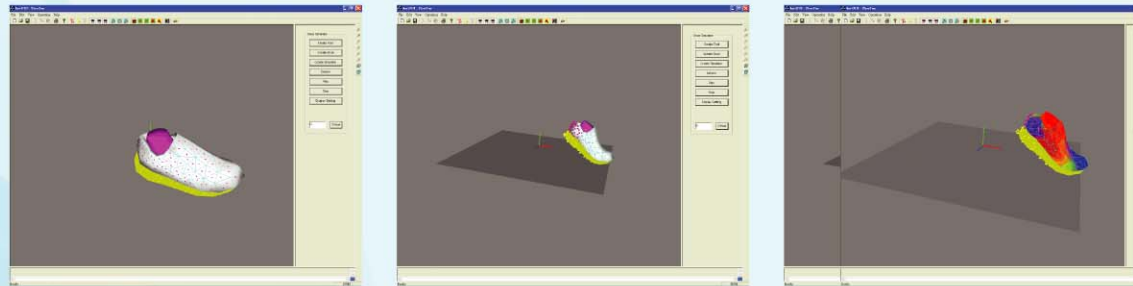
- 教育系統
- 商務與培訓
- 家庭用戶



Computer-Aided Analysis of Shoe Fitting 鞋形合適度電腦輔助分析系統

Prof. HUI Kin Chuen (Department of Automation and Computer-Aided Engineering)
Prof. HONG Youlian (Department of Sports Science & Physical Education)
許健泉教授 (自動化與計算機輔助工程學系)
洪友廉博士 (體育運動化科學系)

Funded by Innovation and Technology Fund
由創新及科技基金資助



Putting a shoe to a foot model
(將鞋履穿在腳模上)

Simulating shoe deformation in a gait motion
(模擬腳部行走時的鞋形變動)

Stress distribution on a deforming shoe
(變形鞋履的壓力分佈)

A system for simulating the deformation of a shoe and its interaction with the foot in a gait motion is developed. A parametric foot shape model is developed for generating 3D foot models based on a set of standard foot shape parameters. The action of putting on a shoe is simulated by deforming the shoe model to fit a given foot model. An accelerated boundary element technique is developed for the deformation of the shoe and the foot. Stress distributions on the insole and the upper surface of the shoe in a gait motion are computed and can be used for analyzing the fitness of the shoe on a given foot model.

此項目開發了一個模擬腳部行走時鞋形變動的互動仿真系統。腳部三維模型是根據一套標準的腳部形狀參數製造出來。鞋履穿在腳上時，鞋身各處會受到不同壓力而稍為變形。電腦仿真系統根據腳部模型與鞋身的互動情況，利用「加速邊界元素運算法」來推算鞋身和腳部因互相受壓而變形的幅度。系統更可計算出穿鞋走動時，鞋內各位置的壓力分佈，從而分析該鞋與有關腳型的合適程度。

目標用戶

鞋類設計師與製造商。此系統不單可使設計師得到靜態鞋形的資料，亦可以得到當行走時鞋形變動的資料。

Outstanding Features

A parametric foot shape model for generating 3D foot shapes based on a set of standard foot shape parameters. A simulation of the foot and shoe deformation and their interaction in a gait motion.

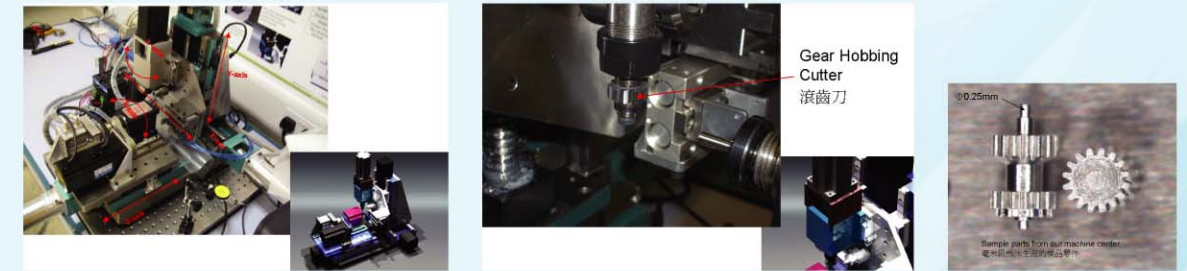
Target Users

Shoes designers and manufacturers. This system allows the designer to assess the design of a shoe based not only on the static shape of the shoe, but also the deformation of the shoe in a gait motion.

Development of Cost Effective Millimeter Scale Machine Tools 發展有成本效益毫米級機床

Prof. DU Ru Xu, Prof. KONG Ching Tom, Dr. WONG King Sau Sammy, Mr. CHAN Ngai Shing Sunny (Institute of Precision Engineering)
杜如虛教授，江爭教授，黃敬修博士，陳毅承先生 (精密工程研究所)

Funded by Hong Kong Watch Manufacturers Association Limited, The Federation of Hong Kong Watch Trades and Industries Limited, Innovation and Technology Commission, The Chinese University of Hong Kong
由香港錶廠商會、香港鐘錶業總會、創新科技署、香港中文大學資助



The objective of this project is to design and build a cost effective millimeter-scale machining center for manufacturing high precision micro-components. These watch parts include pinions and gears, which are commonly and effectively manufactured by gear hobbing method. Our prototype machine can perform not only the above hobbing method, but also turning operation. As a result, we simplify and automate the multiple manufacturing processes of high precision watch components within a single machine. Currently, this machine can fabricate micro shaft component with minimum diameter 0.1 mm and micro gear with minimum gear module 0.09.

In addition, current trends in product miniaturization demand more such micro-components, which are not cost effective to be manufactured by traditional large scale machines. The development of low cost millimeter scale machine tool is the solution.

Outstanding Features

In general, the cost of a large scale multi-axis machining center is about HK\$1,500,000 to HK\$3,000,000. However, the target cost of the millimeter scale machine is less than HK\$200,000. The operation cost of millimeter scale machine is also lower, because it consumes less energy. The millimeter scale machine has also integrated both the gear hobbing and turning function. Such kind of design can decrease the manufacturing procedure of each component. As a result, this millimeter scale machine can help the watch industry to achieve cost effective manufacturing.

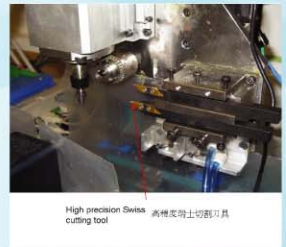
這個項目的目標是設計和建造具成本效益毫米級機床使用於精確微型零件的製造。這些手錶零件包括小齒軸和齒輪，而滾齒加工是一個普及和有效的製造方法。我們的原型機器不僅可進行上述滾齒加工，而且可進行車加工。結果，我們在一個機器之內把高精度手錶零件生產簡化和自動化。目前，這台機器可以製造出最小直徑為0.1毫米的微型軸零件和最小輪齒輪模數為0.09的微型齒輪。

特點

一個傳統大型多軸機械加工中心的成本是大約港幣\$1,500,000至港幣\$3,000,000。但是毫米級機床的建成本大約只需港幣\$200,000。由於毫米級機床的能量消耗較少，因此運作費比較低。毫米級機床同時有滾齒的和車工的功功能。這樣設計可以減少工件生產工序。因此，毫米級機床可以幫助手錶製造工業達到低成本的生產。

項目效益

機械手錶機蕊需要許多類型高精度微型零件譬如擺輪、齒輪、小齒軸、軸和擒縱。具成本效益的零件製造方式為成功在香港生產機械手錶提供了重要技術。另外，由於產品趨向小型化增加了對微型零件需求，使用傳統大型機器作為微型零件的製造工具並非一個有成本效益的方法。解決方法是發展具成本效益毫米級機床。



High precision Swiss cutting tool 高精密瑞士切割工具

Corresponding Benefit

Mechanical watch movement consists of many types of high precision micro-components such as balance wheel, gears, pinions, shafts and escape wheel. The cost effective way of manufacturing those components provides a critical technology for the success of making mechanical watch movement in Hong Kong.

Development of Optical Pickup Chipsets for Blue Laser DVDs 開發用於藍色激光DVD的光獲取芯片組

Prof. CHOY Chiu Sing Oliver, Prof. PUN Kong Pang (Department of Electronic Engineering)
蔡潮盛教授, 潘江鵬教授 (電子工程學系)

Funded by Innovation and Technology Fund
由創新及科技基金資助

Collaboration with SiliconCore Technology (HK) Ltd., and Jianghai Electronic Co., Ltd
合作夥伴為硅芯科技(香港)有限公司、江海電子股份有限公司

This project aims at developing key optical pickup ICs for the next generation optical storage discs based on blue laser technology. The products include a photo-detector IC (PDIC) and a laser diode driver (LDD) that support both DVD playing and recording functions. The ICs will also be compatible with existing optical storage formats: CD/DVD/DVD-RW/ DVD+RW/DVD RAM.

Applications

- HD DVD optical interface
- Blu-ray Disc optical interface

Outstanding Features

- Up to 1 GHz modulating frequency for the LDD
- Low temperature coefficient for the HFM: 200ppm/°C
- Temperature sensor embedded in the LDD
- Fast LDD output rise and fall times (< 0.5ns)
- High sensitivity for the PDIC (> 0.24A/W)

Target Users

- DVD player/recorder manufacturers
- Optical Pickup Unit manufacturers: Cost-effective core IP will lower barrier to the Blue-Laser DVD market

此項目旨在開發用在下一代藍光DVD機(包括HDDVD與BD)光獲取單元(OPU)中的關鍵芯片組。具體產品包括藍色激光二極管驅動器(LDD)和光電控測集成電路(PDIC)。開發的芯片將支持藍光DVD的讀與寫,並與現有的光存儲標準: CD / DVD / DVD-RW / DVD+RW / DVD RAM等相容。

應用範疇

- HD DVD光接口
- Blu-ray Disc光接口

特點

- 高達1GHz的LDD調諧頻率
- 低溫度係數的HFM: 200ppm/°C
- 內置於LDD的溫度傳感器
- LDD輸出的上升及下降時間短(<0.5ns)
- PDIC的敏感度高 (> 0.24A/W)

目標用戶及效益

- DVD 播放器/刻錄機製造商
- 光獲取單元製造商, 效益為降低進入藍光DVD市場的壁壘, 因成本降低及更容易獲得使用核心IP的權利。



Products using LDD and PDIC
(藍光DVD和PDIC的應用)

Development of Ultra-Low-Power Alcohol Vapor Sensors Based on Functionalized CNT Sensing Elements 利用功能性碳納米管為材料研製的低功率酒精測試器

Prof. LI Wen Jung(Centre for Micro and Nano System), Prof. WONG Ka Wai(Department of physics)
李文榮教授(微納米系統中心), 黃家偉教授 (物理學系)

Funded by Innovation Technology Commission
由創新及科技署資助
Collaboration with Automatic MFG. Ltd.
合作夥伴為藝美達實業有限公司

We have successfully chemically functionalized the multi-walled carbon nanotubes (MWCNTs) with COOH group by the method of oxidation and used AC electrophoresis to formed these bundles MWCNTs between Au electrodes on the Si substrate. We then demonstrated that these resistive elements are capable of detecting alcohol vapor using an ultra-low input power of only ~0.01micronWatt. The sensors exhibit fast, repeatable, sensitive, and reversible response. Our results show that the resistances of the sensors vary linearly with alcohol vapor concentration from 5ppth to 100ppth (ppth = part per thousand). We can also easily reverse the initial resistance of the sensors by annealing them in real time at 100-250micron ampere current within 1-6 minutes.

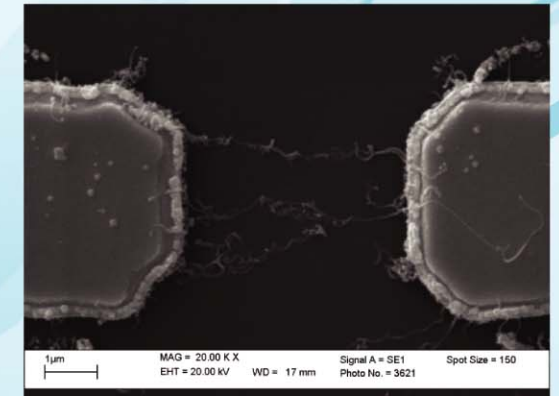
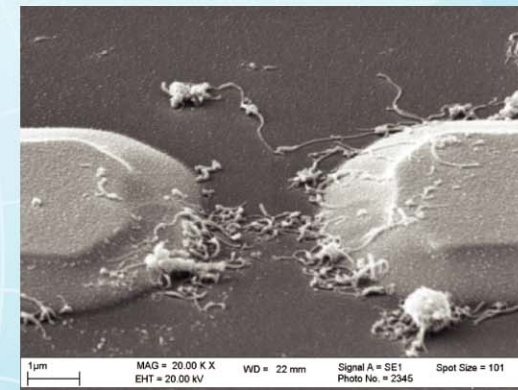
Target Users

Developers and manufacturers who want to develop alcohol sensors for road safety check by police, or for wen personal use.

我們成功地把碳納米管系統功能化, 利用氧化方法把碳酸化學分子(COOH)依附在碳納米管上, 並利用電泳力操作技術, 快捷及大量地製作碳納米管感應器。我們嘗試測試這感應器對不同酒精濃度的反應, 發現它的功率消耗不但很低, 只須要大約0.01微瓦特, 反應時間快, 信號的重複度也高。而且只要利用100-250微安培電流, 感應器可輕易地在1-6分鐘內逆轉回原本的電阻值。實驗結果證明感應器的電阻值和酒精濃度有著線性的關係, 最低更可測量到千分之五的酒精濃度。

目標用戶

有意發展酒精測量器予警察部進行道路完全檢查的發展商及製造商, 及個人用途。



Expert Label Pattern Design System 標籤設計專家系統

Prof. Du Ru Xu, Miss LIU Chung Yan (Institute of Precision Engineering)
杜如虛教授，廖頌欣小姐（精密工程研究所）

Funded by SML Group Ltd.
由東英商標有限公司資助

In the traditional design process of textile labels, the designer needs to create a new pattern file for each new label to be produced. This project is to develop an "Expert Label Pattern Design System" to automate this tedious label pattern design process. The expert system is implemented using Frame-based Expert System. A software, namely "VLabel", is developed for this system using Visual C++. The system has been developed and tested by an industrial sponsor, SML Group Limited. It has been proven to work well and used for production in the shop floor now.

Applications

1. Woven Label Pattern Design
2. Woven Label Simulations

Outstanding Features

The system can automatically generate a template file for the label. With this template file, user can edit the text content in the label and the system will automatically generate a new label pattern accordingly. Also, The "VLabel" software contains a function to automatically scan the weave pattern file and generate the 3D virtual model for the label using VRML.

Target Users

With this expert design system, the cost and time for pattern design are drastically reduced. Also, the virtual label allows the designer to check whether there is any problem in the design without producing an actual label.



Virtual Label (三維虛擬標籤模型)



VLabel Software (VLabel 軟件)

在傳統的標籤排版過程，設計人員需要為每一個新的標籤設計新的標籤版。此研究項目開發了一個標籤排版專家系統，令標籤的排版過程自動化。我們應用了框架式專家系統的技術，及以「Visual C++」開發了一個軟件「Vlabel」來實踐這個標籤排版專家系統。這個專家系統已在一標籤生產商—東英商標有限公司通過測試，並已應用於其生產過程中。

應用範疇

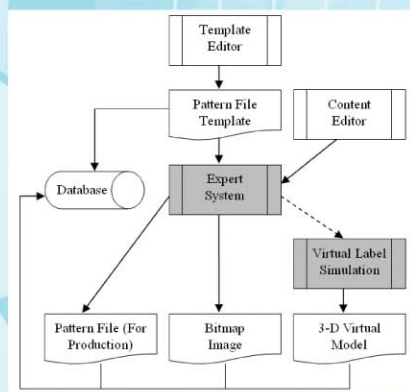
1. 標籤模版設計
2. 建立標籤模擬

特點

這個系統可自動製作出標籤版。用者只要更改文字內容並輸入專家系統，系統就會自動生產一個新的標籤版。另外，「Vlabel」軟件能自動閱讀標籤的組織設計圖，同時建立一個「VRML」檔案來顯示標籤的三維模型。

目標用戶

這個自動化的專家系統減省了一些標籤排版的繁複過程，大量縮短標籤版的设计時間。另一方面，用者可在生產前從虛擬標籤預先檢視標籤設計的效果。



System Structure (系統結構)

Face Recognition 人臉識別

Prof. TANG Xiaou, Prof. LIU Jianzhuang (Department of Information Engineering)
湯曉鵬教授，劉健庄教授（訊息工程學系）

Funded by Innovation and Technology Fund
由創新及科技基金資助

The developed techniques and prototype demos include:

- Face detection in still images and videos
- Face tracking with an active camera
- Face-based identity verification
- Academic achievements: More than 30 papers have been published in top international conferences on computer vision (CVPR, ICCV) in the past three years.

Applications

- Security
- Surveillance
- Identity Verification
- Suspect Identification
- Family Album

Outstanding Features

- Liveness Detection
- Active Tracking
- Realtime Alignment

Target Users

- Police, Customs
- Companies and organizations that require security systems
- Intelligent Toy Manufacturers



Sketch and photo retrieval system
素描與人像搜索系統

已開發的技術及原型包括：

- 在靜態圖片和視頻中的人臉檢測
- 基於活動相機的人臉跟蹤
- 人臉認證技術
- 學術成果：最近三年已經在計算機視覺兩個國際會議 CVPR和ICCV上發表了超過30篇論文

應用範疇

- 保安
- 監控
- 身份驗證
- 罪犯辨識
- 家庭相冊

特點

- 活體檢測技術
- 自動人臉跟蹤技術
- 實時人臉定位技術

目標用戶

- 警察局，海關
- 對保安性能要求較高的公司及機構
- 智能玩具生產廠商



Face recognition system
人臉識別系統

Intelligent Mobile Human Identification System - Follow Me Robot

智能移動人臉辨識系統—跟我走機器人



Prof. MOON Yiu Sang (Department of Computer Science and Engineering)
 蒙耀生教授 (計算機科學與工程學系)

Our project aims at developing a robot, called "Follow-Me" Robot, which has the features of face recognition and motion tracking. The robot is able to perform face recognition to check the identity of the user before move to follow him/her. "Follow Me" can serve many industrial applications although it is demonstrated as an intelligent toy at the current stage.

此項目旨在發展一個具有辨識人臉及追蹤動作的「跟我走機器人」。此機器人能透過其主人的臉部特徵辨識身份。「跟我走機器人」的初部應用雖然是一具先進及高智慧的玩具，但它亦可應用於不同的工業範疇。

用戶介面

系統提供以聲音作響導的簡易互動介面，使用戶能方便地管理機器人。

功能概覽

用戶透過臉部特徵辨識從而控制系統。之後用戶便可隨意加入新用戶或指令機器人跟隨移動。

User Interface

The system provides a user-friendly interface with voice guidance which allows users to manage the robot easily.

Function Overview

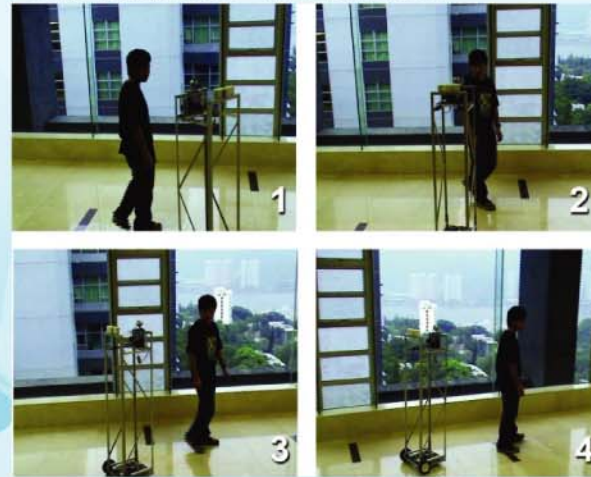
The user gains control to the system via face identification. Afterwards he/she can add new users or order the robot to follow him/her.

Hardware Components

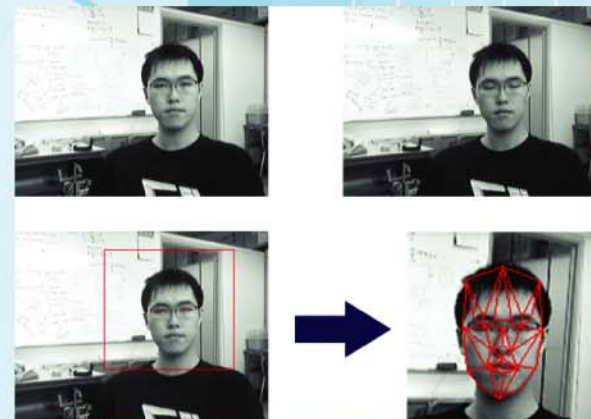
硬件組件



After enabling the tracking function, the robot will follow after its master
 當啟動運動跟蹤功能後，機器人能夠跟隨用戶



The robot can recognize its master by the facial features
 機器人能透過用戶的臉部特徵，辨別其身份



Award獎項:
 First Honor of Intel Cup Winner
 英特爾杯最高榮譽

<http://pc89225.cse.cuhk.edu.hk/intelcup/>

Imaging System for Three-Dimensional Reconstruction of Surface Profiles

重建三維表面影像系統



Prof. CHUNG Chi Kit Ronald (Department of Automation and Computer-Aided Engineering)
 鍾志杰教授 (自動化與計算機輔助工程學系)

Funded by Innovation and Technology Commission, ASM Assembly Automation Ltd.
 由創新科技署及先進自動器材有限公司資助

As the electronic industry advances rapidly towards manufacturing smaller, lighter, faster, and cheaper products, area array packages including Ball-Grid Array ("BGA") packages, Chip-Scale Packages ("CSP"), flip chips, wafer bumping and wafer-level packaging ("WLP") are increasingly becoming the focus of IC packaging technology.

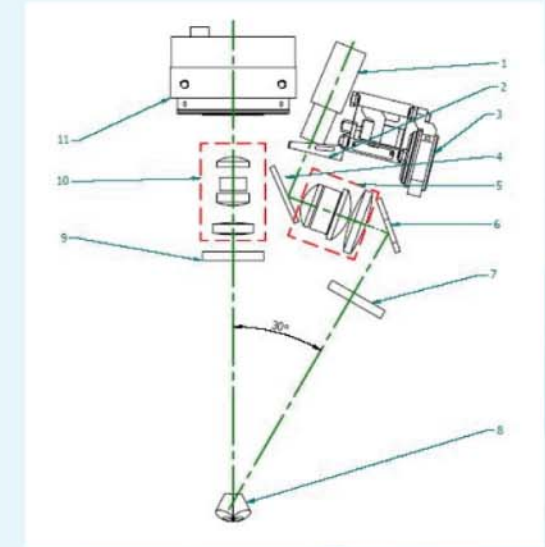
However, the reduced dimensions of the devices also lead to more stringent requirements on process control and quality assurance. A particular challenge relates to the development of vision techniques for three-dimensionally inspecting the surfaces of these smaller devices accurately and efficiently. An example would be the inspection of wafer bumps formed on BGA devices. Specifically, wafer bump heights should be measured and examined in three dimensions to determine if they are defective. However, the small size of the wafer bumps, which typically have diameters of about 60 microns, means that traditional inspection technologies, such as techniques for inspecting solder bumps on printed circuit boards, are inapplicable.

Adding further difficulty to the inspection task is the often highly specular and textureless nature of the microscopic surfaces. It is also demanded that the size of the inspection system itself be small so as to minimize restraint on the operation of the various moving parts that are involved in the speedy manufacturing process.

The patented technology is about a new 3D reconstruction mechanism for the task. The mechanism is based upon the familiar concept of the structured-light projection, but adapted to a new configuration that owns a particularly miniaturized size and that operates in a different manner. The mechanism consists of only a single light source in combination with a binary grating for projecting binary pattern. To equip each position of the inspected surface with a distinct binary code-string for correspondence, the binary grating is shifted in space and in every shifting a separate image of the illuminated surface is taken. With such a bright-or-dark world for the image data, issues like image saturation, image noise, and textureless nature of the inspected surfaces are avoided.

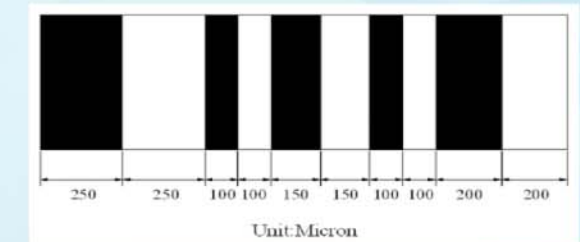
隨著電子工業迅速邁向生產較小、較輕、較快及較便宜的產品，面積陣列裝置，包括BGA, CSP, Flip Chips和晶片直接包裝("WLP")，正日益成為IC封裝技術的重點。

但是，減少了設備方面的要求需要嚴格的程序控制和質量保證。特別困難的是發展三維影像技術以檢查這些細小的器件。其中一個例子是檢查由BGA裝置上的球形接點。



A schematic diagram of an imaging system
 視像系統結構示意圖

特別是接點高度應以三維方式來衡量和檢驗，以確定是否有缺陷。但是，由於接點體積細小，典型的直徑約只有60微米，傳統的檢驗技術和方法，並不適用。毫無質感的微觀面進一步增加檢查工作的困難。檢查系統本身的體積必需細小，以儘量減少快速生產過程中，所牽涉不同移動部份正常運作的影響。這個已註冊專利的新技術源自三維重建的方案。概念是基於熟悉的結構式光線投射，但採用了一個擁有特別微型規模和不同運作方式的新結構。本項目採用了單一光源和一個光柵結合成黑白條紋的光線投射。檢查表面的每個位置都有明顯的二元代碼串以作檢算，光柵位置會作出移動，而每一次移動投射面的獨立影像都會被拍下。有了光或暗的圖像資料，圖像飽和、圖像噪音和毫無質感的檢查表面等問題得以避免。



An example of an irregular binary pattern; and there are at least two bright regions and two dark regions whose widths are different. 一個不規則二值光柵的例子，黑白條紋的寬度不全相同

Intelligent Office Assistant 智能辦公助手

Prof. MOON Yiu Sang (Department of Computer Science and Engineering)
蒙耀生教授 (計算機科學與工程學系)

Intelligent Office Assistant is aimed at helping a business executive to effectively collect and organize the information one encounters in everyday work. The system can be used to capture video, audio, text and image data. It can also be accessed online for remote data retrieval.

Meeting Function

Capture meeting videos with speaker tracking capability

Document Function

Captures paper documents and indexes them automatically with OCR

Whiteboard Function

Captures notes on a blank page or on a captured document

Email Function

Sends and receives emails

Schedule

Reminds users of events

Remote Access

Retrieves information from InOA with a remote computer

Outstanding Features

Meeting Function

As one of the most important functions of InOA, the meeting function captures and encodes in realtime the video and audio of a business meeting. InOA directs the camera to point to the speaking person during a meeting, so that the corresponding facial expressions and body language can be recorded lively.



"智能辦公助手"系統開發目的在幫助商界更有效地收集和管理日常工作上所遇到的各種信息，減輕工作負擔，提高工作效率。為了達到以上目的，本系統整合了多個模組來提供不同的功能。用戶可以使用本系統紀錄會議過程影像與聲音，以及電子化處理文件和圖像。本系統還支援搜尋及遠端線上遙控功能。

會議記錄

配有追蹤發言人錄像錄音的會議記錄

文件處理

使用OCR (光學文字辨識) 紀錄及索引文件

電子白板

用戶可以使用手寫板記錄筆記或備忘

電郵收發

用戶可以使用本系統收發電子郵件

行事曆

提醒用戶重要會議和工作

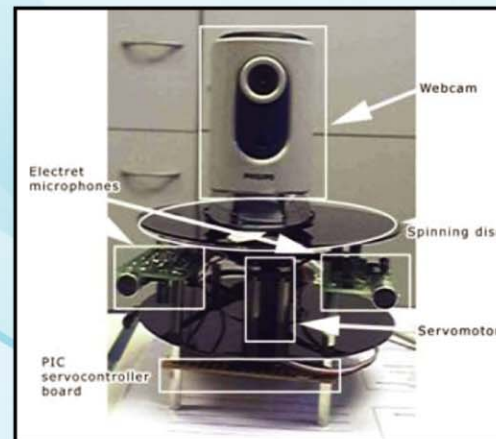
遠端線上遙控

允許用戶在遠端電腦使用互聯網搜尋本系統上之資料

特點

會議記錄功能

會議記錄 (聲音追蹤) 功能是本系統其中一個最重要的功能，其能夠以實時之方式紀錄會議過程影像與聲音。我們研製了一個聲音追蹤功能，在會議時，系統能自動轉向對準拍攝發言人，使會議錄影片段更有動感。



Hardware design of Meeting Function
會議記錄的硬件設計

Award:
First Honor (Intel-ECX)
獎項:
一等獎 (平台: Intel-ECX)



Intelligent Omni-directional Hybrid Electric Vehicle (IOHEV)

一種新型的環保汽車：混合動力，全方位及智能化

Prof. XU Yangsheng (Department of Automation and Computer-Aided Engineering)
徐揚生教授 (自動化與計算機輔助工程學)

Funded by Innovation and Technology Commission

由創新科技署資助

Collaboration with Sun East Technology (Holdings) Ltd, Shenzhen Dang Jin Technology Ltd, Shanghai Maple Automobile Co. Ltd (SMA), Tsinghua University, Shanghai Jiaotong University
合作夥伴為日東科技(控股)有限公司、上海華普汽車、清華大學、上海交通大學

Today we all face two major crises: the problems of energy and pollution. The hybrid electric vehicle (HEV) concept is the best approach in killing two birds with one stone, as it saves fuel energy by optimizing the vehicle power, and at the same time reduces pollution by controlling the emission. HEV also allows us to simplify the mechanical transmission and makes it possible for 'drive by wire'. This proposal is to develop a serial hybrid electric vehicle platform that demonstrates the key technologies for commercial use. It will involve the following three major areas:

1. Intelligent energy management and control technology based on serial hybrid design for optimization of engine. We will develop an intelligent HEV energy management and control system that harmonizes the following key components:
 - Battery as power source
 - Engine/Electric generator as auxiliary power unit
 - Electric motor for wheels
 - Control area network for communication between components in the vehicle
 - HEV control system for the coordination and control between the components
 - Power management and control system that optimizes vehicle performance based on output power, fuel consumption and emission.
2. 4-independent-wheel-drive that can improve the efficiency through electronic differential which substitute for mechanic differential; wheel control system that can enable 4-wheel-steering with independent suspension for omni-directional motion
 - 4-wheel drive
 - 4-wheel steering
 - Antiskid control in multiple directions
 - Intelligent road condition estimation

3. Intelligent electronic system for coordination of forward collision warning and avoidance system stop & go and cruise system and intelligent information platform.
 - An automatic navigational system for parking based on restricted maneuvers that advantage of 4WS mechanism
 - Intelligent architectural-electronic-based information platform that supports
 - Intelligent car safety system based on modeling of human dynamic driving behaviors

The goal is to save fuel consumption, and substantially reduce pollution emission and improve safety. It is believable that the IOHEV R&D will impact significantly impact car manufacturing, energy as well as environment protection.

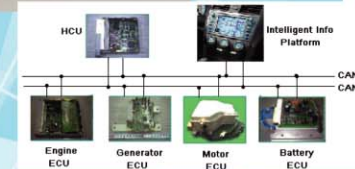
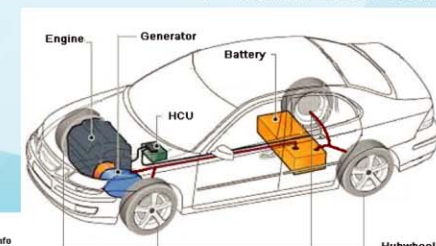
我們今天面臨能源和污染兩大難題。混合動力汽車是一石二鳥的最好解決辦法，它通過優化動力來節油，通過控制排放來減少污染。由於取消了傳統的傳動系統，其四輪獨立驅動的電動輪機構將提高車輛的機動性。

我們的目標是節省油耗，減少排放和提高汽車安全性。而開發這個世界領先的平臺將對汽車製造、節能、建立環保社會帶來深遠的影響。我們堅信這一研究將有助於香港及中國經濟發展和環境改善。

計畫開發一個串聯結構混合動力汽車平臺，並基於此平臺研究具有商業價值的汽車產業相關核心技術。此新型混合動力汽車用有以下特點：四輪驅動，四輪轉向，獨立懸掛系統以及線驅動結構。

所開發的混合動力汽車關鍵技術分三類：

1. 以經濟性和排放為優化性能指標的能量管理控制技術，從而在油耗、動力和污染排放三個指標中取得平衡
2. 多方向運動的四輪驅動/轉向系統，用來實現多方向運動
3. 智能資訊平臺和安全功能綜合系統，是集成了自動泊車、資訊平臺和安全功能的智能電子系統



Performance Measurement of Mobile Networks

流動通訊網絡的功能表現測試

Prof. LAU Wing Cheong (Department of Information Engineering)
劉永昌教授 (訊息工程學系)

Funded by Ericsson Limited, SmarTone Mobile Communications Limited and Office of the Telecommunications Authority (OFTA)
由愛立信有限公司、數碼通電訊有限公司及電訊管理局資助

The performance of mobile networks is measured and analysed in 3 independent approaches. The results will then be integrated to give a accurate picture of the network performance under various loading conditions, and for different applications. The 3 approached include (1)using simulation analysis (2) deploying a Radio Access Network (RAN) Emulator and (3) conducting field measurement. Simulation analysis is done by using off-the-shelf simulation software. The RAN emulator has been developed by the research team for detail analysis and fine-tuning of network parameters for performance optimization. Field measurements are done to collect performance data for feeding into the RAN emulator and simulator. The measurement and analytic methodology will be instrumental for network opertaors to optimize quality-of-service under different applications and network loading conditions.

Applications

Mobile or Wireless Network planning and performance anlysis, Quality-of-Service monitoring and analysis, network capacity estimation, network performance optimizatoin

Outstanding Features

Although network performance for voice communication applications has been well developed, there is no established methodology for scientific measurement of quality-of-service for mobile applications like video streaming, mobile games, file transfer or other mobile applications other than voice. The project proposed and verified a number of systematic models for analysing and measuring network performance for non-voice applications.

Target Users

Network operators can apply the proposed models for clear definitions of quality-of-service or network capacity, for communicating with their stakeholders. The measurement and analysis techniques can be applied to optimize network capacity to save cost, and to give the best quality-of-service to customers.

我們利用3個獨立的方法測量及分析流動網絡的表現。這些結果將可綜合顯示出網絡於不同載荷情況和不同應用下的準確狀況。這3個方法包括(1)利用模擬分析；(2)展開無線存取網絡仿真器；及(3)進行實地測試。模擬分析可利用現成的模擬軟件。無線存取網絡仿真器已由研究小組開發，用作詳細分析及微調網絡參數以優化表現。實地測試則收集表現數據供無線存取網絡仿真器及模擬器。這些測試法和分析方法將有助網路操作者優化於不同應用及載荷情況下的服務質量。

應用範疇

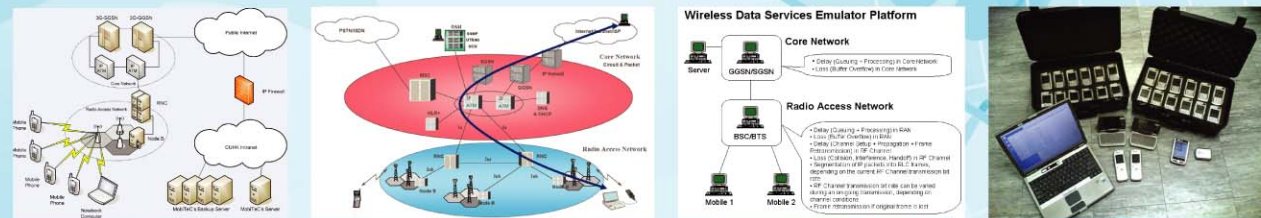
流動或無線網絡之計劃及表現分析、監察及分析服務質量、估計網絡容量及優化網絡表現

特點

雖然測試網絡於通話時的表現已有完善的量度機制，然而具科學性地測試非通話的流動應用的服務質量，如影像串流、手機遊戲、檔案傳遞等，則尚未有確立的方法論。因此，此項目提出及證實一些有系統的模式以分析及測試非通話應用的網絡表現。

目標用戶

網絡供應商可利用提供的模型，清楚地定義服務質素或網絡容量。此外，測試和分析的技巧亦可優化網絡容量，從而減低成本及為用戶提供更優質之服務。



<http://mobitec.ie.cuhk.edu.hk/>

Network Coding Theory

網絡編碼理論

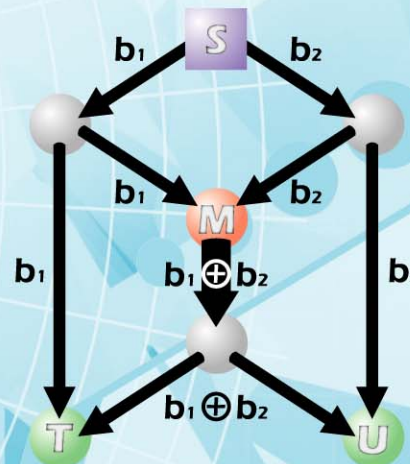
Prof. YEUNG Wai Ho Raymond, Prof. LI Shuo Yen Robert (Department of Information Engineering)
楊偉豪教授、李碩彥教授 (訊息工程學系)

Network coding is among the most important breakthroughs in network communications. Since its inception in 1997, network coding has quickly developed into a research field that has fundamental influence on information theory, coding theory, networking, switching theory, wireless communications, computer science, cryptography, operations research, and matrix theory.

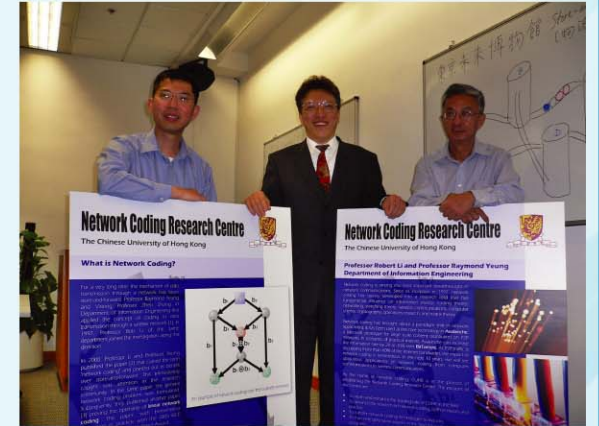
Network coding has brought about a paradigm shift in network applications. It has been used as the core technology in Avalanche, a Microsoft prototype for large scale content distribution on P2P networks. In scenarios of practical interest, Avalanche can increase the information rate by 20 to 30% over BitTorrent. As P2P traffic is occupying more than 60% of the Internet bandwidth, the impact of network coding is tremendous. In the next 10 years, we will see ubiquitous applications of network coding from computer communications to wireless communications.

Published by Prof. Yeung, Prof. Li and Dr. Cai, the paper, linear network coding, with tremendous implication in practice, won the 2005 IEEE Information Theory Society Paper Award.

CUHK is in the process of establishing the Network Coding Research Centre. The Centre aims to retain and enhance the leading role of CUHK in the field, to advance the research on network coding, both in theory and practice and to transfer network coding technologies to industry. The Centre will serve as a rendezvous for researchers in the field, with the aim to foster collaborations between academics and industry.



The benefit of network coding over store-and-forward is best illustrated by the butterfly network example 圖中所示的 butterfly network，正好顯示網絡編碼 (network coding) 較存儲轉發機制 (store and forward) 優秀的例子。



From left: Professor YEUNG Wai Ho Raymond, Professor LI Shuo Yen Robert and Dr. CA Ning
左起：楊偉豪教授、李碩彥教授和蔡寧博士

網絡編碼理論 (network coding theory) 始源於香港中文大學，是網絡通信研究領域中一項重要突破，自從首次提出以來，網絡編碼已迅速發展成一個重要的研究範疇，並對信息論、編碼、通信網絡、網絡交換理論、無線通信、計算機科學、密碼學、運籌學、矩陣理論等領域帶來影響深遠。網絡編碼是現今世界各地一流大學及工業實驗室最熱門研究領域之一，亦是許多國際研討會的熱門議題。

網絡編碼帶給網絡應用一場範式革命。微軟公司最近以網絡編碼作為核心技術開發出「雪崩」(Avalanche) 原型軟件。「雪崩」於P2P通訊之大規模數據分發，傳送速度可高出BT (BitTorrent) 百分之二十至三十。由於P2P通訊佔互聯網頻寬百分之六十以上，網絡編碼的影響深遠。預料未來十年，從電腦通訊、無線電通訊、以至於其他各類通訊，都會廣泛地應用網絡編碼。

香港中文大學訊息工程學系李碩彥教授、楊偉豪教授及蔡寧博士合著之「線性網絡編碼」(Linear Network Coding) 獲頒二零零五年IEEE電機及電子工程師學會信息理論學會論文獎。該文證明線性網絡編碼之最優性，並將網絡編碼理論落實至實際應用，為網絡通信帶來突破發展。

香港中文大學正籌組全球首創「網絡編碼研究中心」，目的為維持並深化中大在此領域的主導地位，加強理論研究及推廣工業應用，以及提升香港在信息科學領域的國際地位。

Award 獎項:
2005 IEEE Information Theory Society Paper Award

Plug-and-play Data Security Platform

隨插即用數據保密平臺

Prof. CHAN Kam Tai, Mr. WONG Tsz Yeung (Department of Electronic Engineering)
 Prof. WONG Man Hon, Prof. LUI Chi Shing (Department of Computer Science and Engineering)
 陳錦泰教授，黃子洋先生（電子工程學系）
 王文漢教授，呂自成教授（計算機科學與工程學系）

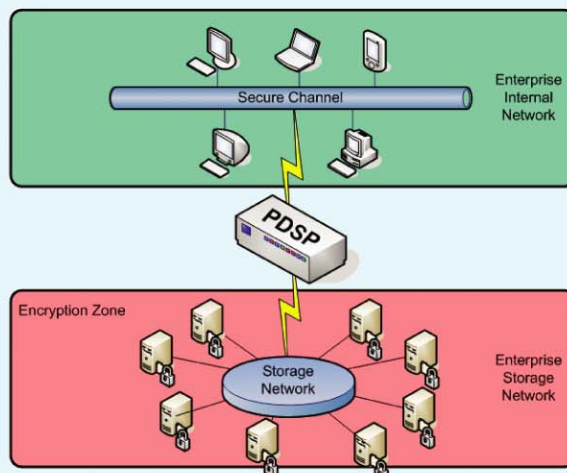
Funded by Innovation and Technology Fund

由創新及科技基金資助

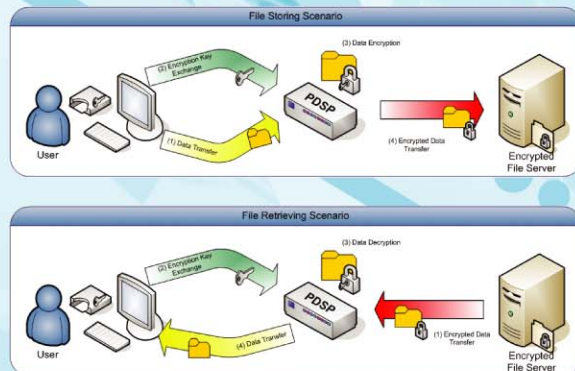
Collaboration with ASK Technology Ltd., EIL Compang Ltd., and Tanxia System Inc.

合作夥伴為亞之傑科技有限公司，星光電子有限公司及Tanxia System Inc.

As more and more company data are being processed and stored, especially in Network Attached Storage (NAS) or Storage Area Network (SAN), which is deployed to improve the scalability and manageability of and access to critical data, significant security risks arise because of the larger chances of unauthorized access, theft and virus intrusion. Technologies such as Firewalls, Intrusion Detection Systems and Virtual Private Networks can only secure data assets by protecting the perimeter of the network. They do not address the security of the stored data. This project aims at developing a Plug-and-Play Data Security Platform (PDSP) for NAS systems, in the form of a hardware box with software, which can provide comprehensive protection of stored data, and which can be integrated transparently into the existing operating environment of SME in general. The technology is application-independent, vendor-agnostic and will not interfere with any user workflow. The PDSP combines secure access controls, authentication, data encryption, encryption key management and secure logging to provide maximum protection and manageability of stored data.



越來越多公司數據被處理和被儲存，特別是在網路連接存儲 (NAS) 或儲域網路 (SAN) 之應用上。NAS以及SAN可以改善數據存取的擴容性和管理，但亦更容易被非法登入，盜竊和病毒侵入，從而引致嚴重數據安全問題。網路防護技術譬如防火牆、侵入檢測系統和虛擬私人網路只可能從保護網路的邊界來保護數據。它們並不能解決儲存數據的安全問題。本項目應用在 NAS 系統，目的是發展一套隨插即用數據保密平臺 (PDSP)，以硬體的形形式加上軟件，對被儲存的資料提供全面保護，及具有高透明度配合現有的操作環境。這技術能獨立應用，具有跨平台和可與不同供應商產品兼容的特點，並不會影響任何用戶的工作程序。PDSP結合了安全存取控制、認證、數據加密、密鑰管理和安全登入，提供最佳的數據保護和可管理性。



Precision Positioning of Hard Disk Drives Using Piezoelectric Actuators

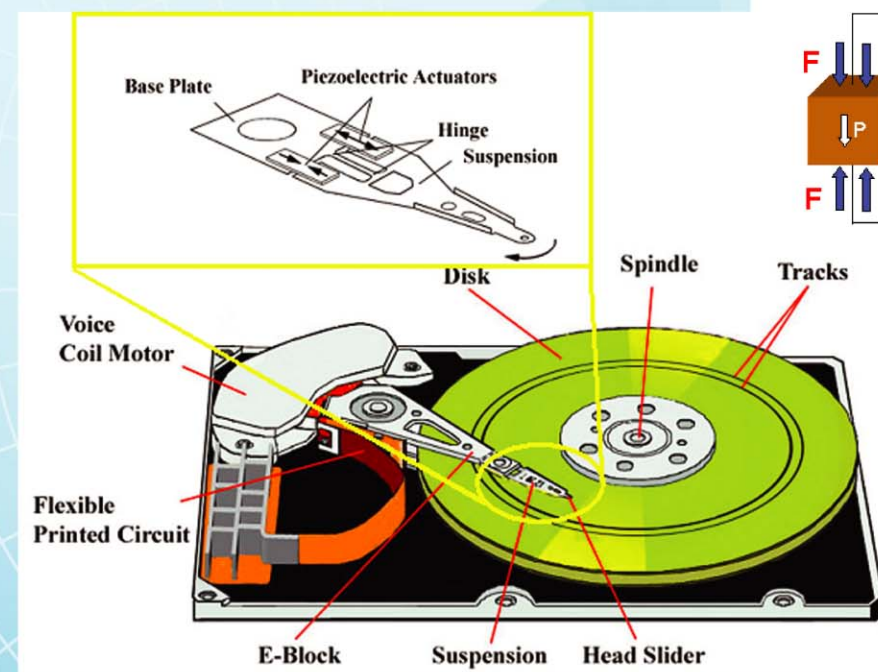
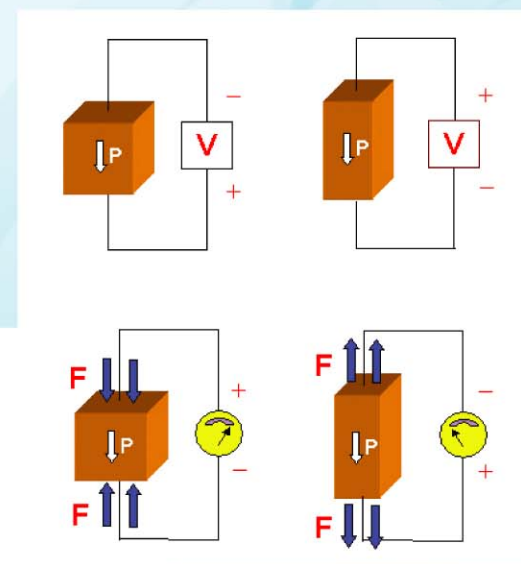
利用壓電微驅動器於硬盤精密定位

Prof. LIAO Wei Hsin (Department of Automation and Computer-Aided Engineering)
 廖維新教授 (自動化與計算機輔助工程學系)

Funded by Research Grants Council - Earmarked Grant
 由研究資助局研究用途補助金資助

Positioning precision is crucial to today's increasingly high-speed, high-capacity, high data density, and miniaturized hard disk drives (HDDs). The demand for higher bandwidth servo systems that can quickly and precisely position the read/write head on a high track density becomes more pressing. Recently, the idea of applying dual-stage actuators to track servo systems has been explored. The push-pull piezoelectrically actuated devices have been developed as micro actuators for fine and fast positioning, while the voice coil motor functions as a large but coarse seeking. We proposed a dual-stage servo system using enhanced active-passive hybrid piezoelectric actuators. The developed actuators could improve the existing dual-stage actuators for higher precision and shock resistance, due to the incorporation of passive damping in the design. New piezoelectrically actuated suspensions with passive damping have been designed and fabricated. Experimental efforts were carried out to evaluate positioning and track following performances. The synthesized active-passive suspension for the dual-stage HDD track servo system was also implemented.

隨著科技進步，硬盤不斷要朝著高速度，大容量，高密度方向發展，日趨小而精巧，其內在的精密定位是至關緊要的。因此，對提高伺服系統的帶寬，在高密度磁道上作快而精地讀寫頭定位的需求，顯得尤為重要。近年來，在解決高密度磁道定位問題上，已對兩級定位伺服系統進行研究。兩級定位伺服系統是以傳統的音圈電機為第一級進行步幅大而粗略的尋道，另在其上附加一個拉伸性壓電微驅動器作為第二級步幅控制，進行快捷而精密的定位。我們提出一種主被動混合式壓電微驅動器應用於兩級定位伺服系統，並有增強型主動阻尼層的設計，即是在主動阻尼層上增加了邊緣元件。此設計結合了主動驅動與被動減振機制，將會改善兩級定位的精度，而且具有抗振的功能。從中對新型具有被動減振機制的懸浮臂式微驅動器進行了設計和製造，再透過實驗研究新設計裝置的定位和磁道跟蹤的表現，從而實現了主被動混合式兩級定位伺服系統。



RFID Tag and Reader Technologies at UHF band for Logistic Management. 用於物流管理的UHF波段無線射頻識別標籤及閱讀設備的技術

Prof. WU Ke Li, Prof. CHENG Kwok Keung Michael (Department of Electronic Engineering)
Prof. YAN Houmin (Department of Systems Engineering and Engineering Management)
Prof. LAU Wing Cheong (Department of Information Engineering)
吳克利教授，鄭國強教授（電子工程學系），嚴厚民教授（系統工程與工程管理學系），劉永昌教授（訊息工程學系）

Funded by Innovation and Technology Fund
由創新及科技基金資助
Collaboration with IVHS Division, Mark IV Industries Ltd, ANSEN Electronics Company, e-jing Technologies, Compass Technology Company Ltd.

This project innovatively designed CU-badge for personnel and asset identification. The whole system contains four parts: Badge, Activator, Receiver, Command center. The Badge is usually attached on personal body or virtually any asset. The whole system is working in UHF Band from 920MHz to 926MHz at very low transmission power. The wake-up range is up to 3 meter. Once the Badge is activated by the Activator, it will communicate with Receiver regularly, the collected ID and other information will be sent to the Control Center, any authorized parties can get useful information from the Command center. Our system can work with multi-Badge and multi-Receiver in practical environment. The number and locality of Activator and Receiver can be varied according to user requirements.

Applications

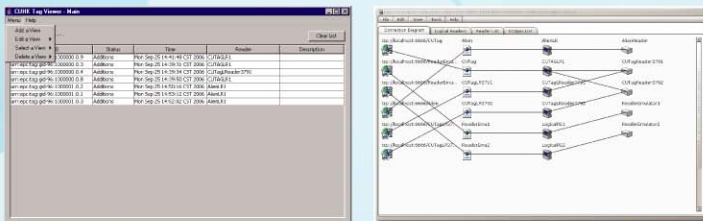
1. Personnel tracking and Identification
2. Product/Asset tracking and Identification
3. Tracking and monitoring Person/Product/Asset for security purpose.
4. Inventory management.

Outstanding Features

Special Power Saving Technology Operated by an innovative power saving protocol.

Target Users

This system can be applied in business operation to reduce inventories monitoring costs and provide security in the business



本項目創新開發了CU-badge（CU徽章）以識別個人身份和設備資產。整個系統由4個部分組成：徽章、激發器、接收器和控制中心。徽章可佩戴於人體或其他任何設備資產上。整個系統於UHF波段的920MHz到926MHz運作。徽章的喚醒距離大概是3米，且能以低功耗的方式進行通信。被激發器喚醒後，徽章會有規律地與接收器保持聯繫，徽章的身份和其他資訊會被傳送到控制中心。授權用戶都可以連接到控制中心來獲取這些資訊。此系統可於多徽章、多接收器的實際環境下操作。激發器和接收器的數量和位置均可根據用戶需求進行調整。

應用範疇

1. 個人身份識別和追蹤
2. 產品和設備資產識別和追蹤
3. 即時追蹤和監控個人、產品和設備資產
4. 存貨管理

特點

採用創新的低功耗技術

目標用戶

此技術應用於商業工作上，以減少存貨清點費用和提供商業保安。

多功能智能卡
基于 UHF 射頻识别技术

Semi-active CU-Badge 特点:

- 工作于 UHF 频段
- 低发射功率 (低于 0.1 瓦瓦, 是手机最大发射功率的 1/10000, 对人体无害)
- 单个接收机的接收半径 > 40m
- 长寿命
- 有网简单
- 低成本
- 该系统可进行实时监控。(第一代产品定位精度在米量级, 第二代产品的定位精度将提高到厘米量级)
- 系统中存在一个或多个激励器。

公司员工管理
生产及仓儲管理
貴重物品
实时定位跟蹤
医院医护人员
和病患者管理
礦井安全

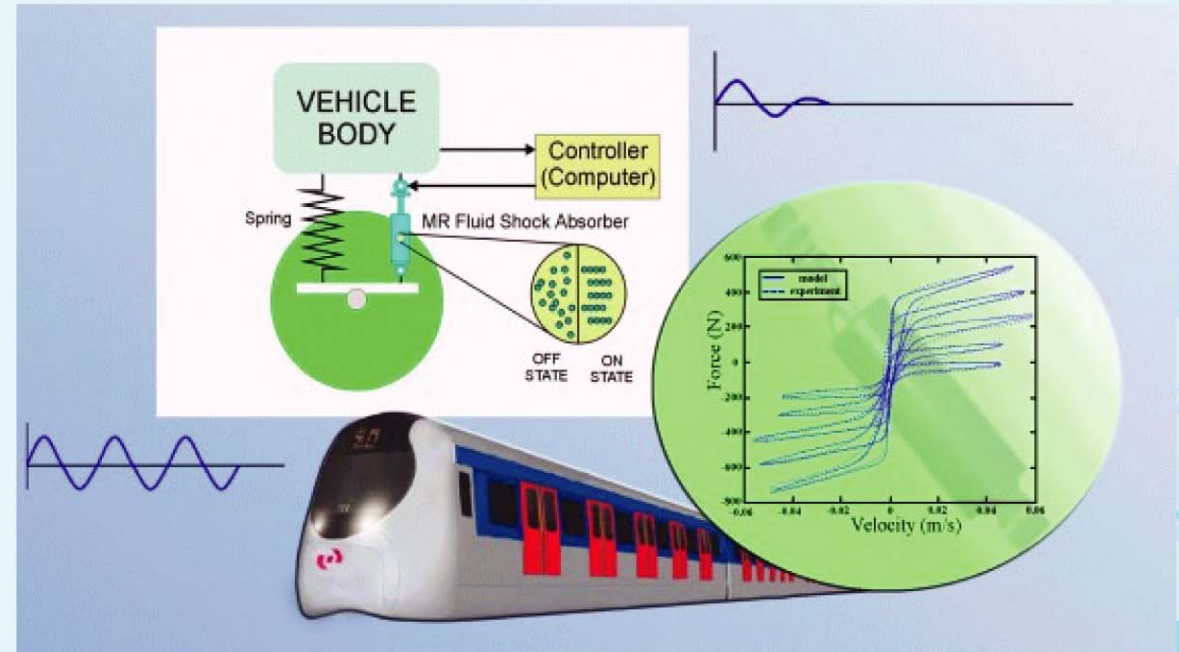
香港中文大學
The Chinese University of Hong Kong

Smart Dampers for Suspension Systems 應用於懸掛系統的智能阻尼器



Prof. LIAO Wei Hsin (Department of Automation and Computer-Aided Engineering)
廖維新教授（自動化與計算機輔助工程學系）

Funded by Research Grants Council - Earmarked Grant
由研究資助局研究用途補助金資助



Vibration in today's high-rise buildings, high-speed vehicles and machines severely affects their safety, comfort and precision. In recent years, it has been found that magneto-rheological (MR) fluid can be quite promising for vibration control by virtue of its adaptive properties. This controllable change of state with some desirable features such as high strength, good stability, and fast response time give rise to many applications. We have designed innovative dampers with MR fluids through coupling the material characteristics with the system dynamics. We also developed semi-active control algorithms for the systems with MR dampers. The system performances were evaluated in various conditions. The devices and principles we developed would facilitate the full realization of smart dampers for vibration control of various systems such as train suspension systems and civil infrastructures.

當今，高樓大廈、高速車輛以及機器中的振動嚴重影響了他們的安全、舒適和精度。近年來，磁流變液以其具有自適應特性的優點，被發現能夠有效地控制振動。這種可控制的狀態變化，以及伴隨的一些優良特徵，比如高強度、良好的穩定性以及快速的反應時間，產生了許多的應用。我們通過結合材料的特性與系統動力學，設計了創新的阻尼器。我們還設計了磁流變阻尼器系統的半主動控制演算法。系統的性能在不同的條件下進行了評估。我們開發的器件和原理將促進智能阻尼器完全實現各種系統如火車懸架系統和土木建築的振動控制。

Award 獎項:
TA Steward Dyer/F H Trevithick Prize, Awarded by Railway Division of the Institution of Mechanical Engineers, 2006

The Chinese University Plagiarism Identification Engine (CUPIDE)

剽檢通



Prof. KING Kuo Chin Irwin, Prof. LEE Ho Man Jimmy, Mr. TAM Sai Wah, Mr. WEI Wei, Mr. LAU Tak Pang (Department of Computer Science and Engineering) 金國慶教授, 李浩文教授, 譚世華先生, 韋偉先生, 劉德鵬先生 (計算機科學與工程學系)

Collaboration with IEEE Xplore, Springer Link, Wan Fang Data, ProQuest, Emerald, Mergent Online, CNKI, Elsevier, SCA, ISI and Wiley



CUPIDE is the First System Supporting Chinese Plagiarism Detection 剽檢通率先支援繁體中文剽竊檢索

The CUPIDE (Chinese University Plagiarism Identification Engine) System is a new generation plagiarism detection software designed for promoting and upholding academic honesty in educational institutions. The system supports English, traditional and simplified Chinese, and provides a user-friendly web interface for class assignment management and submissions. It can handle documents in different formats including MS Word, Acrobat PDF, HTML and plain text. Submitted documents are compared among one another, and with other documents in the central database and the Internet. Output from the system is an originality report highlighting suspected plagiarized contents, and giving detailed analytic and statistical data.

Applications

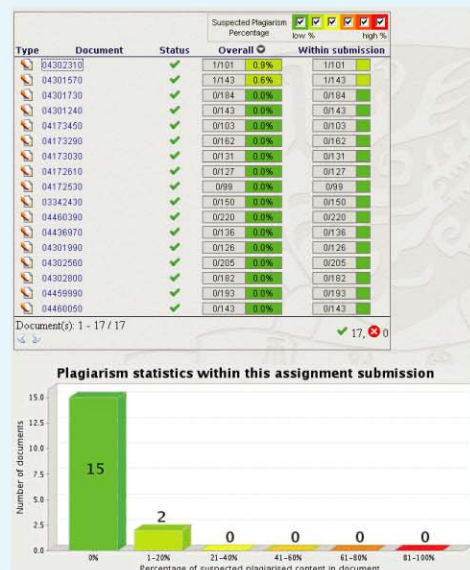
1. Course and Assignment Management System - to archive past year assignment and references, and perform plagiarism detection
2. Conference Management System - to detect multiple submissions and analyze differences between initial and final versions of publications

Outstanding Features

CUPIDE is the first system supporting traditional and simplified Chinese plagiarism detection. This system compares traditional and simplified Chinese documents and finds out their similarities. Furthermore, teachers from China, Taiwan, and Hong Kong can select their favorite languages used in the originality report.

Target Users

1. Schools, Teachers, and Students
2. Conference Committee



Various Useful Information and Statistics in Originality Report 檢測報告提供各樣實用的資訊及統計數據

剽檢通系統是為促進及維護優良的教育質素和珍貴的誠信美德而設的新世代剽竊檢索系統。該系統支援英文及繁體中文剽竊檢索，能找出各篇文章中相似的內容。此外，該系統提供一站式網上管理、提交和分析功課的介面，為老師帶來一個全面的課堂管理方案。該系統能處理不同的常用文件格式，例如 MS Word、PDF、HTML 和 TXT。當老師把同學的功課提交到剽檢通後，該系統將主要就三個範圍：其他同學功課、歷年功課、以及參考文件作出剽竊檢索。在完成檢索後，該系統會產生一分詳細報告，列出各文件中可能牽涉剽竊的內容，以及各式各樣的統計資料。

應用範疇

1. 課堂及功課管理系統 - 保留及整理過往功課及參考資料，及進行剽竊檢索
2. 研討會管理系統 - 檢測多項提交及分析對於最終版本的修改程度

特點

本系統率先支援繁體中文剽竊檢索，不但能對比繁體中文檔，找出繁體檔中的相似內容，更能讓老師自由選擇閱讀繁體報告，方便中港臺三地老師使用。

目標用戶

1. 學校，老師，學生
2. 研討會籌備會

Award 獎項:

- Third Award in the 9th Challenge Cup 2006
- Champion in CUHK Vice-Chancellor's Cup of Student Innovation 2005
- Champion in the IEEE(HK) Computational Intelligence Chapter, Final Year Project Competition 2005



Digital Entertainment
數碼娛樂

Augmented Reality Computing Arena for Digital Entertainment 擴充現實數碼娛樂運算環境

Prof. LYU Rung Tsong Michael (Department of Computer Science and Engineering)
呂榮聰教授(計算機科學與工程學系)

Funded by Innovation and Technology Fund
由創新科技基金資助



Augmented Reality (AR) is a form of human-machine interaction. The key feature of the Augmented Reality technology is to present auxiliary information in the field of view for the user without manual intervention. The effect is similar to composing computer-animated images with real scenes. AR technology enhances the users perception of and interaction with the real world.

The objectives of Augmented Reality Computing Arena for Digital Entertainment (ARCADE) are

- to ease the hurdle of applying the Augmented Reality technology for digital entertainment,
- to enable new entertainment experience for end-users,
- and to provide new tools for helping the production of digital composition of virtual images with real scenes.

Video object tracking engine (VOTE™) is the core component in ARCADE. Two video object tracking algorithms have been developed: 3D surface markers tracking and human head and face tracking. The former tracking technology will provide new technology tools for TV production and digital animation house. The latter tracking technology will bring new entertainment experience to theme park or amusement park visitors, kiosk-based entertainment viewers, and mobile entertainment application users.

Applications

Augmented Reality (AR) is an emerging technology area. The applications of AR technology can provide immense opportunities to create new user experience, especially in Digital Entertainment industry.

Award 獎項:
'Best Mobile Entertainment Software'
Title in the 4th Hong Kong Digital
Entertainment Excellence Award

擴充現實(AR)是一種人機交互的形式，其主要特點在於利用擴充現實技術自動的在用戶眼前展現出虛擬的景象。這種效果就如同將電腦動畫與現實場景結合在一起。AR技術提升了用戶對真實世界的感受和互動能力。

擴充現實數碼娛樂運算環境的目標在於：

- 減低擴充現實應用於數碼娛樂的困難；
- 提供新的娛樂感受；及
- 新的工具協助實境及電腦映射之合併。

擴充現實之主要部件為視像物件追蹤引擎。我們會發展兩種新的視像物件追蹤技術；三維表面標識技術及人頭和面孔追蹤技術，前者提供新的工具協助實境及電腦映射之合併。

應用範疇

擴充現實(AR)是一個新興的技術領域。基於AR技術的應用可以為創造新的用戶感受提供更多的機遇，尤其在數碼娛樂工業。



<http://www.viewtech.org/>



Chinese Style Video Game Authoring ToolKit - "Curvair" 中國化電子遊戲開發工具 - '弧飛'

Prof. HUI Kin Chuen (Department of Automation and Computer-Aided Engineering)
許健泉教授 (自動化與計算機輔助工程學系)

Funded by Innovation and Technology Fund
由創新及科技基金資助

"Curvair" is an advanced 3D game development system. One major breakthrough introduced by Curvair is the use of "Curve-Pair Based Axial Representation". While currently most computer games often resort to equip characters with heavy armour or tight clothes to simplify the characters' movements, the new technique allows designers to dress characters in long gowns or robes using a model that resembles the wavy movements of the real cloth. Curvair also provides a series of characters, models of Chinese buildings, and a facial expression editor for easy construction of computer games in Chinese style.

Applications

Those who intend to compete in the Chinese game market may use Curvair to simplify the development of Chinese style games. Curvair can also be easily incorporated into other existing game development platforms.

Outstanding Features

"Curvair" Provides a novel technique for modeling flexible object motion and an axial object construction technique for modeling walls and fence on 3D terrace efficiently.

Target Users

Video game developers, other interactive graphics applications.



Building Chinese Palace using Curvair
以弧飛設計繪構出來的
宮廷建築



Using Curvair to build your own
Great Wall
以弧飛介面，可輕易建構宏偉的遊戲背景，圖為萬里長城



弧飛開發隊伍

弧飛是一個富有中國特色的遊戲開發系統。弧飛系統在角色塑造時採用了研發的技術"雙曲線軸心表示法"模擬衣服布幔的移動，角色無需再以硬繃繃的盔甲示人，除可輕易創造出如小龍女一般有飄逸衣服效果的角色，弧飛包含了一系列工具有助遊戲設計師快捷地打造出華麗的中國式宮廷建築、古代英雄及其表情等等。

應用範疇

要在中外遊戲廠商激烈競爭下爭取市場，發展具原創內容及中國文化特色的遊戲成為業內企業發展重點。弧飛作為一個多元化及富中國特色的3D電腦遊戲設計系統，既配合了現時內地遊戲市場的中國風，更可輕易成為相容新式遊戲設計技術之基本平台。

特點

弧飛能靈活地塑造出物件移動效果，其線軸物件打造技術能快捷地製造立體城牆及台階等建築。

目標用戶

電腦遊戲發展商及其他互動繪圖應用。



Major function of Curvair, modeling of wavy robes
弧飛另一主要功能，模擬衣履在移動時的飄逸感



<http://www.acae.cuhk.edu.hk/~cad/Curvair/gallery.htm>

Transparent Real-time Video Transcoder For 3G Mobile Networks 用於 3G 流動網絡即時視像轉碼器



Prof. LEE Yiu Ben Jack, Mr. NGAU Keung Hung Rudolf (Department of Information Engineering)
李耀斌教授，顏姜雄先生（訊息工程學系）

Funded by UGC-AoE Scheme-IT, Competitive Earmarked Research Grant, Mobile Technology Center
由教資會卓越學科領域(訊息工程)、研究用途補助金資助
Collaboration with Smartone Telecommunications Holdings Ltd.
合作夥伴為數碼通電訊有限公司

Video transcoding is the procedure to convert a compressed video into another one with different format (i.e., different bit rate, different frame size and even different coding standard). Since most current handheld devices have only limited computing and display capabilities, which are not suitable for high quality video decoding and displaying. To make high quality video streamable and playable in mobile devices we need to perform transcoding to adapt the bit rate, spatial resolution and/or temporal resolution to match the mobile network and device capabilities.

When using the transcoder, if a mobile user clicks on the streaming URL it will automatically sends a RTSP request to the 3GPP Streaming Server, which then decodes the URL and inform the Real-time Video Transcoder to begin requesting for the original streaming media from the Internet Media Server for transcoding and eventually streaming to the mobile handset.

The Real-time Video Transcoder is currently implemented in C/C++ in the Linux platform (RedHat 7.3). To maintain transparency to the handset the system relies on intercepting HTTP request and response so that any URLs for media content will be replaced by a new URL pointing to the 3GPP Streaming Server.

Applications

1. Video streaming for mobile networks
2. Video conference across mobile and fixed networks

Outstanding Features

First, the transcoding process is performed in real-time without the need to first download the media file. Second, the transcoded media stream is compatible to the 3GPP standard so that no modification to the handset playback software is needed. Finally, the transcoder is decoupled from the streaming server so that one can scale up the system transcoding capacity simply by adding more transcoding servers, and scale up the streaming capacity by adding more streaming servers.

Target Users

Telecommunication companies and contents providers

視像轉碼程式是一個將壓縮視像格式轉變為另一種不同形式的程序(即不同編碼傳輸率、不同畫面大小、甚至不同編碼標準)。由於目前大多數手提式電器器材的運算速度及視像播放功能有限，並不適合高質量視像解碼和播放。要在流動器材中播放高品質視像，我們需要透過轉碼方法來配合視像源不同的編碼傳輸率、解像度和畫面轉換速度等。

當使用轉碼器時，如果流動用戶點擊一個視像網址，它便會自動傳送RTSP往3GPP串流伺服器，然後將視像網址解碼，並通知即時視像轉碼器向互聯網媒體伺服器要求原有的串流媒體以作解碼，最終串流至流動手機。

即時視像轉碼器是在Linux (RedHat7.3)平臺上的C/C++中編寫出來的。當用戶使用視像網址時，系統會攔截HTTP的要求和回應，指令3GPP串流伺服器的新視像網址代替所有媒體內容的視像網址，用戶手機接收到切合其播放功能的視像串流。

應用範疇

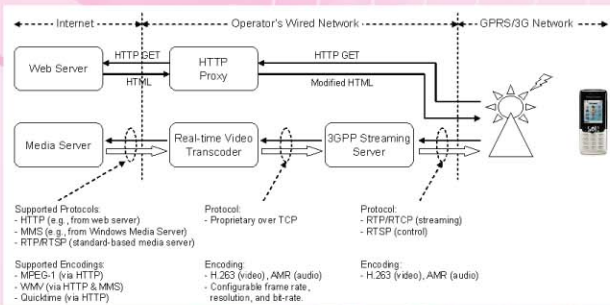
1. 流動網絡的視像串流
2. 在固定和流動網路間進行視像會議

特點

- 第一，轉碼過程可即時進行而無需事先下載媒體檔案。
- 第二，已轉碼的串流視像內容已達3GPP的標準，故無需更改手機內的播放軟件設定。最後，轉碼器與串流伺服器獨立運作，若要增加系統的轉碼或分流容量只需增置相關的伺服器。

目標用戶

電訊公司和內容提供商



System Architecture of the Real-time Video Transcoding System.
即時視像轉碼系統建構圖

Virtual Cycling 虛擬腳踏車

Prof. CHAN Kai Ming Cavor (Department of Orthopaedics and Traumatology)
Prof. HUI Kin Chuen (Department of Automation and Computer-Aided Engineering)
陳啟明教授（矯形外科及創傷學系），許健泉教授（自動化與計算機輔助工程學系）



此項目旨在發展一個利用虛擬現實技術模擬腳踏自行車的系統。此系統可配合現有自行車使用。在虛擬環境中腳踏單車全憑探測車輪的移動方向。依附在后車輪的牽動引擎能為上山及下坡提供動力。另外圖像顯示系統結合了感應器，使圖像顯示能同時配合車輪的動作。這技術令用戶不需真正踏單車亦有踏單車的真實感。

應用範疇

作為運動機械及訓練用途

特點

可使用於不同類型的單車，可模擬在不同環境踏單車。

目標用戶

體育館及健身中心

The objective of this project is to develop a system for simulating the experience of cycling using virtual reality techniques. The system can be adapted to an existing bicycle. Navigation in the virtual environment is attained by detecting the turning motion of the steering wheel. A traction motor attached to the rear wheel provides the traction force when going uphill and downhill. A graphics display system is integrated with the sensing devices such that the graphics display is synchronized with the wheel motions. This provides the experience of riding on a bicycle without actually riding on the road.

Applications

Used as exercise machine, and for training purposes

Outstanding Features

Can be adapted to different bicycle. Provide cycling experience in different environments.

Target Users

Gymnasium, fitness center.



Hardware Components
硬件組件



Air Ventilation Assessment System 空氣流通評估方法

Prof. NG Yan Yung Edward (Department of Architecture)
吳恩融教授 (建築學系)

Funded by Civil Engineering Development Department, managed by Planning Department
由土木工程拓展署資助，規劃署管理

Collaboration with Environmental Protection Department, Hong Kong Observatory and Housing Department.
合作夥伴為環境保護署、香港天文台及房屋署

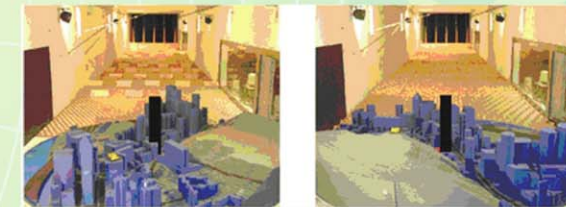
The objective of this project is to establish some scientific based protocols to assess the effects of urban planning and building development proposals on external air movement for achieving an acceptable macro wind environment. Conceptually, it is described as a form of "urban acupuncture" for enhanced, long-term quality of life in the high-density urban context of Hong Kong.

To conduct the assessment, selected sites and affected areas surrounding the development proposal are identified. Then resolve the meteorological wind availability data (16 directions, strength and frequency) to site wind data using simulation or topographical models in wind tunnel. Based on a wind boundary layer profile appropriate to the urban condition under study, conduct tests (either by simulation, or more accurately for complex scenes, using wind tunnel) to obtain results to be reported based on: Wind Velocity Ratio (VRw).

VRw is the assessment indicator. It indicates how much of the wind availability of a location could be experienced and enjoyed by pedestrians on ground taking into account the surrounding buildings. The higher the value of VRw, the lesser the impact of buildings on wind availability.

Applications

1. Preparation of new town plans and major revision of such plans;
2. Development that deviates from the statutory development restriction(s);
3. Erection of building structure within a designated breezeway;
4. Development that involves agglomeration of sites/closure and building over of existing streets;
5. Development with shielding effect on waterfront, particularly in confined airsheds;
6. Large-scale development with a high density; and
7. Massive elevated structures over a road in the dense urban areas



Description: The test site and the approaching wind set up in a wind tunnel; note the roughness in front of the model to reproduce the boundary wind conditions. This must be set up properly with the information obtained from using the topographical model.
上圖顯示了設置在風洞的地盤模型及風來源；留意模型前方的凹凸面，能有助模擬風邊界的情況。這些凹凸面必須根據從地段模型所得的資料而設。

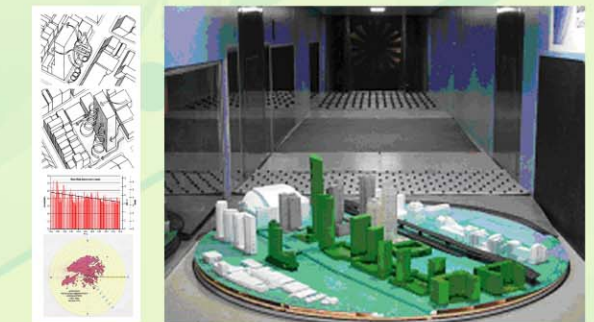
此計劃旨在定立一些具科學基礎的標準，以評估都市規劃及建築發展建議對戶外空氣流動情況所產生的影響，以取得滿意的總體環境通風狀況。此計劃在概念上可稱為「都市針灸」，藉以為香港這個人煙稠密的城市締造長久的優質生活空間。

在進行評估前，先確定發展地盤及週邊受影響地區。利用計算機模擬地理模型，將測風氣象資料（16個方向、強度及頻率）轉變為地區風數據。依據研究市區環境所適用的風邊界流層，進行測試（可用計算機模擬測試，若情況複雜及需要更精確的結果，可採用風洞測試）並取得以風速比(VRw)表示的結果。

風速比是評估的指標。這比率顧及到一個地區四週的建築物，並指出該區內地面上行人所能享有的通風程度。當風速比的值越高，某發展的設計對通風程度的影響便越小，因而對總體風環境所造成的影響也會越小。

應用範疇

1. 制定城市規劃或對城市規劃進行重大修訂；
2. 進行法例以外的發展項目；
3. 在指定主要通風道樹立建築物；
4. 涉及多個地盤結合，兼且封閉現有街道及上蓋樓宇的市區重建發展項目；
5. 對海傍地區，可能造成遮擋或有屏蔽效應的發展項目；
6. 高密度的大型發展項目；及
7. 在高密度市區道路上興建的大型高架建築物。



Award 獎項:

*2006 'Feasibility Study for Establishment of Air Ventilation Assessment Method in Hong Kong', Grand Award - Research and Planning Studies, Professional Green Building Council (PGBC)

*2006 'Air Ventilation Assessment System for High Density Planning and Design', Best Paper Award, Passive Low Energy Architecture (PLEA) Conference, Geneva, Sept 6-8, 2006.

Environment
生態環境

An Auralized 3-Dimensional Traffic Noise Assessment Tool

會發聲的立體交通噪音評估工具

Prof. LAM Kin Che (Centre for Environmental Policy and Resource Management),
Ms XIONG Xiaohua (Shanghai Second Polytechnic University),
Mr. HUI Wing Chi, Mr. CHAN Pak Kin (Department of Geography and Resource Management)
林健枝教授 (環境政策與資源管理研究中心),
熊小華小姐 (上海第二工業大學),
許榮枝先生 (地理與資源管理學系), 陳栢健先生 (地理與資源管理學系)

Funded by United College, The Chinese University of Hong Kong
由香港中文大學聯合書院資助

Collaboration with Assessment and Noise Group, Environmental Assessment Division,
Environmental Protection Department Government of HKSAR
合作夥伴為香港環境保護署環境評估科評估及噪音組

The Centre for Environmental Policy and Resource Management of The Chinese University of Hong Kong has collaborated with the Environmental Protection Department to develop an application which not only displays noise mapping results in a 3-D model with a specified colour scheme, but also allows users to listen to the predicted noise levels.

Applications

- Display noise mapping results, both visually and aurally, to the general public during the consultation periods of construction and development projects
- Used by project proponents, architects, urban planners and other stakeholders as an efficient communication tool among them to exchange opinions and ideas about the proposed projects
- Assess noise impact of different proposed designs and noise mitigation measures by modeling and displaying the results, both visually and aurally, under different scenarios.

Outstanding Features

- This 3-D auralized model is the first-of-its-kind.
- This technique allows people to "listen" to the predicted noise levels. It is therefore easy for a person to "experience" the noisiness even if he/she is not familiar with the decibel (dB) scale. This encourages public participation in the consultation stage of a construction or development plan.
- The software has a built-in calibration function which allows users to calibrate the output volume of their speakers by using a sound level meter. This allows users to listen to the "actual" rather than "relative" noisiness of the predicted results.
- Users may customize the sound clips. For example, in an area where railway noise dominates, sound clips of pure road traffic noise can be replaced by one with railway noise dominating.



Target Users

Project proponents, developers, urban planners, architects and other stakeholders.

香港中文大學環境政策與資源管理研究中心與香港環保署合作開發了一個「立體交通噪音評估工具」,不但可將噪聲地圖的結果利用顏色於三維模型上顯示出來,更能讓使用者聽到預測的噪音值。

應用範疇

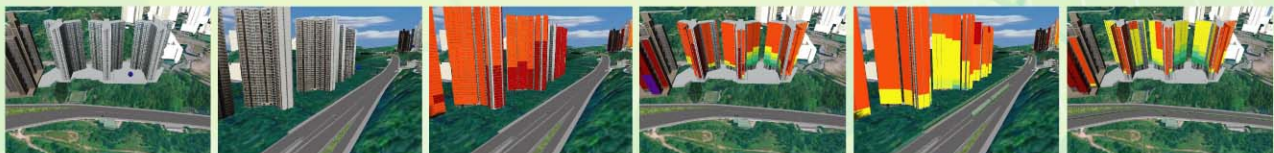
- 於工程項目的諮詢階段,從視覺上及聽覺上把噪聲地圖所預測的噪音值清楚模擬給公眾。
- 項目開發人員、發展商、承建商、城市規劃人員及其他相關人士可運用此工具作為交換意見的橋梁。
- 此工具可從視覺上及聽覺上顯示預測的噪音值,因此能更有效地比較各種減低噪音的措施之成效。

特點

- 此發聲的三維噪聲地圖技術是世界首創的。
- 此技術讓使用者可「聽」到預測的噪音值。這不但讓不認識分貝值的人士清楚瞭解所預測的噪音水平,更可鼓勵公眾就各項工程發展提出意見。
- 此技術設有校正功能,使用者可利用噪聲計把揚聲器的音量校正,令播出的聲音片段能確實反映預測的正確噪音水平。
- 使用者可按照個別需要撤換不同的聲音片段。例如在火車噪音為主的地區,道路汽車噪音的聲音帶可撤換為火車為主的聲音片段。

目標用戶

項目開發人員、發展商、承建商、城市規劃人員及其他有關人士。



3-D Model of a housing estate
屋苑的三維模型

Noise mapping result
噪音評估結果

Assess noise impact of different proposed designs and noise mitigation measures.
加入減低噪音措施後的預測噪音值

Build and Operate a Ground Receiving Station of the ENVISAT Radar Remote Sensing Satellite for All-weather Environmental Monitoring

建立和運行全天候環境監測的ENVISAT雷達遙感衛星地面接收站

Prof. LIN Hui, Prof. LIAN Shizhu (Institute of Space and Earth Information Science)
Prof. SHAO Yun (Joint Laboratory for Geoinformation Science)
林琿教授, 連石柱教授 (太空與地球信息科學研究所), 邵雲教授 (地球信息科學聯合實驗室)

Funded by Innovation and Technology Fund, 863 High Technology Research and Development Program of the Ministry of Science and Technology of the People's Republic of China.

由創新及科技基金、國家科學技術部863高技術研究發展計劃資助
Collaboration with The Chinese Academy of Science
合作夥伴為中國科學院

Satellite Remote-sensing Ground Receiving Station is an important facility of the University's Institute of Space and Earth Information Science. The Station can capture and process satellite-sourced remote sensing data and provide useful information to governments and private corporations in Hong Kong, South China and neighboring regions.

Applications

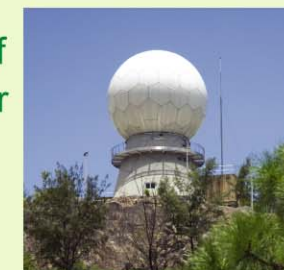
1. Flood monitoring and control along Changjiang River
2. Ground surface movement monitoring for the Chinese mining industry using InSAR Analysis
3. Paddy rice growth monitoring under cloud-prone and rainy weather conditions
4. Radar remote sensing for wetland habitat mapping
5. Sea ice monitoring in BoHau Bay Area
6. InSAR Analysis for slope monitoring in Hong Kong
7. Pearl River Near-shore environmental monitoring

Outstanding Features

The region has been struck by many natural disasters in recent years, leading to severe civilian casualties and economic loss. These disasters include landslide, subsidence, earthquakes, tsunamis, floods and typhoons. The Station initially operates with radar image from ENVISAT Remote Sensing Satellite. This all-weather system can provide environment and natural disaster monitoring for Hong Kong and neighbouring regions despite the frequent rainy and cloudy weather.

Corresponding Benefits

In the long run, the Station will serve as a platform to enhance technology collaboration between Hong Kong and mainland China, accelerating the development of the remote sensing industry in the greater Pearl River Delta region.



「衛星遙感地面接收站」是新成立的香港中文大學「太空與地球信息科學研究所」的重要設施。地面站將可紀錄及處理大量從衛星接收的遙感數據,為本港、華南及周邊地區的政府與私人機構提供各項有用資料。

應用範疇

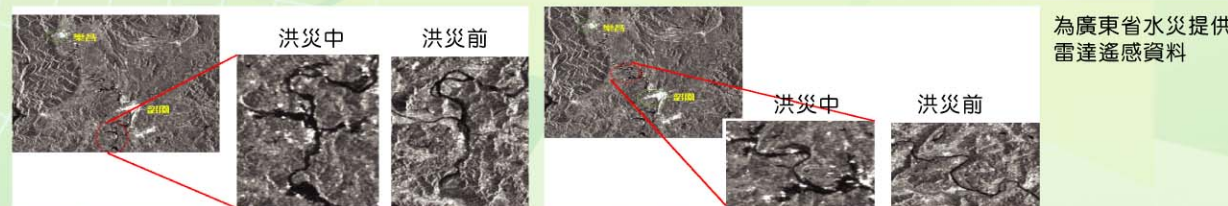
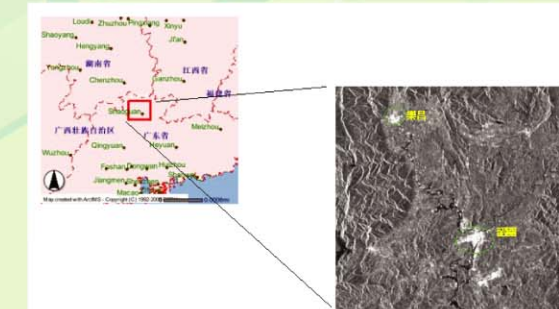
- 1、長江流域水災與環境監測
- 2、利用干涉雷達方法監測煤礦的地表下陷
- 3、多雲多雨環境下的農作物長勢監測
- 4、多雲多雨地區濕地的微波遙感
- 5、渤海灣海冰監測
- 6、香港地區地表穩定性監測
- 7、珠江口及近海環境監測

特點

近年區內的自然災害日益頻繁,包括山泥傾瀉、地震、海嘯、洪水和颱風等,帶來沉重的人命及經濟損失。地面站首先採用來自ENVISAT遙感衛星的雷達圖像數據。這系統能為長年多雲多雨的香港以及周邊地區提供全天候的環境與自然災害監測。

項目效益

長遠而言,地面站將提供重要平台,促進香港與國內的技術合作,加速大珠江三角地區遙感技術產業的發展。



為廣東省水災提供雷達遙感資料

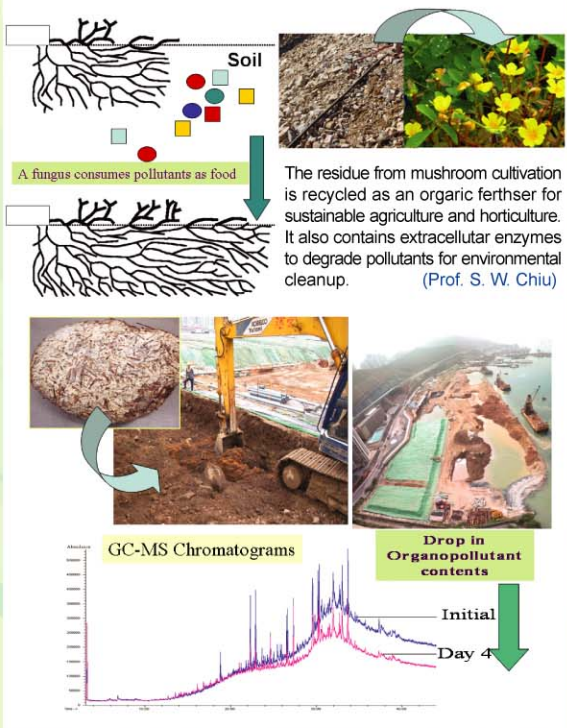
<http://www.iseis.cuhk.edu.hk/groundstation/>

Mushroom Remediation 環保菇法

Prof. CHIU Siu Wai (Department of Biology)
趙紹惠教授 (生物系)

Funded by Direct Grants, CUHK
由香港中文大學贊助
Collaboration with Gammon Construction Limited
合作夥伴為金門建築公司

If a waste can be recycled, we solve the problem of waste disposal and reduce resource exploitation.



Spent mushroom compost is an abundant agricultural waste awaiting disposal. This project recycled this particular solid matter into an environmental cleanup agent for polluted environment for reclamation enhancing economic development.

Applications

1. Bioremediation/environmental cleanup
2. Agriculture, Horticulture and Landscape

Outstanding Features

Zero waste generation, reduce investment cost, versatile in application in soil & water environment; shorten treatment time, safe for operation, sustainable technology

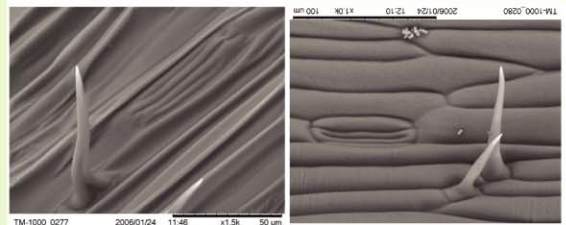
Target Users

- Construction sector, environmental technology sector: Cost-effective technology, environmental friendly operation
- Agriculture, Horticulture & Landscape Sectors: Organic fertilizer with improved soil conditions, no introduction of heavy metal contaminants

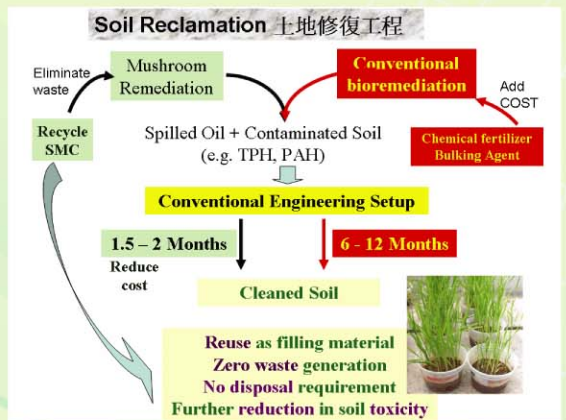
Award 獎項:
Grand Award, Innovation Competition 2005, Gammon Construction Ltd.



Embankments (fill slopes) are mechanical structure for motorways and bridges. They present an arid environment unfavourable for vegetation. The construction material, crushed stones, is nutrient poor. SMC improves soil properties and enhance drought-tolerance of plants.



Scanning Electron Micrographs: Left: Drought-stressed root. Right: Normal root.



食用菇後廢料是一大量的農業廢物，本項目將此廢料循環使用，作為淨化污染地的原料，以修復土地質素，從而提升經濟效益。

應用範疇

1. 環境修復; 及
2. 農業、園藝、造景建築

特點

零廢、減少投資及盈運費用、縮短處理時間、於水及泥土的環境多功能應用、中期 (非短期) 效應、安全操作、持續科技

目標用戶

- 建築業、環境科技業: 零廢, 減少投資、盈運費用, 縮短處理時間, 可持續發展環保科技。
- 農業、園藝、造景建築、綠化工程: 中期 (非短期) 效應、安全操作、可持續發展環保科技。

Studies on Salt Tolerance of Soybean 大豆耐鹽研究



Prof. LAM Hon Ming (Biology and Molecular Biotechnology Program)
林漢明教授 (生物及分子生物技術課程)

Funded by RGC and UGC-AoE Scheme,
由研究資助局及教資會卓越學科領域資助
Collaboration with Prof. Guihua Shao of the Chinese Academy of Agricultural Sciences
合作夥伴為中國農業科學院邵桂花教授

Making use of the rich soybean germplasm in China, we performed a comprehensive screen for salt tolerance varieties. Selected germplasms were then successfully used as parents in soybean breeding program to improve salt tolerance. To understand the mechanism of tolerance, we performed physiological, biochemical, and molecular analysis of these germplasms. We cloned salt responsive genes encoding functions related to ion compartmentation, ROS scavenging, and drought adaptation. Some candidate genes can confer salt tolerance to heterologous systems including transgenic tobacco cells (as cell model), Arabidopsis thaliana (dicot model) and rice (monot model).

Applications

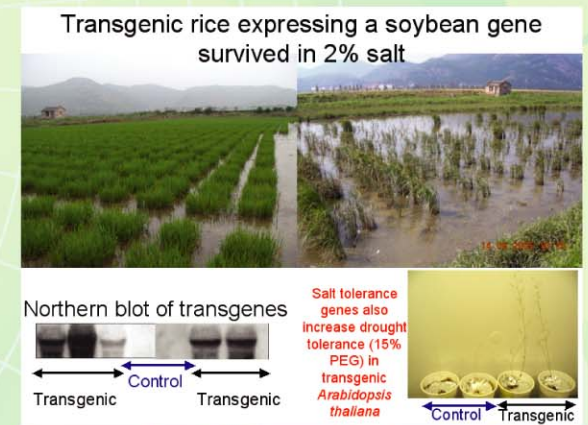
- (1) Production of salt tolerance soybean via breeding program;
- (2) Identification of salt tolerance genes; and
- (3) Application of salt tolerance genes

Outstanding Features

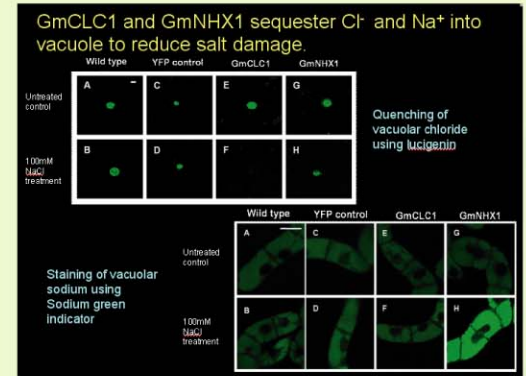
This project made use of the rich germplasms collection in China (soybean was originated in China). The research approach combined the traditional wisdom of breeders with state-of-the-art biotechnology. Through this project, the PI and his collaborators received a Second Class Beijing Technological Advancement Award.

Target Users

- (1) Farmers and agricultural institutes: use to improve yield under stress conditions; and
- (2) Seed and biotechnology companies: further development of the target genes into value-added products.



Transgenic rice expressing a soybean gene survived in 2% salt (表達一個大豆基因的轉基因水稻能在2%的環境下生存)



GmCLC1 and GmNHX1 sequester Cl⁻ and Na⁺ into vacuole to reduce salt damage. (GmCLC1及GmNHX1通過把氯離子及鈉離子排進液泡減輕鹽害)

利用中國大豆的豐富種質資源篩選出耐鹽品種。部分選出品種成功地用作耐鹽大豆育種項目的親本。為了解大豆耐鹽機理，我們進行了一系列生理、生化及分子生物學的研究。我們繁殖數個鹽脅迫反應基因，使其功能與隔離離子、清除過氧化物及適應乾旱脅迫等機制相關。一些目標基因能在異種系統中提高耐鹽能力，其中包括轉基因煙草細胞 (植物細胞模型)、擬南芥 (雙子葉植物模型) 及水稻 (單子葉植物模型)。

應用範疇

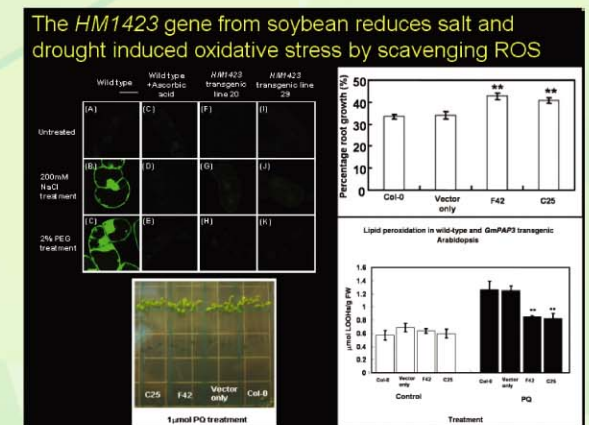
- (1) 通過育種項目培育耐鹽大豆;
- (2) 鑑定耐鹽基因; 及
- (3) 應用耐鹽基因

特點

這項目利用中國豐富種質資源 (大豆源於中國)，並結合育種家傳統智慧與嶄新生物科技。通過這項目，獲得了北京市科技進步二等獎。

目標用戶

- (1) 農民與農業機構: 增加逆境條件下的產量; 及
- (2) 種子與生物科技公司: 將目標基因發展成增值產品。



The HM1423 gene from soybean reduces salt and drought induced oxidative stress by scavenging ROS (大豆的HM1423基因通過清除過氧化物減輕鹽及乾旱引起的氧化脅迫)



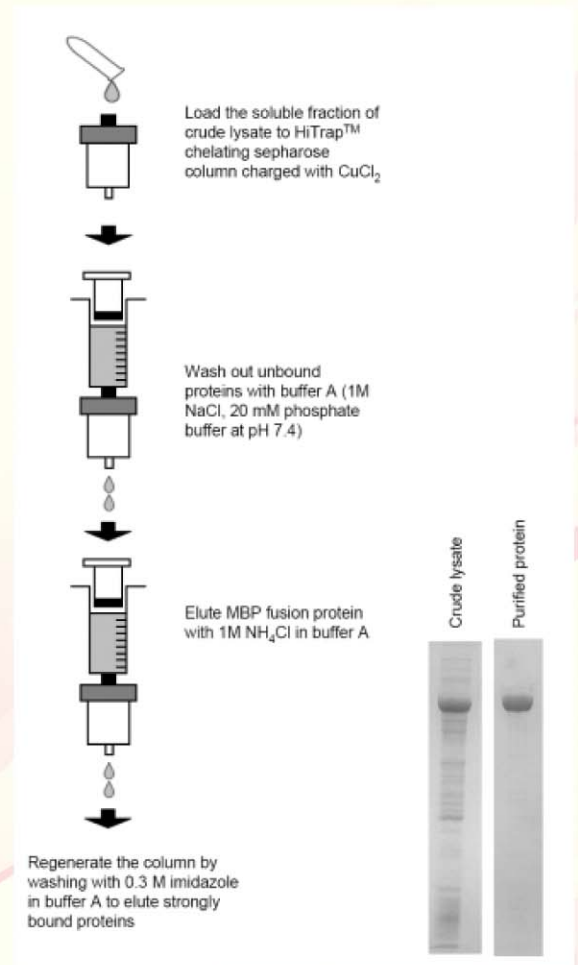
Medicine and Health
生物科技

A high-yield one-step purification method for recombinant proteins fused with maltose-binding protein 一種高回產率、一步法的純化方法 --- 用於重組麥芽糖結合蛋白(MBP) 融合蛋白的純化

Prof. WONG Kam Bo (Department of Biochemistry)
黃錦波 教授 (生物化學系)

Maltose-binding protein (MBP) is a popular fusion tag for recombinant expression of protein because it can increase the expression level and solubility of fusion proteins. However, conventional amylose-affinity purification of MBP fusion proteins suffers from the limitation of low yield due to inefficient binding of MBP to the amylose resin. We have developed a novel method of using copper-chelating chromatography to achieve one-step purification of MBP fusion protein with 5 times the yield of conventional amylose-affinity chromatography. The whole purification process is summarized in the Figure. We achieve a yield of about 25 mg of purified MBP fusion protein per 250 ml of bacterial culture, compared to only about 5 mg for amylose-affinity column under the same conditions.

麥芽糖結合蛋白 (MBP) 是一種常用於重組蛋白的融合標籤。它可以提高蛋白表達水平和融合蛋白的溶解性。然而，用傳統的澱粉糖親和層析柱純化 MBP 融合蛋白的方法有其局限性，即由於 MBP 與 澱粉糖親和性低導致的低產率。我們發明了一種銅離子親和層析的方法。這種方法只經過一步純化便可獲得高於傳統澱粉糖親和層析法五倍的 MBP 融合蛋白。我們可以從 250 毫升的細菌培養液中獲得大約 25 毫克的純 MBP 融合蛋白。而用傳統澱粉糖親和法，在同樣的條件下只獲得大約 5 毫克的純蛋白。



An Orange Fluorescent Protein from Tube Anemone 管葵橙色螢光蛋白

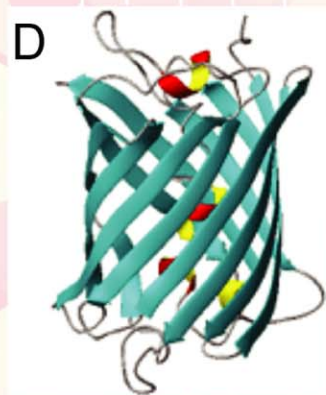
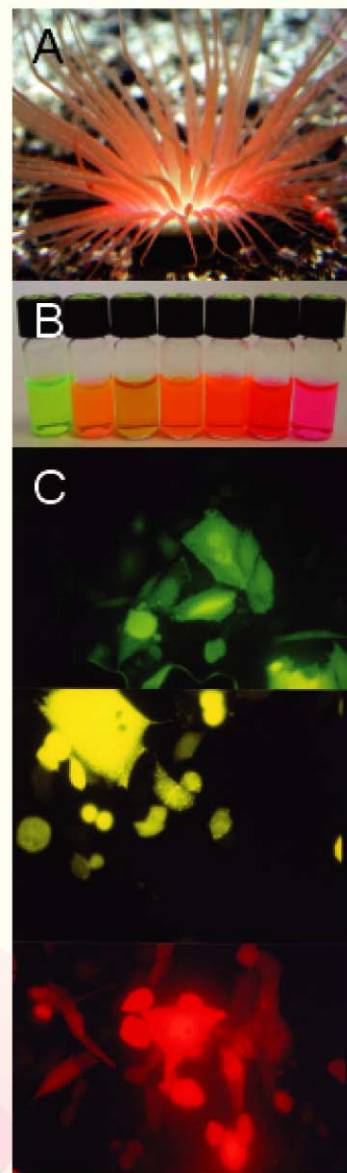
Prof. WAN Chi Cheong David (Department of Biochemistry)
溫志昌教授 (生物化學系)

We have cloned the first native Orange Fluorescent Protein (OFP) from the tentacles of *Cnidarian* "tube anemone" *Cerianthus* sp. After structural and biochemical analyses, we found that OFP has an emission maximum lined at the orange color region of the visible light spectrum. No catalytic enzymes or exogenous cofactors are required for its chromophore formation except molecular oxygen. This protein addresses the research need for a red-shifted fluorescent protein and will be an extremely useful tool for tracking and quantifying biological entities in the fields of biochemistry, biotechnology, molecular biology, cell biology and medical diagnosis complementing fluorescent proteins from other sources currently employed.

螢光蛋白最早是從水母 (*Aequorea victoria*) 中分離出來的。作為螢光蛋白家族新成員，橙螢光蛋白也是選殖自一種海洋生物管葵 (*Cerianthus* sp.)，經蛋白質晶體結構和生化分析，發現它的多肽鏈中含有特殊的生色團結構，無需外加輔助因子或進行任何特殊處理，便可以在短波長激發光的照射下發出穩定的長波長可見光，作為生物分子或基因探針具有很大的優越性，這種橙螢光蛋白不但有助於科學界深入對光譜紅移螢光蛋白的研究，而且在少數已知有輔助用途的螢光蛋白外，提供了一種能追蹤及量度生物物質極為有用的工具，能廣泛應用於生物化學、生物科技、分子生物學、細胞生物學和醫療診斷等範疇。

Figures: (A) *Cerianthus* sp.;
(B) Purified fluorescent mutants of OFP;
(C) Expression of OFP and its different color mutants in Chinese hamster ovary cells;
(D) Structure of OFP.

圖解：(A) 橙螢光管葵；
(B) 經純化的各色基因變種橙螢光蛋白；
(C) 野生種橙螢光蛋白及其綠色、紅色基因變種型在中國倉鼠卵巢細胞(CHO cells)內表達；
(D) OFP的分子結構。



Authentication and Quality Assessment of Chinese Medicinal Materials by DNA and Chemical technologies 中藥材的分子和化學鑑別及品質檢定

Prof. SHAW Pang Chui (Department of Biochemistry & Institute of Chinese Medicine)
Prof. BUT Pui Hay Paul (Department of Biology & Institute of Chinese Medicine)
Dr. JIANG Ren Wang (Institute of Chinese Medicine)
邵鵬柱教授 (生物化學系及中醫中藥研究所)，畢培曦教授 (生物系及中醫中藥研究所)，江仁望博士 (中醫中藥研究所)

Funded by Hong Kong Jockey Club Institute of Chinese Medicine

由香港賽馬會中藥研究院有限公司資助

Collaboration with National Institute for the Control of Pharmaceutical and Biological Products, National Center for the Modernization and Engineering of Traditional Chinese Medicine

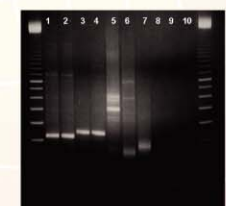
合作夥伴為中國藥品生物制品檢定所、國家中藥現代化工程技術研究中心

Conventionally, Chinese medicinal materials are differentiated by the shape, colour and smell according to experience. However, many Chinese medicinal materials have similar shape, incorporated with substitutes and imitations, making the differentiation process difficult. As every organism has a unique DNA sequence, this becomes the most accurate method to authentication.

Quality assurance of TCM products stems from genuine materials authenticated with unique and characteristic molecular and chemical profiles and markers. A combined DNA and chemical strategy for authentication and quality control is developed. This strategy employs DNA sequences together with chemical profiles or markers, to serve as the basis for the development of protocols for fast identification and quality control.

Applications

DNA sequences for molecular authentication; Chemical markers for authentication; Protocols for extraction of DNA and chemicals; Technologies developed to increase the speed and accuracy of authentication. These data will be useful for authentication and regulatory quality compliance for international market. Besides, it is also useful for law enforcing agencies.



DNA fingerprintings DNA 指紋圖譜

A) Ginseng and related species:

Ginseng from China; Ginseng from Korea; American ginseng from Canada; American ginseng from USA; *Panax japonica*; *Panax major*; *Panax trifolius*; *Panax notoginseng*
A) 不同品種的參類植物：中國人參；韓國人參；加拿大花旗參；美國花旗參；竹節參；珠子參；三葉參；三七

B) Adulterants: *Mirabilis jalapa*;

Phytolacca acinosa

B) 偽品：紫茉莉；商陸

P
alent



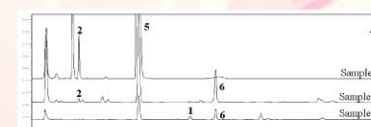
一直以來，分辨中藥材的方法，是依靠業界的經驗，從外型、顏色和味道來分辨。可是，不少中藥材的外型相似，又有替代品和贗品，難免出錯。由於生物都各有獨特的脫氧核糖核酸 (DNA) 序列，DNA 成為最準確的辨別方法。中藥材的品質控制首要有標準的分子和化學圖譜和標識物，利用藥材的 DNA 序列和化學圖譜或標記測定產品的真偽和品質，發展 DNA 和化學聯合鑑別和品質控制方法。

應用範疇

DNA 序列及化學標識物用於鑑定中藥材；藥材提取 DNA 及化學物工藝流程；提供更快速及準確的鑑定技術

項目效益

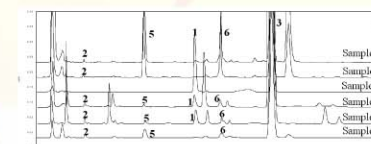
這些資料可作為業界鑑定藥材和申報外國市場品質檢定的依據 (例如用作申報美國 FDA 的 CMC 數據)。所得成果，也對執法單位有用。



HPLC-ELSD chromatograms of *stemona tuberosa*. The thirteen sources fall into four types.



對葉百部的 HPLC-ELSD 圖譜。13 個樣本共分為 4 大種化學類型。



Biosensor Arrays Based on Surface Plasmon Resonance Phase Imaging 基於表面等離子波動表面相差影像的生物傳感陣列

Prof. HO Ho Pui Aaron (Department of Electronic Engineering)
何浩培教授 (電子工程學系)

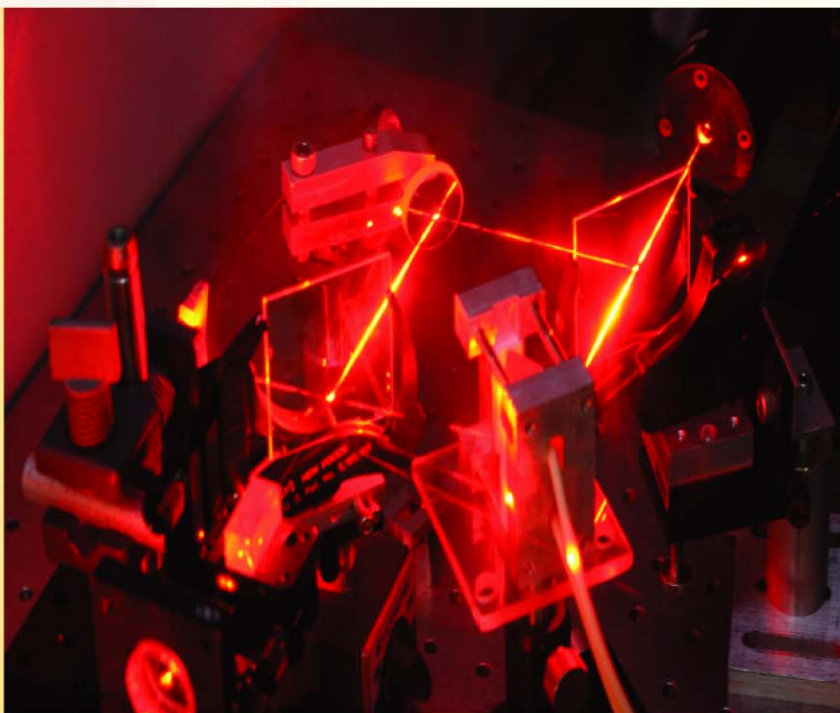
Funded by Shun Hing Institute of Advanced Engineering, Research Grants Council
由信興高等工程研究所及研究資助局資助

Collaboration with The Institute for Lasers, Photonics and Biophotonics, University at Buffalo, New York, USA
and Department of Physics, Tsinghua University, China

合作夥伴為紐約州立大學水牛城分校 The Institute for Lasers, Photonics and Biophotonics 及中國清華大學物理系

We present a simple photonic biosensor array technology based on measuring the optical phase associated with the surface plasmon resonance (SPR) effect. This technology may be used for performing rapid point-of-care screening of a range of medical conditions at low-cost. Existing biosensor arrays are predominantly based measuring the florescence of disease markers. In addition, the florescent markers are mostly expensive because of their proprietary nature. While SPR biosensor arrays are well-known to offer a solution to these two problems by not requiring florescence and providing accurate measurement data, our group has further developed a new single-beam SPR system that provided much improved detection performance and, more importantly, opened the possibility of performing phase imaging - an attribute that conventional SPR systems have great difficulty in achieving.

量度和表面等離子波動 (SPR) 所影響的相關光學週期，我們提出一種簡單光學生物傳感陣列技術。此技術可低成本，於從一系列的醫療情況中篩選急需關注的狀況。現時的生物傳感器都顯著地以量度疾病標記的螢光度為主。加上螢光標記基於其特有性質，價格多較昂貴。當眾所周知生物傳感器可為以上兩個問題提供解決方案而不需依賴螢光度及提供準確量度數據，我們更進一步開發一嶄新的單束電子束表面等離子波動 (SPR) 系統。此系統大大改進偵測的表現，同時更重要地，開展了執行表面相差影像 - 傳統 SPR 系統難以實現的一種特性。



Buffered propranolol sublingual tablet for treatment of atrial fibrillation and situational anxiety 普乃洛爾舌下緩衝含片治療心房顫動及社交焦慮症

Prof. CHOW Sing Sum Moses, Prof. ZUO Zhong, Dr. WANG Yan Feng (School of Pharmacy)
周禮森教授，左中教授，王雁峰博士 (藥劑學院)

Funded by Hing Wing Co., Hong Kong
由香港顯榮行有限公司資助

Collaboration with Comprehensive Drug Enterprise
合作夥伴為全球藥物發展有限公司

Our group developed a novel technology in incorporating buffering agent into propranolol formulation for sublingual administration to achieve fast attainment of blood level and rapid onset of effect as compared to conventional formulation.

Applications

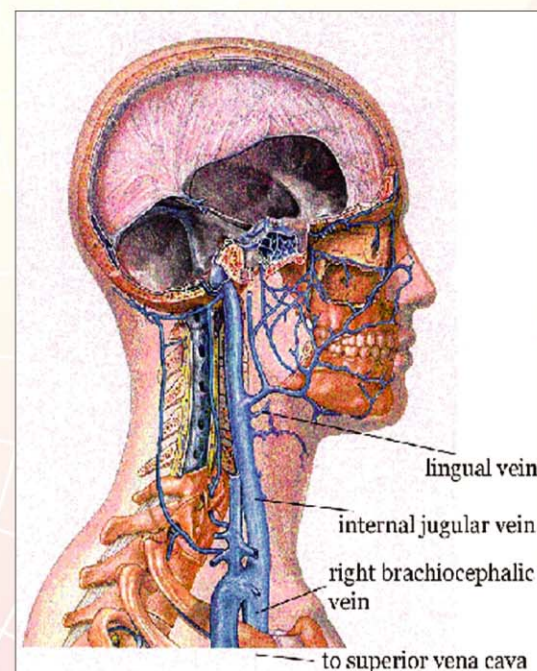
Such product can be useful for rapid treatment of acute fibrillation, angina, and anxiety. This technology may also be potentially applied to the treatment of other acute medical conditions in the future.

Outstanding Features

The optimized pH for maximal drug absorption through sublingual mucosa can be easily obtained input several physicochemical parameters into the theoretical model we firstly developed, then the kind and amount of buffering agent will be readily designed and incorporated into sublingual formulation according to the optimal pH.

Target Users

The patients with acute cardiovascular diseases, and social conditional anxiety



我們的研究小組首次開發出一種新型的普乃洛爾舌下緩衝含片。與傳統普乃洛爾片劑相比，我們首次發展並應用了一項全新的固體制劑緩衝技術，能夠有效地促進藥物通過舌下粘膜吸收，使血藥濃度更加迅速地升高，從而達到快速起效的治療目的。

應用範疇

該產品能夠快速緩解治療心絞痛、高血壓、心肌梗塞、心房纖維顫動以及焦慮等症狀。

特點

通過將藥物常用的理化參數輸入我們首次發展的理論預測模型，舌下吸收的最佳酸鹼度及所用緩衝劑的用量能夠快速地得到，從而避免了大量的體外/體內實驗，直接進行舌下給藥的劑型設計與優化。

目標用戶

可用於對急性心血管疾病以及社交焦慮症的病人

Centre for Clinical Trials - An Academic CRO for drug and device development

臨床實驗中心 - 學術承辦研究組織

Prof. ZEE Chung Ying Benny (Centre for Clinical Trials)
徐仲英教授 (臨床實驗中心)

Centre for Clinical Trials (CCT) was established in 2003 under the School of Public Health, the Chinese University of Hong Kong. We aim at undertaking clinical trials with internationally accepted standards of scientific excellence. We support related clinical research in Hong Kong and Asia. The close collaboration between academia and industry is mutually beneficial in achieving high start in new drug application and innovative biotechnology development.

Services include:

- Clinical Trials Operation
- State Food and Drug Administration (SFDA)
- Education and Training
- Information Technology Development for Clinical Trials Operation

臨床實驗中心成立於 2003 年，附屬於香港中文大學公共衛生學院。我們致力進行臨床實驗達國際認可標準。我們支持於本港及亞洲進行、相關的臨床研究。與學界及業界保持緊密合作可互利於啟動新藥品的應用及創新的生物技術發展。

服務範圍包括：

- 臨床實驗工作
- 提供創新的方法支援本港、地區及國際性的臨床實驗活動
- 中心成員具備臨床實驗設計、分析及數據管理的國際經驗
- 與中國、新加坡、韓國、台灣及澳洲的大學建立合作關係
- 協助研究員洽談合約
- 熟悉道德批核、臨床實驗證書、進口許可及其他條例要求的申請程序
- 於測試及監管方面有豐富的經驗
- 於統計學的臨床實驗具有大量的經驗，可為製藥公司提供藥品開發的生物數據顧問服務



國家食品藥品監督管理局

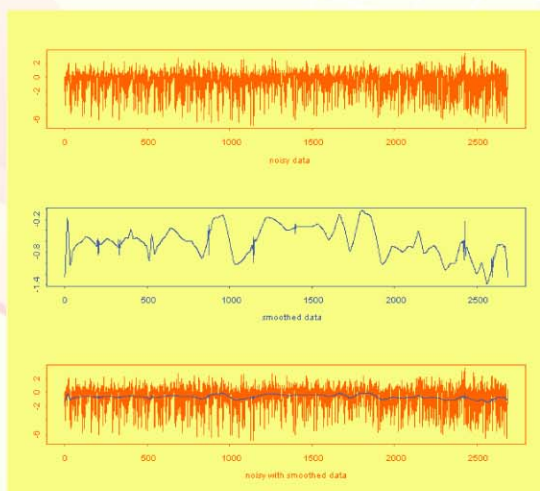
- 與國家食品藥品監督管理局，加快申請時間

教育及培訓

- 我們重視教育，因此，為醫管局、製藥公司及大學不同學系的研究人員提供多個和GCP，倫理學，方法論及中醫藥學有關的工作坊。此外，我們亦提供生物統計及SAS 程式的課程給製藥業界的生物統計人員修讀
- 支持成立 Society of Clinical Research Associate (SoCRA) 的香港分會

臨床實驗工作的資料技術開發

- 我們明白臨床實驗工作的需要及運作，並可利用先進的資訊科技以減低成本
- 我們的資訊科技系統已證實是安全及有效率的。我們採用甲骨文數據庫系統及SAS 作統計分析
- 我們現正開發網上; 隨機選擇、遙距數據控制、Pocket PC 的記錄系統、糖尿病記錄及疾病管理程式



Centre for Protein Science and Crystallography

蛋白質科學與晶體研究中心

Prof. SHAW Pang Chui, Prof. WONG Kam Bo, Prof. CHENG Hon Ki, Prof. AU Wing Ngor Shannon (Department of Biochemistry), Prof. TAM Siu Cheung Michael (Department of Physiology)
邵鵬柱教授，黃錦波教授，鄭漢其教授，區詠娥教授 (生物化學系)，譚兆祥教授 (生理學系)

Funded by Hong Kong Research Grants Council Earmarked Grants,
由香港研究資助局研究基金資助
Collaboration with Institute of Biophysics The Chinese Academy of Sciences, Tsinghua University
合作夥伴為中國科學院生物物理研究所，清華大學

The Centre was established in 2005. We employ multi-disciplinary techniques including protein engineering, biophysical characterization, and X-ray crystallography to study the structure-function relationship of proteins. The Centre houses the first state-of-the-art X-ray crystallographic setup in Hong Kong and South China for high-resolution protein structure determination and major equipment for protein characterization. Our aim is to provide a platform to promote research and development of protein sciences in Hong Kong and South China.

本中心成立於2005年，用多種諸如蛋白質工程、生物物理分析和X-光晶體學手段，研究蛋白質的結構和功能關係。中心有香港和華南首台蛋白質晶體高解象的X-光分析儀和各種研究蛋白質的主要設備。此平台旨在促進香港和華南地區的蛋白質研究和開發工作。

應用範疇

- (1) 蛋白質性質的改造和改善。
- (2) 蛋白質藥物設計。
- (3) 蛋白質結構和功能分析。

特點

本中心有資深的研究人員和香港獨有的儀器，以分析蛋白質的結構及其生物物理和生物化學性質。

目標用戶

目標用戶為從事研究和開發藥用或生物工程蛋白質的高科技工業界。目的為改進蛋白質的性質，使產品更具競爭力。

Applications

- (1) Modification and improvement of protein properties.
- (2) Design of protein drugs.
- (3) Protein structure-function characterization.

Outstanding Features

The Centre has the essential expertise and housed several unique equipment in Hong Kong for structural study of proteins and for biochemical and biophysical characterization.

Target Users

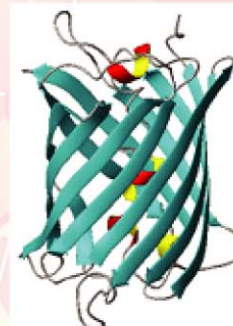
Target user will be high technology industry involved in research and development of biotechnological or pharmacological important proteins, with the aim of improving the properties of proteins, for the products become more competitive in the market.



Crystallization Technology
晶體化技術



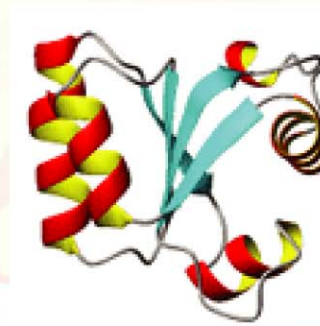
X-ray diffractometer
X-光衍射儀



Structure of Orange Fluorescent
橙色螢光蛋白分子結構



Structure of Trichosanthin variant
天花粉蛋白突變體分子結構



Structure of Ribosomal Protein L30e
核糖體蛋白L30e分子結構

Chinese Medicine Research and Further Development 中醫中藥研究與發展

Prof. LEUNG Ping Chung, Prof. FUNG Kwok Pui (Institute of Chinese Medicine)
梁秉中教授、馮國培教授 (中醫中藥研究所)

Funded by University Grants Committee - Area of Excellence

由大學教育資助委員會-卓越學科領域資助

Collaboration with City University of Hong Kong, The Hong Kong Polytechnic University and The Hong Kong University of Science and Technology

合作夥伴為香港城市大學、香港理工大學及香港科技大學

This 5-year project was selected as an "Area of Excellence" by the University Grants Committee in 2001 to develop 5 priority projects targeting at areas where western medicine has no optimal solution, including viral infection, chronic disorder, degenerative disease, allergy and preventive therapy. The research results include (i) directed effective clinical trials on well-known Chinese medicines; (ii) standardized the quality, safety and effectiveness of Chinese medicines; and (iii) developed the promising Chinese medicines through modern pharmaceutical machinery.

Outstanding Features

The uniqueness of this project is the adoption of an efficacy-driven approach for conducting Chinese medicine research at the areas where western medicine has no optimal solution. The research findings will not only provide more scientific evidence for the efficacy of Chinese medicine, but can also affirm its role as an alternative or complementary therapy in the international arena. The project will also provide important references and set models for Chinese medicine research, its integration with western medicines and the development of nutraceuticals as well as herbal drugs.

「中醫中藥研究與發展」項目於二零零一年獲大學教育資助委員會甄選為「卓越學科領域」，並獲五年撥款發展五個優先研究項目。研究主要針對西方醫學未有解決良方之範疇，包括病毒感染、失調、衰退病、敏感及疾病預防。研究成果包括(i) 尋找中藥良方，進行臨床研究；(ii) 將中醫藥的品質、安全及功效標準化及(iii)利用現代藥品製程開發有潛力的中藥。

計劃的獨特之處在於採用療效主導的研究路向，針對西方醫學未有解決良方的範疇，以有效的傳統中藥用科學方法開展研究。研究成果除可以為中醫藥療效提供更多實證數據外，也有助肯定中醫藥作為另類或輔助療法的功用。此外，項目亦為中西醫結合治療、保健及草藥產品的發展提供重要的參考資料。



Extraction and concentration facility for large scale herbal preparation.
提取濃縮設備



Development of Novel Phthalocyanine-Based Photosensitizers for Photodynamic Therapy 用於光動力治療的新型酞菁光敏劑的研究

Prof. NG Kee Pui Dennis (Department of Chemistry), Prof. FONG Wing Ping (Department of Biochemistry), Prof. KO Wing Hung (Department of Physiology)
吳基培教授 (化學系)，方永平教授 (生物化學系)，高永雄教授 (生理系)

Funded by Hong Kong Research Grants Council
由香港研究資助局資助

Photodynamic therapy (PDT) has been an experimental clinical modality for the treatment of a range of cancer and wet age-related macular degeneration for the past two decades. It involves three individually non-toxic components, namely a photosensitizer, light and oxygen, that are combined to cause cellular and tissue damage. The efficacy of PDT depends on several interdependent factors, among which photosensitizers certainly play a decisive role. This project involves a synergistic collaboration among chemists, biochemists, and physiologists to explore novel phthalocyanine systems as efficient and selective photosensitizers for the use in PDT.

Applications

As anticancer agents

Outstanding Features

PDT is comparatively non-invasive. It can be targeted accurately through precise application of the light with modern fiber-optic systems and various types of endoscopy. Repeated doses can be given without the total-dose limitations associated with radiotherapy. It also does not have the multidrug resistant problem in chemotherapy.

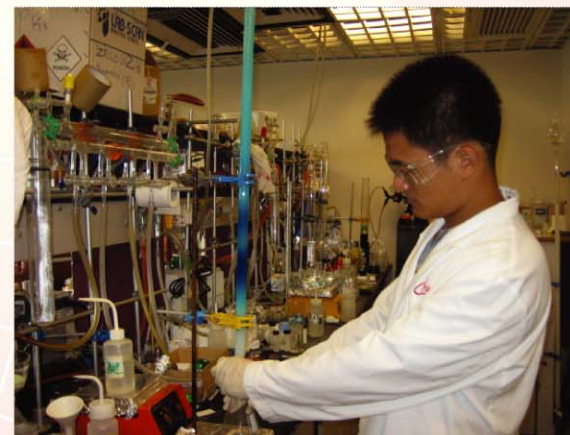
在過去二十年裏，光動力治療 (PDT) 成為一種對廣泛癌症和老年性黃斑病變有效的實驗和臨床治療手段。它包括三個無毒組成部分，即：光敏劑、光和氧氣，它們結合在一起致使細胞和組織死亡。光動力治療的效率決定於一些相互依賴的因素，其中光敏劑起了決定性的作用。在這個計劃裏，化學、生物化學和生理學學者合作開發新的酞菁體系作為高效和有選擇性的光敏劑用於光動力治療。

應用範疇

抗癌藥物

特點

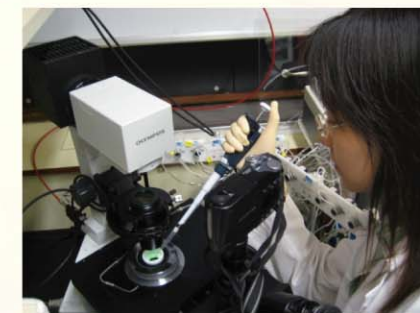
光動力治療是一個相對非創傷性的治療方法。它可以使用現代的光纖光學系統和多種內窺鏡技術實現準確的光定位。相對於放射治療，重複的光劑量沒有總光劑量的限制。它也沒有化學治療中的多種藥抗藥性的問題。



Purification of photosensitizers by gel permeation chromatography



Chemical synthesis of new photosensitizers



Study of the cellular uptake and subcellular localization of the new photosensitizers by fluorescence microscopy.

Photocatalytic Technology 光催化技術

Prof. YU Chai Mei Jimmy (Department of Chemistry)
余濟美教授 (化學系)

Funded by Innovation and Technology Fund,
由創新及科技基金資助
Collaboration with EnvironmentalCare Ltd.
合作夥伴為愛環保有限公司

As air and water pollution becomes more and more serious, the development of efficient and green purification and disinfection technologies becomes more and more critical. Photocatalytic materials can absorb harmful ultraviolet radiation, degrade pollutants, and kill bacteria on contact. With support from the Hong Kong SAR Government, we have developed methods to fabricate nano-sized photocatalysts and mesoporous thin-film coatings. These durable materials have immense industrial potential.

Air Treatment / Water Treatment System employing Photocatalytic Oxidation Technology (PCO) provides the most efficient way to remove bacteria and pollutants from air / water. The PCO core system involves the action of a low UV energy, activating a Titanium Dioxide (TiO₂) based catalyst surface which, in the presence of air / water, generates hydroxyl radicals ($\cdot\text{OH}$) that oxidize pollutants, bacteria and viruses and convert them into harmless carbon dioxide and water.

PCO Cleaning Principle

- 1. Exposure to ultraviolet rays** When a photocatalyst surface is exposed to UV light, energized electrons will break free of the TiO₂ coating. These electrons leave behind positively charged pockets called, "positive holes".
- 2. Creation of Hydroxyl radicals** The positive holes vigorously attract hydroxide ions (OH^-) from ambient air / water. The positive holes then take an electron from an OH^- turning it into an extremely reactive OH radical ($\cdot\text{OH}$).
- 3. Breaking up organic compounds** The OH radicals take electrons from nearby organic compounds and pollutants. This action breaks up the pollutants; thus decomposing them into harmless carbon dioxide and water that are released into the air.

Applications

1. Self-cleaning building materials
2. Anti-bacterial coatings
3. Catalysts for pollution treatment

Outstanding Features

1. Our photocatalysts possess extremely high activities
2. The materials can be modified to achieve special functions

Target Users

This technology is ideal for the environmental health and construction industries

Award:

- * 2002 Hong Kong Award for Industry: CMA Machinery and Equipment Design Award
 - * 2005 National Natural Award, Second prize
- 獎項:
- * 2002年香港工業獎—廠商會機器及設備設計獎
 - * 2005國家自然科學獎二等獎



空氣和水質的污染日益嚴重，發展有效環保的殺菌淨化技術已是刻不容緩。光催化物料能吸收有害紫外線輻射、減低污染物及去除細菌。在香港特區政府的大力支持下，我們發展了納米光催化劑及薄膜。這些耐用物料為環保工業界創造了商機。空氣處理 / 水處理系統所應用的光催化技術是去除細菌和污染物最有效的方法。光催化濾芯系統利用低能量紫外線照射已塗有二氧化鈦(TiO₂) 催化劑的表層，在空氣 / 水中釋放氫氧自由基($\cdot\text{OH}$)，把污染物、細菌和病毒氧化，分解為無害的二氧化碳和水。

光催化氧化原理

- 1. 紫外線照射**
光催化表層經紫外線照射後，會釋放出電子和留下一個帶正電荷的空穴。
- 2. 產生氫氧自由基**
這個帶正電的空穴和水份中的氫氧離子反應形成十分活躍的氫氧自由基。
- 3. 分解有機化合物**
氫氧自由基從鄰近有機化合物及污染物中吸收電子，從而將污染物分解成無害的二氧化碳和水，釋放於空氣中。

應用範疇

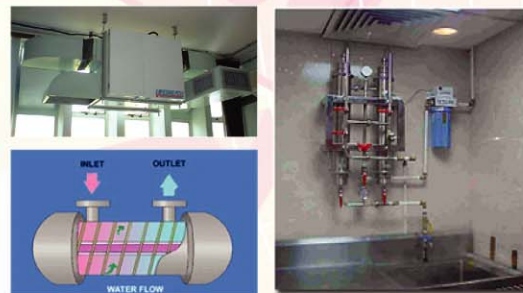
1. 自動清洗建築物料
2. 抗菌表層
3. 光催化污染處理

特點

1. 我們的光催化材料具有高活性
2. 物料可因應需要添加特別功能

目標用戶

此技術十分適用於環境健康及建築行業。



UGC Area of Excellence: Plant and Fungal Biotechnology Program 教資會卓越學科領域：植物與真菌生物科技



Prof. SUN Sai Ming Samuel (Department of Biology)
辛世文講座教授 (生物系)

Funded by University Grants Committee
由大學教育資助委員會資助
Led by Core team members, Department of Biology, The Chinese University of Hong Kong
由香港中文大學生物系核心研究小組統籌
Collaboration with Associated team members includes The University of Hong Kong, Hong Kong Baptist University and The Hong Kong University of Science and Technology
合作夥伴為聯席研究小組成員(包括香港大學、浸會大學及香港科技大學)



Biotechnology high-lysine rice under field trial in mainland China with official permission from the Chinese Authority
獲中國有關單位批准，進行以生物科技研發的高賴氨酸水稻之田間測試。

Crop improvement is our major research priority. Rice, being one of the major staples, is nutritional imbalance and lack of lysine. We made a major breakthrough and successfully obtained the first generation of rice with enhanced lysine content reaching the WHO recommended level. We also succeeded in establishing a "plant bioreactor" technology platform to develop high-value protein products and in optimizing the production of high-value immuno-modulating natural fungal products. Through the state-of-the-art functional genomics study, important genes such as salt tolerant and disease resistant genes were identified for genetic engineering applications. We filed 12 patents, published more than 234 academic publications and trained over 175 skilled biotechnologists.

The program established a number of cross regional collaborations. We work with the world renowned scientists on projects with great regional impact such as with the "Father of Hybrid Rice", Prof. L.P. YUAN (also member of the China CAE) to improve the quality of hybrid rice which cover more than half of the Chinese rice growing area. Apart from receiving scientific awards, our past achievements received dual recognition that we were invited to join the Chinese Key Research Program, "China National Rice Functional Genomics Project" in 2002 and another leading national research consortium on Rice Functional Genomics. Recently we also participated as a key member of the ProVitaMinRice Consortium in the Grand Challenges in Global Health Initiative of Bill & Melinda Gates Foundation, USA to generate a nutrient-rich rice for humanitarian use.

本項目以作物改良為重點。由於稻米屬五穀類，缺乏賴氨酸，故營養不均。我們在這項重要研究工作上取得突破，成功取得首代高質稻米，其賴氨酸含量獲提升達世衛建議水平。另外，我們成功建立以植物生產高價值蛋白的平台與天然真菌保健產品的優化生產系統。我們亦正積極開發數個抗鹽抗病基因之應用，希望提高可耕地面積及作物產量。自2000年啟動以來，我們已遞交了十多個專利的申請，發表共234篇學術性科學文獻，及培訓超過175名生物科技人材。

本項目建立了一系列的跨區協作研究。與世界知名的科學家一同致力於具重要區域性影響的科研，其中包括與"雜交水稻之父"袁隆平教授(亦為中國工程院院士)合作，以祈改進現佔全中國一半種稻耕地的雜交水稻的品質。除屢獲科學獎項外，在2002年，我們更獲邀參與中國重點研究項目"中國國家水稻功能基因組研究課題"及其他全國性的水稻功能基因組研究。最近，我們亦主力參與美國蓋茨基金會所贊助名為"ProVitaMinRice"的國際性研究，目標乃為全人類創造出一種具高營養價值的水稻。



Field test of salt-tolerant biotechnology rice side-by-side with control rice (left). Only salt-tolerant biotechnology rice survived the treatment of 2% salt (right).
抗鹽生物科技水稻與正常水稻之並列田間測試 (左)。只有耐鹽水稻能在鹽份含百分之二的泥土中生長 (右)。



Production of high value protein (e.g. Malaria surface antigen and Human Granulocyte Colony-Stimulating Factor) in plant seeds
用植物的種子生產出高價值的蛋白(如瘧疾表面抗原及人粒細胞集落刺激因子)。

Real-Time Visualization of Chinese Visible Human 中國可視人實時可視化

Prof. HENG Pheng Ann (Department of Computer Science and Engineering / Virtual Reality, Visualization and Imaging Research Centre)
王平安教授 (計算機科學與工程學系、虛擬現實可視化與圖像研究中心)

Funded by Shun Hing Institute of Advanced Engineering
由信興高等工程研究所資助

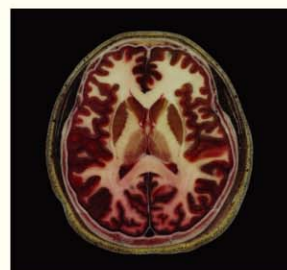
We have successfully achieved extremely high quality interactive 3D visualization of the first Chinese Visible Human data set through advanced rendering and data processing techniques that we developed. The first Chinese Visible Human data set was collected by the Chinese Visible Human Project Team from Third Military Medical University in Chongqing in October 2002. It consists of 2518 serial cross sections of a 35 year old male died due to non-organic disease. The resolution of each sectioned image is 3072 x 2048 and the total data size is about 91 GB. The latest Chinese Visible Male dataset is about 1143 GB in size, extremely fine anatomical features can be observed

In this research, we have made several breakthrough developments in order to achieve extreme high quality rendering of this huge visible human data set interactively on a single PC. We are the first research group in the world to achieve a complete 3D reconstruction and PC-based interactive visualization of the huge Chinese Visible Human datasets.

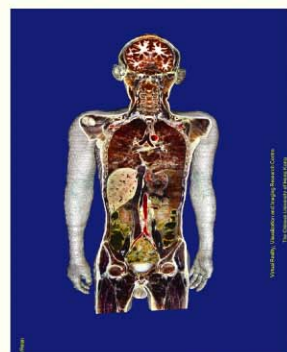
通過我們所開發的先進資料處理技術，我們成功地實現第一位中國可視人資料的高解析度互動式三維視覺化。第一套中國人可視人資料由第三軍醫大學研究隊伍於2002年10月在重慶收集，資料來源於一名死於非器質性疾病的35歲男性，一共由2518像素為3072乘2048的橫切圖像組成，存儲量約為91GB。其中包括一名中國男性資料總容量為1143GB，非常精細的生理特徵都可以在清晰地呈現。

在此研究中，我們取得了重要的突破性進展，使基於普通個人電腦上的海量級人體資料能夠進行高解析度的互動式即時繪製。我們首次在世界上實現了海量級中國可視人資料在個人電腦上三維重建的互動式視覺化。

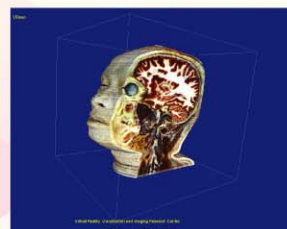
Award 獎項:
Certificate of Merit, RSNA2004
InfoRAD Exhibit Award



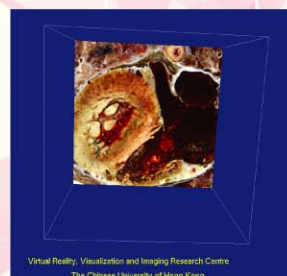
A processed slice from the CVH data
經處理後中國可視人面片



3D reconstruction of the full CVH body
中國可視人三維重組



CVH head
可視人 - 頭部



CVH heart
可視人 - 心臟



Restriction Enzymes: The Scissors for Genetic Engineering 內切酶：DNA的剪刀

Prof. SHAW Pang Chui (Department of Biochemistry)
邵鵬柱教授 (生物化學系)

DNA molecule is the book of life that records the characteristics of living organisms. The 'book' consists of long sequences, or 'sentences', with individual genes, or 'words', which are in turn made of base pairs A, T, G, C, which are the basic 'alphabets'. If we could read and manipulate the DNA molecule, many of life's processes could be controlled.

In genetic engineering, DNA fragments from different origins can be joined; the genes on these fragments can then be located, and analysed. By turning on the genes, large amounts of useful proteins can be made. For examples, the generation of insulin and human growth hormone, the generation of crops with useful genes. Genetic engineering can thus be likened to the 'find', 'cut' and 'paste' functions in a word processor. Studies show that it is the restriction enzymes act as scissors that cut DNA into specific fragments.

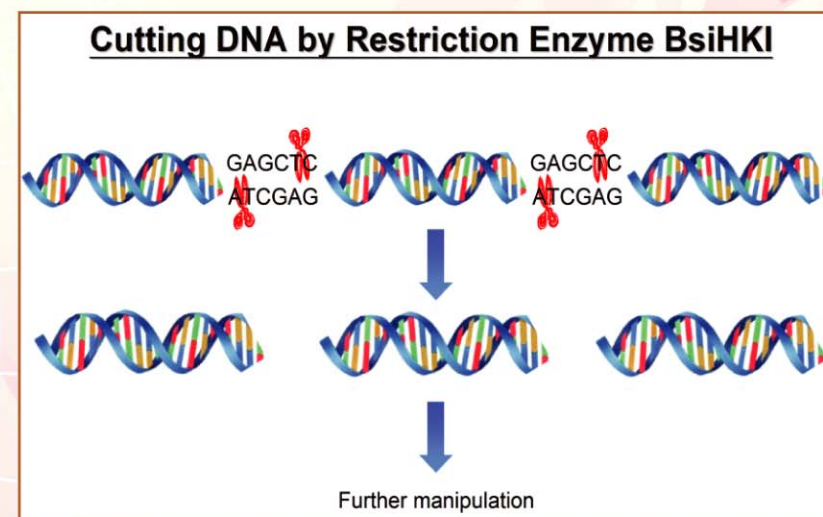
Prof. P. C. Shaw has found more than 100 restriction enzymes with unique properties, such as resistant to high temperature and recognizing rare DNA sequences. Some of them have made their way to commercial production by biochemical companies in the USA, with transfer fees and royalties accruing to the University. This collection of restriction enzymes is available for further downstream development.

脫氧核糖核酸(DNA)就如一本厚厚的書，內裡記錄了所有與生命有關的資料。這本「書」由長串長串的「句子」組成，這些「句子」便是不同的基因，而構成「句子」的「字母」，乃DNA的基本A, T, G, C序列。假如科學家能讀通這本「書」，便可控制生命的程序。

遺傳工程，就是根據需要，先從長長的DNA序列中，找出含特定基因的染色體斷片。然後將染色體斷片與其他來源的斷片接合，藉以培養或複製更多基因供研究之用。遺傳工程的用途相當大，例如生產胰島素及生長激素，製造含有用基因的農作物等。

但是，應該如何尋找所需斷片，以作重組呢？我們試想像，DNA這本「書」的內容，經已全部儲進電腦，要找出特定的句子，必須透過文字處理軟件的各項功能，在這篇文章中進行尋找、分割和連接等操作。負責切割「句子」的，便是內切酶。

邵鵬柱教授的研究小組，已經發現了超過一百種內切酶；其中有些是耐熱的，或辨認出罕有DNA序列的。邵博士的內切酶，有些已為美國生化公司用以大量生產商品。所有的內切酶，均可用作開發。



Stem Cell and Tissue Regeneration Research in CUHK 於中文大學進行的幹細胞及組織再生研究

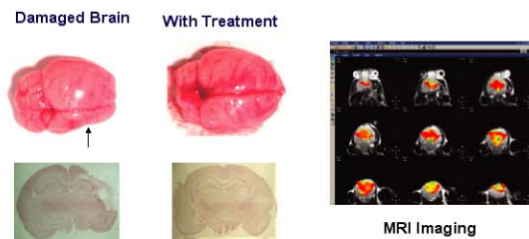
Funded by RGC Earmarked Grant, CUHK Strategic Research Programme, Li Ka Shing Institute of Health Sciences and Children's Cancer Foundation
由研究資助局研究用途補助金、策略性研究計劃、李嘉誠健康科學研究所及兒童癌病基金資助

The Stem Cell Research Group in CUHK comprises of 20 Principal Investigators and is concurrently conducting at least 25 projects. These studies cover various types of stem cells originated from the adult body, fetal tissues and the embryo. The overall objectives are the application of these stem cells for tissue repair and regeneration. Our tissue damage models included diseases that are not readily curable by established medical treatments e.g. liver damage, stroke, hypoxia ischemia-induced brain damage in neonates, chemotherapy-induced cardiotoxicity, diabetes, bone and cartilage degeneration and eye defects. We also study various novel therapeutic agents such as growth factors and purified herbal materials on the promotion of stem cells and tissue repair.

Applications

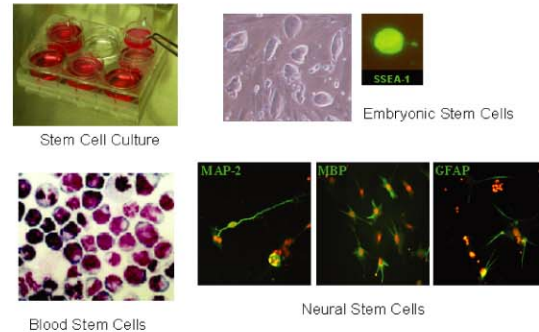
It is anticipated that stem cells and associated therapy would provide revolutionary clinical applications, particularly for treating difficult medical conditions such as neural, heart, and pancreatic islet degeneration. Research on stem cells is also expected to contribute to key medical areas such as cancer therapy, genetic and immunologic diseases and development of pharmaceutical products.

In vivo Model of Neural Protection on Hypoxia-ischemia Brain Injury in Neonatal Rats



Pediatric Research 2005; 58: 784-790

Stem Cell and Tissue Regeneration Research in CUHK

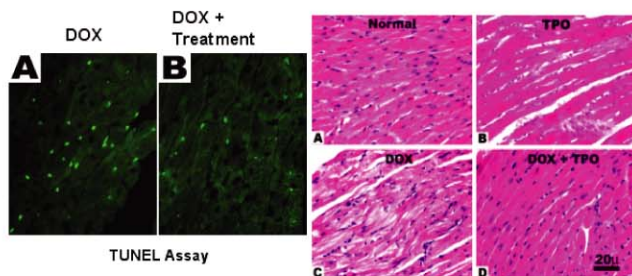


香港中文大學幹細胞研究組的成員由20名主要研究員組成，進行中的研究項目超過25項。這些研究覆蓋了不同類別的幹細胞，它們分別來自成人、胎兒組織和胚胎。這些幹細胞研究的最終目的是能夠達至有助組織收復和再生。研究中的組織創傷模型包括現今仍未有既定治療方案的疾病，如肝臟損傷、中風、新生兒缺氧缺血性腦病、化療導致的心臟毒性、糖尿病、骨及軟骨退化和眼睛疾患，等。我們同時研製新型治療劑，如生長因子和提純草本藥物在幹細胞和組織再生的促進作用。

應用範疇

我們期望幹細胞和相關的療法可提供革命性的臨床應用，特別於處理一些困難的醫療情況，如神經中樞、心臟及胰島衰退。幹細胞研究亦預期於關鍵的醫療範疇上作出貢獻，如治療癌症、遺傳性及免疫學的疾病、以及開發製藥的產品。

Protection against DOX-induced Cardiomyopathy by Growth Factor in a Mouse Model



Circulation 2006; 113: 2211-2220

Technological Improvement in Radiation Therapy for Nasopharynx Cancer 鼻咽癌放射治療之科技改進

Mr. CHAU Ming Chun Ricky, Prof. LEUNG Sing Fai, Dr. KAM Koon Ming Michael, Dr. CHEUNG Kin Yin, Prof. CHAN Tak Cheung Anthony (Department of Clinical Oncology)
周明俊先生、梁承暉教授、甘冠明醫生、張建賢博士、陳德章教授 (腫瘤學系)

Funded by RGC grants
由研究資助局資助
Collaboration with Hospital Authority
合作夥伴為醫院管理局

We improved the technique of Intensity-Modulated Radiation Therapy for treatment of nasopharynx cancer. We created "virtual organs" and "split organs" on the CT scan images of the head and neck region, and achieved optimal coverage of the cancer target reduced radiation to adjacent normal organs (such as salivary glands, brain). We used interpolated contours of organs on the images to save manpower time in the treatment planning process. We achieved a high cancer control rate of more than 90% in the patients treated by the new technique.

Applications

Treatment of nasopharynx cancer

Outstanding Features

Improved therapeutic ratio

Target Users

Patients, health care providers

我們改進以「強度調控」模式治療鼻咽癌之技術。我們在頭頸部之電腦掃描影像上設立「虛擬器官」及「分割器官」，經最優化程序處理下，達致射線射線徹底覆蓋腫瘤範圍並同時減少對周邊器官（例如唾液腺及腦部）之影響。我們並使用「內推補遺」手段注入器官之輪廓，減省程序上消耗之時間。經新技術治療的病入之臨床跟進結果顯示高達超過百分之九十之腫瘤控制率。

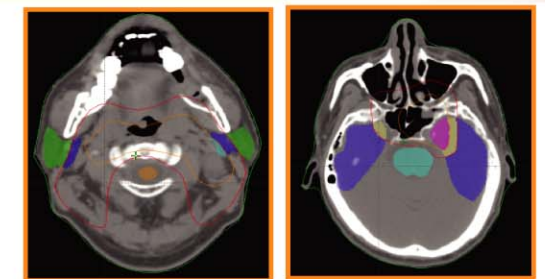


Figure 1. Transverse CT images showing a) parotid glands, and b) temporal lobes contours being split into GTV-overlapping (cyan/magenta), PTV-overlapping (blue/yellow) and non-overlapping regions (green/blue).

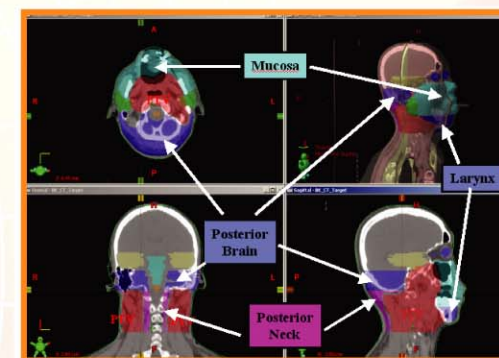


Figure 2. CT images showing the contours of various virtual organs as labeled.

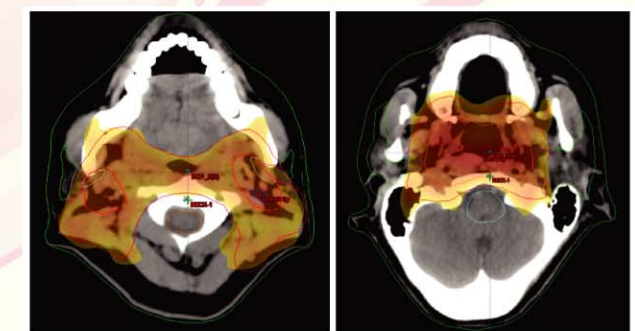


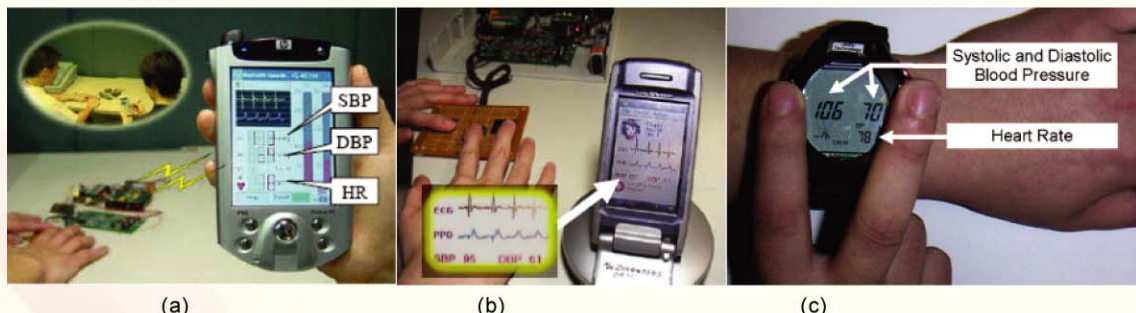
Figure 3. Dose distribution of Intensity-Modulated Radiation Therapy showing the sparing of the split parotid glands and surrounding normal tissues.

The Development of Cuffless Devices for the Noninvasive Measurements of Arterial Blood Pressure

無袖帶式動脈血壓測量裝置的研發

Prof. CHENG Chun Yiu Jack (Pro-Vice-Chancellor), Prof. LEVNG Kwok Sui (Department of Orthopaedics and Traumatology), Prof. ZHANG Yuan Ting (Department of Electronic Engineering)
鄭振耀教授 (副校長)、梁國穗教授 (矯形外科及創傷學系) 及張元亭教授 (電子工程學系)

Funded by Hong Kong Innovation and Technology Fund, Standard Telecommunications Ltd., Jetfly Technology Ltd., Golden Meditech Company Ltd., Bird International Ltd., and Bright Step Corporation.
由創新及科技基金, Standard Telecommunications Ltd., 香港捷飛科研有限公司, 金衛醫療科技有限公司, Bright Step Corporation 和波導國際有限公司資助



Cuffless blood pressure meters (a) PDA-based, (b) mobile phone-based, and (c) wrist watch-based (provided by Jetfly Technology Ltd.).

無袖帶式血壓測量裝置 (a) PDA、(b) 手機和 (c) 手錶上

This project features the development of the wearable gadgets, shirt, and chair capable of monitoring the beat-to-beat arterial blood pressure (BP) continuously without using a cuff. The conventional principles for measuring BP required the use of an occluding cuff, which are undesirable for wearable medical devices in the application of mobile-health. As an alternative, a cuffless and noninvasive technique for measuring BP based on pulse transit time has been developed.

Applications

1. Wearable gadgets (e.g. a watch, a mobile phone, a PDA, and headsets etc.);
2. Health-Shirt (h-Shirt) using e-textile materials; and
3. Health-Chair using e-textile materials.

Target Users

The developed wearable gadgets, shirt and chair with the function of BP monitoring will cater to the needs of the increasingly aging population and provide a constructive and viable solution to the inadequacy of BP control of the hypertension population.

Award 獎項:

* A research paper won the 1st prize at the competition of "IFMBE Outstanding Chinese Student Award" sponsored at the 27th Annual International Conference of the IEEE-EMBS, 2005.

* A research project won, jointly with MBA students, the 1st prize in "e-challenge 2005" organized by the Young Entrepreneurs Development Council of Hong Kong.



Frontal view of the h-Shirt and blood pressure displaying watch
保健衫(h-Shirt)的外觀及血壓顯示表



此項目的將點在於研發了一系列無需使用袖帶即可連續測量動脈血壓的穿戴式裝置、衣服和椅子。傳統的血壓測量方法在測量時需要使用充放氣的袖帶。這種方法並不適合應用於流動醫療中的穿戴式醫療儀器。因此，我們研發了基於脈搏轉送時間發展成的無損無袖帶式血壓測量方法。

應用範疇

1. 穿戴式裝置 (如手錶, 移動電話, 手機和頭戴式裝置);
2. 利用電子織物製成的保健衫; 及
3. 利用電子織物製成的坐椅。

目標用戶

上述研發成果旨在滿足人口老化社會在健康保健方面的需求, 並且高血壓人士提供一個有效監控血壓的解決方案。



Design of a blood pressure monitoring chair.
血壓監測坐椅的設計

The International HapMap Project 國際人類基因組單體型圖計畫

Prof. WAYE Miu Yee Mary, Prof. TSUI Kwok Wing Stephen (Department of Biochemistry)
韋妙宜教授, 徐國榮教授 (生物化學系)

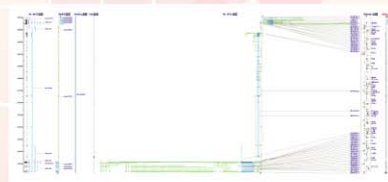
Funded by Strategic Program of the Chinese University of Hong Kong, Research Grants Council of Hong Kong, The Croucher Foundation
由香港中文大學策略資助計劃, 香港研究資助局, 裘槎基金會資助
合作夥伴為國際HapMap聯盟

The International HapMap Project is a multi-country effort to identify and catalog genetic similarities and differences in human beings. Using the information in the HapMap, researchers will be able to find genes that affect health, disease, and individual responses to medications and environmental factors. The Project is a collaboration among scientists and funding agencies from China, the United Kingdom, Canada, Japan, Nigeria, and the United States. The goal of the International HapMap Project is to compare the genetic sequences of different individuals to identify chromosomal regions where genetic variants are shared. Details of the project can be found in <http://www.hapmap.org>.

Applications

1. To provide an extensive resource that researchers can use to discover the genetic variants involved in disease and individual responses to therapeutic agents.
2. To learn much more about the origins of illnesses and about ways to prevent, diagnose, and treat those illnesses.

A study in progress is to find out if Chinese dyslexic children in Hong Kong have certain genotypes that correlate with dyslexia and to characterize the dyslexia susceptibility genes. We have found that certain genotypes of a candidate dyslexia susceptibility gene (KIAA0319) correlate with a nearly 2-fold increase in the odds of having dyslexia. This could provide an additional indicator for identification of children at high risk of learning disability and thus assure provision of early and adequate intervention.



Candidate Dyslexia Gene
閱讀障礙候選基因



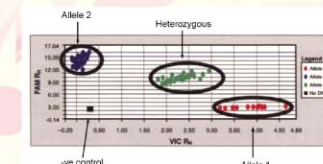
Tom (a famous dyslexic)
湯姆格斯 (著名閱讀障礙者)

國際人類基因組單體型圖計畫 (簡稱HapMap計畫) 是一個多國參與的合作項目, 旨在確定和編目人類遺傳的相似性和差異性。利用HapMap獲得的資訊, 研究人員將能夠發現與人類健康、疾病以及對藥物和環境因數的個體反應差異相關的基因。HapMap計畫是一個多國參與的合作專案, 由來自日本、英國、加拿大、中國、尼日利亞和美國的科學家及資助機構合作完成。其目標是通過比較不同個體的基因組序列來確定染色體上共有的變異區域。

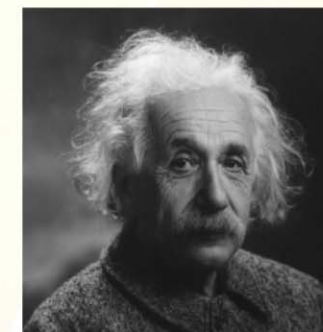
應用範疇

1. 國際HapMap計畫通過提供充分資源, 有助研究人員發現與疾病及個體治療反應相關的遺傳多態位點, 從而對人類健康做出貢獻。
2. 一旦發現這樣的變異位點, 研究人員可以更瞭解該疾病的起因以及預防、診斷和治療的方法。

其中一項在進展中的研究是尋找中國香港患閱讀障礙的兒童相關的基因。研究發現, 某些KIAA0319的基因型和閱讀障礙有關連差不多增加閱讀障礙的機率兩倍之多。這可以提供多一個新識別的標誌, 以便及早提供適當干預。



Genotyping analyses
分析基因型



Einstein a famous dyslexic
愛因斯坦 (著名閱讀障礙者)



Using the Fruitfly Drosophila to Identify and Validate Traditional Chinese Medicine 利用果蠅測試中醫藥

Prof. CHAN Ho Yin Edwin (Department of Biochemistry)
Prof. LIANG Song Ming, Mr. CHAN Kam Leung (School of Chinese Medicine)
陳浩然教授 (生物化學系), 梁頌名教授, 陳錦良先生 (中醫學院)

Many pharmaceutical companies, such as Novartis (www.novartis.com), now use model organisms including mouse and fruitfly Drosophila in drug screening programs. Recently, Drosophila has been used as a model to study effects of several traditional Chinese medicinal drugs including Hu-Bao, Sheng-Bao (Am. J. Chi. Med. 30: 263-270) and Lu-Duo-Wei (Am. J. Chi. Med. 27: 407-413). These studies convincingly showed that Drosophila can be used as an in vivo whole organism model to study effects of traditional Chinese medicines.



Applications
validate efficacy of existing traditional Chinese medicines in the market;
identify new traditional Chinese medicines with higher therapeutic values

Outstanding Features
The fruitfly offers fast and robust screening capacity in traditional Chinese medicine screening and identification

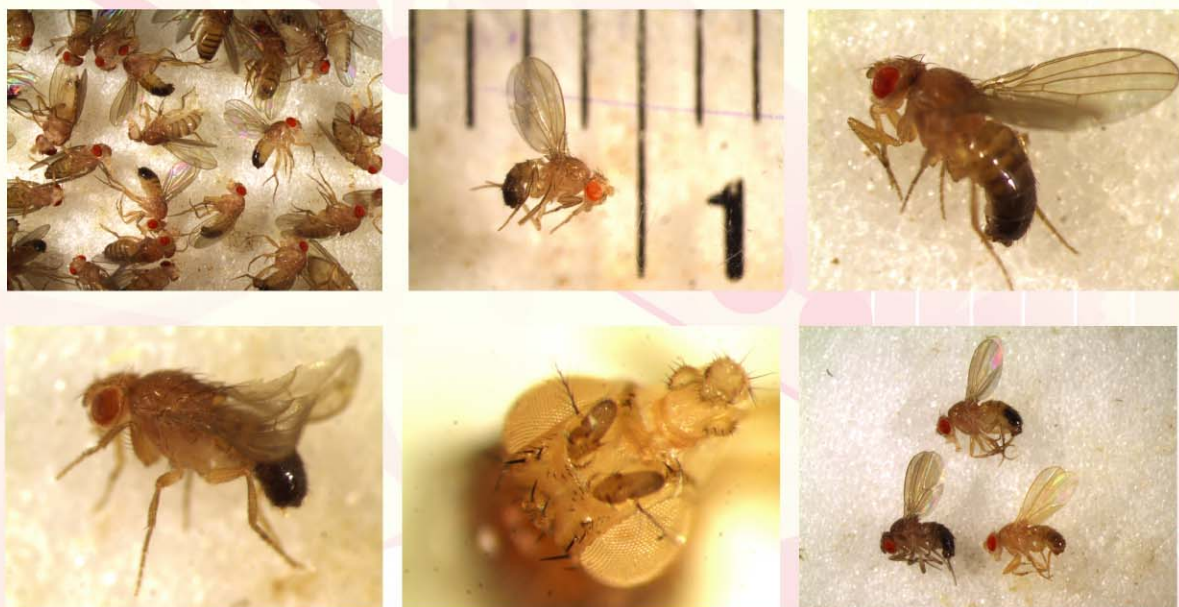
Target Users
Biotechnology & traditional Chinese medicine companies

多間西方藥廠已運用各種動物模型, 如老鼠及果蠅於藥物篩選的項目上。最近, 果蠅更被使用於研究傳統中藥的藥效。上述的研究可有效地證明果蠅能用於研究中藥的效用。

應用範疇
- 能驗證現存於市場上傳統中藥的功效;
- 開發具有更高藥效的中藥

特點
果蠅能提供高效能的中藥篩選及測試

目標用戶
生物技術及中醫藥機構單位



Virtual Acupuncture 虛擬針灸

Prof. HENG Pheng Ann (Department of Computer Science and Engineering/
Virtual Reality, Visualization and Imaging Research Centre)
王平安教授 (計算機科學與工程學系、虛擬現實可視化與圖像研究中心)

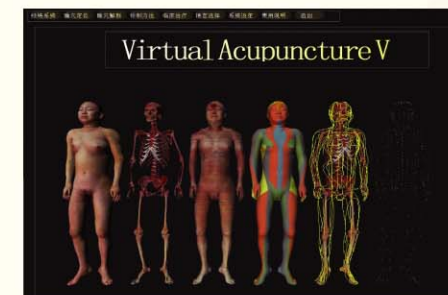
Funded by Shun Hing Institute of Advanced Engineering
由信興高等工程研究所資助

In this project, we have developed advanced information technologies for computer-assisted Chinese acupuncture training and research. Optimally integrated the virtual reality, visualization and imaging techniques, we construct a detailed virtual acupuncture digital human model based on ultra-high resolution Chinese Visible Human dataset. The system integrates many innovative features such as the meridian system positioning, multi-layer dissection, needle puncturing simulation and training, as well as the common diseases-therapy information. In addition to providing multi-modality and multi-lingual support, we are developing an open and comprehensive information-enhanced digital platform to support modern research in Chinese medicine. Our work can be widely applied to acupuncture education, clinical applications, as well as biomedical and digital human research.

This project won the First Award in the 9th Challenge Cup held at Fudan University, Shanghai. The project also won the Gold Award in the 7th IT Excellence Awards (Post-Secondary), was then selected for participating in an international technological competition, Asia Pacific Information and Communication Technology Awards (APICTA), and become the winner of R&D category.

本項目通過應用電腦高新技術輔助研究針灸學。採用中國虛擬人體資料集, 結合虛擬現實、視覺化與圖像技術, 建成了融合經絡系統定位、腧穴立體定位、任意角度腧穴斷面與多層次解剖、全方位腧穴針刺模擬與訓練系統以及針灸臨床常見病治療資訊的高精度虛擬針灸人體數字模型; 同時完成可兼容各種醫學圖像格式與多國文字, 以及支援多系統開發的開放式人機交互數字平台的初步建立。可廣泛應用於實際的針灸教學、臨床及科研的許多領域。

本項目奪得在上海復旦大學舉行的第九屆挑戰盃賽一等獎。此外, 本項目在獲得第七屆資訊科技卓越成就獎(大專組)金獎後, 被選定參與國際性的亞太地區資訊與通訊技術展, 榮獲研發類冠軍。



User interface of our virtual acupuncture
虛擬針灸使用者介面



Virtual meridian
虛擬經絡



Anatomy details under the acupuncture point
腧穴下之解剖細節



APICTA 2005
2005年亞太地區資訊與通訊技術展

Award 獎項:
APICTA 2005 -
winner of RAD
category



9th National Challenge Cup
第九屆國家挑戰盃賽



7th IT Excellence Awards
第七屆資訊科技卓越成就獎

Virtual Neuroanatomy 虛擬腦部解剖

Prof. HENG Pheng Ann (Department of Computer Science and Engineering) (Virtual Reality, Visualization and Imaging Research Centre)
王平安教授(計算機科學與工程學系)(虛擬現實可視化與圖像研究中心)

Funded by Shun Hing Institute of Advanced Engineering
由信興高等工程研究所資助

With the advent of Chinese Visible Human (CVH) data and breakthroughs in programmable Graphic Processing Unit (GPU), nowadays, we have developed a virtual neuroanatomy system which unveils extra-fine anatomic details of the brain and intracranial structures. Having labeled different neuro-tissue within the head and neck region, our interactive visualization system can make the interactive anatomical exploration of the virtual brain vital.

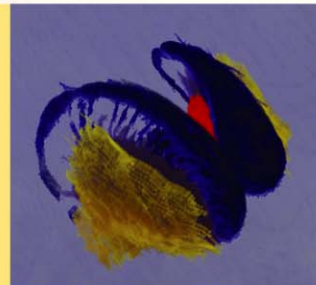
In this project, we deploy various novel techniques in texture compression, volume rendering as well as programmable GPU acceleration. From opaque volume viewing to translucent tissue selection; from true fidelity of real tissue color to interactive pseudo-color dyeing; all visualization procedures can be carried out on a single personal computer in a real-time manner. This serves as a fully intuitive educational and research platform which benefits medical students, surgeons as well as medical imaging professionals.

採用中國虛擬人體資料集，應用最新圖像處理器，我們開發出一套虛擬腦部解剖系統。透過此系統，細緻的腦部解剖細節及顱內結構可以一一呈現。標有不同神經組織的頭部及頸部的可視化系統，可讓使用者以互動形式在虛擬環境中探索大腦的結構。

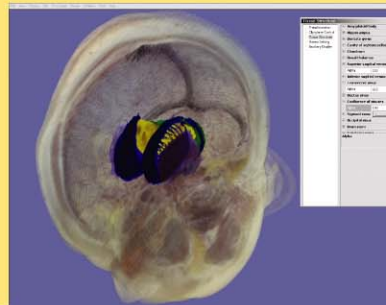
在這個項目中，我們配置了多種新穎的壓縮紋理技術、體數據繪製及可編程的圖像卡加速技術。從半透明到不透明的組織選擇；從真實組織色彩到互動偽色彩漂染；所有可視化程序在一台普通個人電腦上便能實時地進行。此系統為醫科學生、外科醫生以及醫學影像專業人員提供一個教育和研究平台。



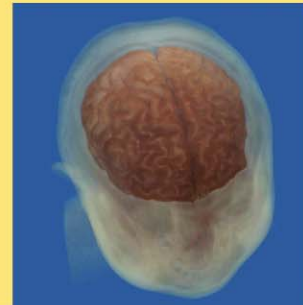
Virtual ventricle
虛擬腦室



Virtual basal ganglia
虛擬基底核



Virtual limbic system
虛擬邊緣系統



Translucent view of virtual cerebrum
以透明狀態顯示虛擬大腦