香港中文大學
THE CHINESE UNIVERSITY OF HONG KONG

Innovation
For Better Life

If you are interested in any of the projects listed in this booklet
please contact the Centre for Innovation and Technology
The Chinese University of Hong Kong

如閣下對目錄內任何科研項目有興趣
請與香港中文大學創新科技中心聯絡

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PREFACE
序言

Besides pursuing research excellence to explore new knowledge, and to nurture next generation professionals and community leaders, a third mission commonly adopted by leading universities around the world is to contribute to regional economical development through technology transfer. Hong Kong, like many other developed cities, is migrating towards a knowledge-based economy. To survive in such hyper-competitive market, companies compete on innovative products or novel services. While no company can afford infinite R&D resources to yield a continuous supply of innovations, there is a global trend taking shape that the business community is tapping into the innovative resources of universities to look for breakthrough technologies. The Centre for Innovation and Technology (CINTEC) in The Chinese University of Hong Kong (CUHK) is a unit dedicated to facilitate technology transfer and collaboration with the industry.

CINTEC encourages communications and mutual understanding between the University and industry through regular participation in technology exhibitions. We coordinate research teams from different faculties to identify projects with high commercialize potential, and to showcase prototypes of their latest inventions.

Prof. WONG Kam Fai
Director, Centre for Innovation and Technology
The Chinese University of Hong Kong

香港中文大學
創新科技中心主任
黃錦輝教授

大學除了以卓越的研究來探索新知識、培養下一代人才和社會領袖外，世界很多頂尖的大學均以技術轉移來帶動區內經濟發展作為第三使命。一如其他已發展的城市，香港已逐漸邁向以知識為本的經濟體系。隨之而來是商業機構更需要在產品及服務上不斷創新，以迎合市場的激烈競爭環境。現實中，企業往往沒法永無止境地為研發產品而投放無限資源，故此開拓利用大學的研發資源來不斷突破本身創新極限已逐漸成為全球成功企業的新趨勢。香港中文大學創新科技中心(CINTEC)便是大學專門為促進科技轉移和產學合作而設的單位。

透過定期參與科技展覽，創新科技中心促進大學與業界的溝通，增強雙方了解和合作。我們統籌各個院系的研究隊伍，安排他們展出具有市場潛力的科技發明及示範其原型系統。

This year, we cluster our exhibits based on the 5 key strategic research areas of the University. They are Chinese Studies, Biomedical Sciences, Information Sciences, Economic and Finance, as well as Geoinformation and Earth Sciences. The University has attained landmark achievements in these areas.

CINTEC has many successful technology transfer cases. This year, our "real-time video transcoder technologies" developed by Professor Jack Lee, Department of Information Engineering, has been adopted by Smartone-Vodafone. The company then launched their world's first unique "Internet on Mobile" services, enabling their subscribers to view essentially any video clips available on the Internet. Late last year, Colisa Limited, a company founded by 4 CUHK graduates successfully secured venture funding from both a local investor as well as an angel investor from London, UK. Based on CUHK technologies, they designed and developed a novel blood pressure monitoring device.

CUHK also contributes to establishment of the regional innovation infrastructure, i.e. "Shenzhen-HK Innovation Circle", by setting up a tripartite collaboration with Shenzhen Municipal Government and the Chinese Academy of Science. We jointly established the Shenzhen Institute of Advanced Integration Technologies. Through such a collaboration, CUHK as well as the regional industry, can tap into the huge R&D resources in the Mainland. One of the successful outcomes of SIAT is the rapid development of an omni-directional hybrid electric vehicle, in which all the major parts are based on CUHK and Chinese intellectual properties.

This brochure is compiled to give you a sample list of our applied R&D projects. If you are interested in any of the listed projects, or if there is any area you want to collaborate with our research teams, please feel free to contact us at CINTEC.

今年我們根據中大的五大策略性研究重點領域為展品分類，分別是中國研究、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。中大在這些科研領域已達到劃時代的成就，並為社會帶來莫大的裨益。

我們在科技轉移方面有許多成功的例子。今年，由訊息工程學系李耀斌教授研發的「即時視像轉碼技術」被數碼通公司採納並發展成一套全球首創的「流動互聯網」服務。客戶可透過手機瀏覽互聯網上任何多媒體影像。去年底，由中大四位畢業生創立的香港康利佳醫療科技有限公司成功吸引了本地及英國創投基金注資，支持他們開發基於中大技術的創新血壓測量儀。

中大積極參與推動建設區域性項目例如「深港創新圈計劃」。中大與深圳市政府及中國科學院三方面聯手合作成立了深圳先進技術研究院(SIAT)。這合作項目有助中大和區內業界更有效地利用中國內地龐大的研發資源。SIAT產生的一項成果便是迅速地研製了一輛全方位混合動力汽車，當中大部份零件的設計都是源自中大或國內自主的知識產權。

這小冊子是向大家簡單介紹大學的各個科研項目。若閣下對任何項目感興趣，希望得到更詳盡的資料或有意與我們的科研小組接觸，請隨時聯繫我們。

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生物醫學科學

Biomedical Sciences

Two Formulae for Tackling "Sleep Disorder" and "Post-Stroke Rehabilitation"
治療睡眠失調及中風後期治理的兩劑中藥

Modernization of Chinese Medicine from Clinical Efficacy to Drug Production – Two Innovative Formulae for Comprehensive Research
中藥現代化的道路 - 探討兩創意中藥的臨床效用及生理基理

Prof. LEUNG Ping Chung
Institute of Chinese Medicine
梁秉中教授
中醫中藥研究所

This project is led by Institute of Chinese Medicine of The Chinese University of Hong Kong, and in collaboration with 5 local universities. The 6 universities form a wide collaborative research platform to develop 2 herbal formulae to tackle the clinical challenges of "Sleep Disorder" and "Post-stroke Rehabilitation". The project explores different aspects of the two innovative herbal formulae for their quality control, biological activities and clinical efficacy. The research program under planning includes laboratory work on phytomorphology, phytochemistry, biology, biochemistry and pharmacology, as well as clinical trials based on evidence-based medicine.

Formula for Post-Stroke Rehabilitation: Astragalus membranaceus (Huangqi), Ligusticum chuan-xiong (Chuanxiong), Salvia miltiorrhiza (Danshen), Cassia obtusifolia (Juemingzi), Glycyrrhiza uralensis (Gancao), Angelica sinensis (Danggui), Paeonia lactiflora (Chishao)

Formula for Sleep Disorder: Ziziphus jujuba (Suanzaoren), Polygonum multiflorum (Yejiaoteng), Poria cocos (Fushen), Triticum aestivum (Xiaomai), Anemarrhena asphodeloides (Zhimu), Polygala tenuifolia (Yuanzhi)

(Note: In order to reach a safe and effective result, there are specific weight to various components of the two formulae. Do not drink based on your own modulation.)

項目由香港中文大學中醫中藥研究所領導，並與本港五所大學合作，就各院校之研究專長發展兩條有效方劑以治療睡眠失調症及中風後期的治理，並從事其製作、品質控制、找尋生理影響的根據及臨床實証測試等，進行分工研究。項目透過植物形態學、植物化學、生物學、生化學、藥物學和臨床效果等不同層面的探討，兩方劑的治病機理可望獲得基本的肯定。

治療中風後期藥方：黃耆、川芎、丹參、決明子、生甘草、當歸尾、赤芍

治療睡眠失調症藥方：酸棗仁、夜交藤、茯神、浮小麥、知母、遠志

(註：由於上述藥方各種成分須以特定份量調配，才能安全發揮效用，請勿自行調製飲用。)

Fig. 1

Fig. 2

Fig. 1
Huangqi
黃耆

Fig. 2
Danggui
當歸尾

Applications
應用範疇

1. On a specific scale, the two innovative formulae would have the potential of being developed into drug preparations
   項目中的兩劑創意中藥，具優厚潛力發展為臨床上有效的方劑
2. On a broad basis of development, the two model studies on herbs of a comprehensive nature, would illustrate a practical scientific approach to the modernization of Chinese medicine: building up a solid scientific basis for successful marketing
   宏觀而言，透過不同層面的探討，兩劑創意中藥的治病機理可獲得基本肯定；由此，研究的成果將帶出商機

Target Users
目標用戶

1. Patients who just recovered from a stroke attack on their way to rehabilitation
   中風後期接受康復治療者
2. Patients suffering from primary insomnia
   罹患睡眠失調症之人士

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with University of Hong Kong, Hong Kong University of Science & Technology, City University of Hong Kong, Hong Kong Polytechnic University and Hong Kong Baptist University
由創新科技署資助。合作夥伴為香港大學、香港科技大學、香港城市大學、香港理工大學及香港浸會大學

Prof. QIN Ling
Director of Musculoskeletal Research Center, Department of Orthopaedics & Traumatology

秦嶺教授
肌肉骨骼研究中心主任
矯形外科及創傷學系

A Chinese Medicine for Prevention of Steroid Caused Bone Death
預防激素性枯骨的中藥

R&D of Epimedium-derived-flavonoids-fraction for Prevention of Steroid-associated Osteonecrosis through a Unique Mechanism by Inhibiting both Intravascular Thrombosis and Extravascular Lipid-deposit
預防激素性骨壞死作用機制獨特的淫羊藿黃酮餾分的研發

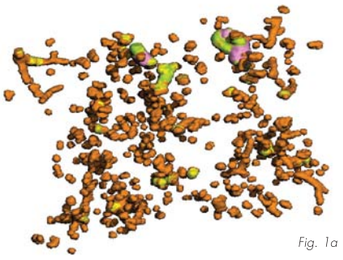

Fig. 1a

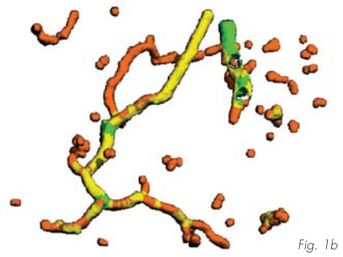

Fig. 1b

The underlying pathogenesis of steroid-associated osteonecrosis (ON) is known to be both intravascular thrombosis-induced occlusion and extravascular lipid-deposit-induced compression. The prevention strategy shall therefore specifically target on those two pathogenic pathways to develop a drug for long-term and safe usage. The investigators have carried out a pilot study and the preliminary findings suggested that a flavonoids, i.e., phytoestrogenic fraction (PF) extracted from a traditionally and safely used 'Bone Strengthening' Chinese herb Epimedium, might prevent steroid-associated ON via inhibiting both intravascular thrombosis and extravascular lipid-deposit. The proposed will systemically investigate PF using our established steroid-associated ON through two specific aims: 1) to evaluate the efficacy profile in relation to PF dosage; 2) to study the action mechanism profile in relation to PF dosage.

激素性骨壞死發病機制涉及骨骼血管內血栓性堵塞和血管外脂肪堆積，造成骨內血供中斷。預防策略應該是同時針對血管內、外涉及的發病機制，研製出可供長期安全使用的藥物。我們一項初步研究發現，傳統安全地應用於中醫臨床的壯骨草藥—淫羊藿的植物雌激素黃酮餾分，可能具有抑制血管內血栓形成和血管外脂肪堆積的作用，達到預防激素性骨壞死。本項目從以下兩個角度有系統地研究淫羊藿的黃酮餾分：劑量與效能的關係和劑量與機制的關係。

Features
特點

To simultaneously target both intravascular and extravascular pathogenic participation events
同時應用於血管內和血栓內和血管外發病機制事件

Applications
應用範疇

To reduce the risk of steroid-associated osteonecrosis in those patients treated with pulsed or long-term steroid
降低接受大劑量激素治療的患者發生激素性骨壞死的風險

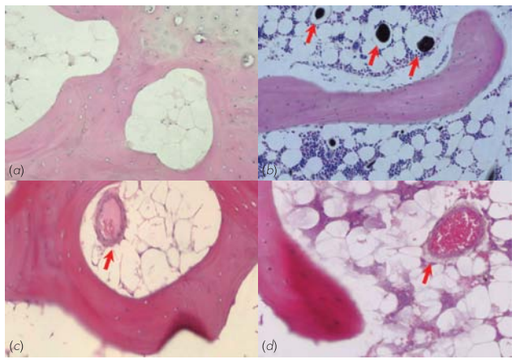

Fig. 2

Fig. 1a
激素性骨壞死模型對照組
Fig. 1b
淫羊藿黃酮餾分預防組
三維顯微CT血管重建證據提示淫羊藿黃酮餾分能夠預防激素導致的局部骨內主幹血管結構的中斷
註解：三維顯微CT血管重建顯示激素誘導的骨壞死模型局部骨內大尺寸的血管造影結構缺失，同時出現大量的無血管形狀的造影劑滲漏樣顆粒，以及由於缺血導的雜亂的新生樣血管，淫羊藿黃酮餾分預防組的局部骨內大尺寸的血管造影結構仍然獲得保留

Fig. 2
病理學證據提示淫羊藿黃酮餾分抑制血栓形成、減少脂肪細胞堆積的數量和尺寸，降低骨壞死發生的風險
註解：骨組織存在大量空的骨陷窩(死骨)，周圍被顯著增大的脂肪細胞包圍，骨髓的細胞成分由於受到增大的脂肪細胞的擠壓而缺失(a)；骨組織存在大量的含有骨細胞的骨陷窩(活骨)，周圍含有被血管造影劑(箭頭)充盈的血管，血管外脂肪細胞尺寸適中，骨髓細胞成分存在(b)；死骨鄰近的骨髓血管內存在機化的血栓(箭頭)，周圍被增大甚至融合的脂肪細胞包圍(c)；活骨鄰近的骨髓血管內存在豐富的紅細胞(箭頭)，沒有發現血栓(d)

Target Users
目標用戶

Patients treated with pulsed or long-term steroid
接受大劑量或長程激素治療的患者

Award and Patent
獎項及專利

USA patent in application
美國專利正在申請中

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission
由創新科技署資助

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Non-invasive Prenatal Detection of Down Syndrome
無創傷性產前唐氏綜合症檢測

Development of Molecular Strategies for the Non-invasive Prenatal Detection of Down syndrome
無創傷性產前唐氏綜合症之檢測

Down syndrome is the predominant reason why many pregnant women opt for prenatal diagnosis. At present, the major methods for prenatal diagnosis, such as chorionic villus sampling and amniocentesis, are invasive with a finite risk to the mother and unborn baby. We discovered the presence of fetal nucleic acids in maternal blood plasma. In this project, we used a mass spectrometry-based method to identify molecular markers which would allow us to identify the presence of a baby affected by Down syndrome, just by analyzing peripheral blood of the mother.

唐氏綜合症是很多婦女選擇產前診斷的原因。現今很多產前診斷的方法，如絨膜絨毛取樣及羊膜穿刺術，是具創傷性的，並有可能對母親和胎兒有不良的影響。我們發現胎兒會於懷孕期內釋放胎兒核酸到母親的血漿內。本項目提出利用質譜儀技術來發展出新的分子標記，以確定胎兒是否患有唐氏綜合症。

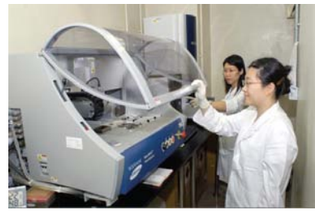

Fig. 1

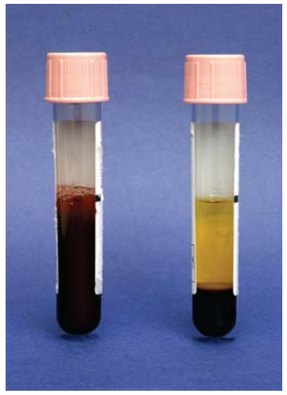

Fig. 2

Fig. 1
State-of-the-art technologies, like mass spectrometry, are employed in the research project
這研究項目利用了現代的檢測技術，如質譜儀

Fig. 2
To separate plasma from blood cells by centrifugation
使用離心機將血細胞及血漿分開

Fig. 3
RNA expressed by the placenta are detectable in maternal plasma and could be targeted for the development of non-invasive tests for the prenatal diagnosis of Down syndrome
胎盤組織表達的基因會釋放於母親的血漿內，從而可用作發展無創傷性唐氏綜合症產前的檢測

Features
特點

Allow the testing of Down Syndrome based simply on maternal blood sampling to prevent traditional risks of testing which may potentially be applied to 54,000 pregnancies in Hong Kong every year.
醫生只需利用母親的血液就可以安全地檢測胎兒，從而免卻了傳統檢測的危險。令每年懷孕的五萬四千名香港婦女得到更安全的產前檢測服務。

Testing procedures are as follows:
檢測程序如下：

1. Blood separation 分血
   To separate plasma from blood cells by centrifugation
   使用離心機將血細胞及血漿分開
2. RNA extraction 抽取核糖核酸
   To extract RNA from plasma using the spin column technology
   利用離心柱技術抽取血漿中的核糖核酸
3. Amplification 倍量化
   To amplify extracted RNA using the RT-PCR technique
   利用逆轉錄聚合酶鏈反應技術增加核糖核酸的數量
4. Mass spectrometry 質譜儀
   To detect chromosome 21-specific RNA single nucleotide polymorphism (SNP)
   檢測第21條染色體的核糖核酸的單核苷酸多態性
5. Data analysis 資料分析
   To calculate the ratio of paternal vs. maternal allele based on the RNA SNP
   根據核糖核酸的單核苷酸多態性計算出父方及母方的等位基因比例
   Deviation from the normal ratio (1:1) may indicate the presence of a Down syndrome fetus
   如比例分析不正常(1:1)，胎兒便可能患有唐氏綜合症

Applications
應用範疇

Non-invasive prenatal diagnosis of fetal Down syndrome
胎兒唐氏綜合症無創傷性產前檢測

Target Users
目標用戶

The non-invasive strategies could potentially be applicable to all pregnant women interested in prenatal diagnosis of fetal Down syndrome
所有擔心胎兒受唐氏綜合症影響的孕婦都有可能成為新檢測的應用對象

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission
由創新科技署資助

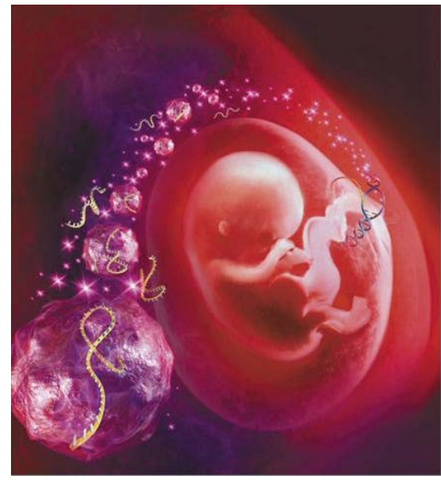

Fig. 3

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Accurate Blood Test for Hepatocellular Carcinoma
準確的肝癌血液測試

Accurate Blood Test for the Detection and Monitoring of Hepatocellular Carcinoma
準確診斷及監察肝癌的血液測試

Hepatocellular carcinoma (HCC) is the second commonest cancer in Hong Kong. Unfortunately, most HCC patients present with advanced disease are not qualified for curative-intent treatment. In this project, we target to develop a blood test for the early detection of HCC by detecting cancer-derived DNA changes in plasma.

肝癌是香港第二最常見的癌病。可惜，只有少數病人能在早期診斷出來並接受以根治為目標的治療。因此，在是次項目中，我們將開發一種新的測試技術，從肝癌患者的血液中偵測及量度癌症基因。這新技術將大大提高診斷肝癌測試的準確性。

Features
特點

1. Non-invasive test
   非入侵性的檢驗
2. Can be used in conjunction with existing tests
   可結合現存的測試使用

Applications
應用範疇

1. Screening of HCC in asymptomatic high risk individuals, e.g. chronic viral hepatitis carriers
   對於肝癌高危族，例如，慢性肝炎帶菌者，及早診斷肝癌
2. Monitoring of HCC patients after surgical resection of the cancer
   監察肝癌的治療效果，並且及早診斷肝癌復發
3. Prognostication of HCC patients before and after treatment
   預測肝癌的治療結果

Target Users
目標用戶

1. Individuals with high risk of developing HCC, e.g. chronic hepatitis B carriers (10% of the Hong Kong population are chronic hepatitis B carriers)
   肝癌高危族，例如，慢性肝炎帶菌者(香港十分之一的人口為慢性乙型肝炎帶菌者)
2. Patients with confirmed HCC
   肝癌病人

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission
由創新科技署資助

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Surface Plasmon Resonance Biosensors
等離子共振生物分子感測器

Biosensor Arrays Based on Surface Plasmon Resonance Phase Imaging
採用二維等離子共振技術生物感測器

InSPROA (Instant Surface-Plasmon-Resonance Optical Analyzer) is an innovative piece of equipment for real-time study of biomolecular interaction. Detection of bio-molecular interaction is based on a physical phenomenon called Surface Plasmon Resonance. By monitoring the phase change of a laser beam caused by the presence of target molecules, InSPROA achieves outstanding sensitivity an order of magnitude better than any of the commercially available equipment.

InSPROA(表面等離子體共振即時光學分析器)是一個即時研究生物分子互動作用的嶄新設備。測試生物分子互動作用是基於一種物理現象稱為表面等離子體共振。透過監測因目標分子存在而引發相位轉變的激光束。InSPROA能達致市場同類型商品更為優秀的極高靈敏度。

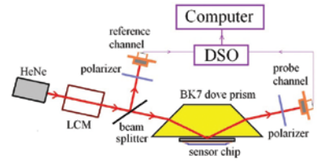

Fig. 1

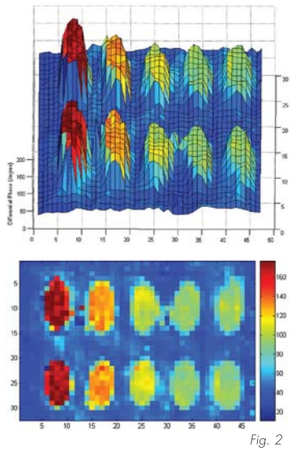

Fig. 2

Fig. 1
Schematic diagram
結構示意圖

Fig. 2
SPR phase map recorded from a 10-element sensor array in which individual elements are exposed to salt-water mixtures of different salt concentration. With InSPROA, one can perform parallel SPR sensing of a large number of different analytes using a 2-dimensional matrix of sensor elements.
表面等離子共振相位圖像紀錄十個感應器上的個別物質在接觸到不同鹽水濃度的溶液後的變化。InSPROA運用二維表面等離子共振技術對測試樣本進行二維同步測試，在進行大量樣本測試時尤其便利。

Features
特點

1. Sensitivity 10x times higher than the best available in market
   敏感度比市場同類型產品高出十倍
2. Very fast test cycle achievable by outstanding sensitivity
   透過極高靈敏度達致極速測試周期
3. No fluorescent or any label required
   無需熒光或任何標籤
4. Ideal for studying protein interaction and drug discovery
   適合用於研究蛋白質互動作用及藥物測試
5. Cost effctive and easy-to-produce photonic biosensor structure
   具成本效益及易於生物的光子生物檢測結構
6. Patent pending phase based SPR measurement
   專利註冊的表面等離子體共振相位差量技術

Applications
應用範疇

InSPROA is best used for analysis of biomolecular interaction such as virus study, antibody-antigen study, DNA and protein study. Example applications of InSPROA are:
InSPROA能有效分析生物分子的相動作用，如病毒研究、抗體抗原研究、脫氧核糖核酸(基因的基本成分)和蛋白質的研究。InSPROA的應用例子為：

1. Antibiotics Efficacy Testing 抗生素療效測試
   InSPROA can be used for rapid immunoassay and antibiotics efficacy testing. Thanks to the outstanding sensitivity of InSPROA, effectiveness of antibiotics in dealing with virus under test can be confirmed within a couple of hours, whereas 3-4 days may be required with other techniques. Multi-channel simultaneous testing is possible in InSPROA
   InSPROA可應用於快速免疫分析及抗生素療效測試。全靠靈敏度極高的InSPROA，可在幾小時內確認不同抗生素對抗所測試的病毒效能，而其他方法卻需要長達三至四天時間。InSPROA亦可同時進行多管道同時測試
2. Water Quality Monitoring 水質監測
   InSPROA may be used for real-time continuous monitoring of water quality against hazardous impurities or contaminations
   InSPROA可針對水中有害雜質或污染物作即時連續性水質監測
3. Food Analysis & Drug Discovery
   食品分析及藥物測試
   InSPROA is a sensitive and cost-effective analytic instrument for studying protein, DNA, and bio-molecular interactions. With its labelfree and supreme sensitive measurement, it is an ideal research tool for drug discovery and food analysis. It will be an excellent alternative for instruments based on radioisotope or fluorescentHabeling techniques
   InSPROA是一部靈敏度高和具成本效益的分析儀器。可應用於研究蛋白質、脫氧核糖核酸及生物分子互動作用。其無標籤和極高靈敏度的量度，是一個測試藥物和分析食品的理想研究工具。它應該是取代放射性同位素或熒光標籤技術的另一個極佳選擇

Target Users
目標用戶

Clinics and medical institutions
診所及醫療機構

Funding Source and Collaboration
資助來源及合作夥伴

Collaboration with The Institute for Lasers, Phtonics 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, Phtonics and Biophotonics及中國清華大學物理系

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Near-Infrared Spectrophotometer for Measuring Blood Oxygen Level
測量血液含氧量的近紅外光譜儀

The Miniaturized Duel-Channel Tissue Oximeters based on Near-Infrared Spectroscopy
以近紅外吸收光譜為基礎的血氧儀

The principal objectives of this project are to develop a dual-channel oximeter (for measuring the blood oxygen level) and the 2D imaging prototypes based on Near-Infrared Spectroscopy using near-infrared laser diodes and photodetectors. This will significantly increase the potential clinical applications for this device module which will facilitate blood oxygen level monitoring as well as screening, diagnosis and monitoring of a wide range of other disease processes.

此項目旨在於開發以近紅外吸收光譜為基礎的雙通道血氧儀和2D的血氧儀樣機。這將會顯著提高這種儀器的臨床應用，不僅簡化對血液含氧量的監測，同時亦有助於對較廣範圍的其他疾病進程的篩查、診斷和監測。

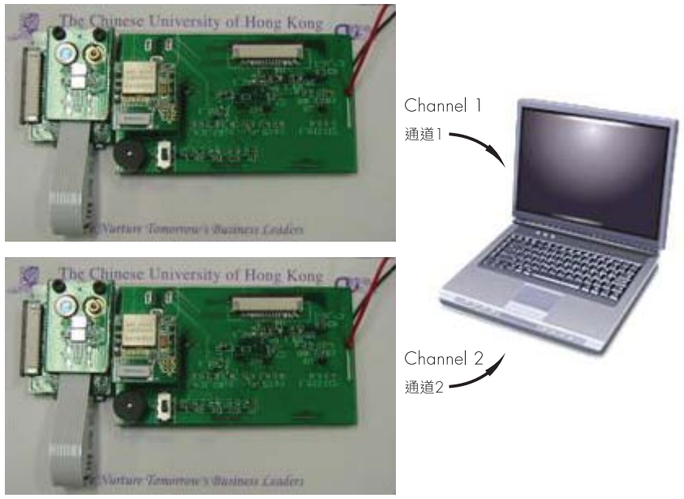
Features
特點

1. Harmless and non-invasive
   無害性及無侵略性
2. Wireless and compact
   無線及小巧
3. Low cost and easy to use
   低成本及方便使用

Applications
應用範疇

Such a device may have a significant impact on both hospital and clinic based medical diagnostics and monitoring practice. Since it is compact and its potential cost is low, it could also be used for home health care applications
此儀器對於醫院或診所內的醫學診斷和監測工作都有重要幫助。因為它小巧而且低成本，相信也可以應用於家庭保健護理

The prototype dual channel oximeter
雙通道血液濃度計原型



Target Users
目標用戶

1. Hospitals and Clinics
   醫院及診所
2. Home health care
   家庭保健護理

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with Vitalink Industry (Shenzhen) Co Ltd and Precis Nanotechnology (Shenzhen) Co Ltd
由創新科技署資助。合作夥伴為維達力實業(深圳)有限公司以及Precis Nanotechnology (Shenzhen) Co Ltd

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Body Sensor Networks for Monitoring of Physiological Signals
監控生理信號的軀域傳感網絡

M-Health: Wearable Body Sensor Networks for the Noninvasive and Continuous Tele-monitoring of Physiological Signals
移動醫療：可實現生理信號遠程監測的穿戴式軀域傳感網絡

For the benefits of the aging population who are often non-hospitalized patients having chronic diseases, we proposed in this project to develop and build an innovative body sensor network (BSN) connecting wearable devices into a hands-free system that can be easily worn on home-users for tele-monitoring of physiological parameters, especially blood pressure (BP) and blood pressure variability (BPV) overnight.

為改善老齡人群慢性疾病的長期監測問題，本項目將研製一種全新的軀域傳感網絡，用於連接監測血壓變異性和其它生理參數的穿戴式生物醫學傳感器，以實現無需雙手操作、可在睡眠時進行血壓監測的系統。

Features
特點

1. A hands-free system
   無需雙手操作
2. Continuously monitoring
   連續性監測
3. Remote monitoring
   遙控監測

Applications
應用範疇

1. Overnight blood pressure (BP) and blood pressure variability (BPV) monitoring of patients
   無需雙手操作及非侵入式的連續血壓監測，例如可監測病人血壓和血壓變異性的病床
2. Tele-monitoring of physiological parameters by using body sensor network
   利用軀域傳感網絡遠程監測生理參數

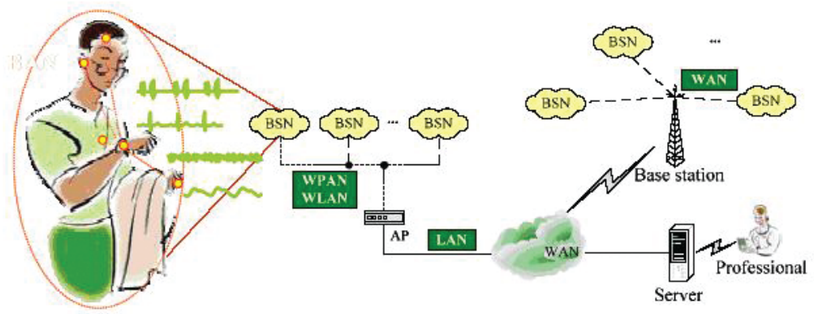

Fig. 1

Fig. 1
Systematic architecture of a BSN for m-health
用於移動醫療系統的軀域傳感網絡結構示意圖

Target Users
目標用戶

1. Aging population
   長者
2. Hypertension population
   高血壓人士

Award and Patent
獎項及專利

VCCI Cup in Vice-Chancellor's Cup of Student Innovation 2007 - with the project "A body sensor network for continuous blood pressure monitoring and hypertension treatment"
二零零七年香港中文大學校長杯學生創新比賽獲得校長杯，項目名稱為“可用於連續測量與治療高血壓的區域網”
Patent in application
專利正在申請中

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with Jetfly Technology Ltd, Bird International Ltd, Golden Meditech Company Ltd
由創新科技署資助。合作夥伴為香港捷飛科研有限公司、波導國際有限公司及金衛醫療科技有限公司

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Cuffless Blood Pressure Measurement and Non-drug Treatment Device
穿戴式血壓測度及非藥物醫療儀器

Cuffless Blood Pressure Measurement and Non-drug Hypertensive Therapeutic Device
穿戴式血壓測量和高血壓非藥物治療儀器

This project aims at developing technologies to produce wearable devices for the monitor, diagnosis, and treatment of chronic diseases. They are useful for the healthcare of aging population and the new bio-model-based approach enables the cuffless design of electronic device for quantifying the arterial Blood Pressure Variability (BPV) non-invasively and continuously. A novel hybrid non-drug hypertensive therapeutic solution is proposed.

本項目旨在發展適用於長者和慢性病患者的集合監測、診斷及治療於一體的穿戴式醫療儀器，提出一種基於生物模型的無袖帶式、無創、連續血壓變化率測量新方法，另開發一種新型高血壓非藥物治療方案。

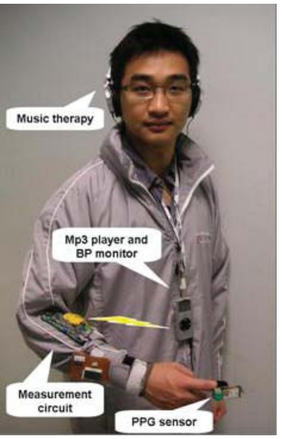

Fig. 1
Design of the cuffless BP measurement and non-drug hypertensive therapeutic device
無袖帶血壓測量和高血壓非藥物治療裝置的設計

Features
特點

1. Cuffless blood pressure measurement
   無袖帶式血壓測量
2. Cuffless devices (PDA, watch, mobile phone, MP3 player) to quantify the beat-to-beat variation of arterial blood pressure (BP) non-invasively and continuously
   無袖帶式無創連續監測血壓變化率儀器(PDA、手錶、流動電話和MP3)
3. Adaptive bio-feedback mechanism
   自適應生物反饋技術
4. Non-drug treatment solution – music therapeutic function
   非藥物治療 - 音樂治療功能
5. When the device detect user's blood pressure has increased to a certain level, it will automatically play therapeutic music to relax user in order to decrease his/ her blood pressure until back to normal
   高血壓非藥物治療設備：當儀器測量到使用者的血壓上升到一定指標，便會啟動MP3播出治療音樂令使用者放鬆，從而降低使用者的高血壓，直至回復正常

Target Users
目標用戶

1. Aging population
   長者
2. Population with chronic diseases, especially those suffering from hypertension
   慢性病人，尤其是高血壓患者

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with Golden MediTech Company Ltd., Bright Steps Corporation, Bird International Ltd., Sun Yat-sen University and Tsinghua University
由創新科技署資助。合作夥伴為金衛醫療科技有限公司、Bright Steps有限公司、波導國際有限公司、中山大學及清華大學深圳研究生院

Award and Patent
獎項及專利

1. Carmen CY Poon won the 1st prize of "IFMBE Outstanding Chinese Student Award" at the 27th Annual International Conference of IEEE Engineering in Medicine and Biology, Shanghai, September 2005
   潘頌欣獲得二零零五年第廿七屆IEEE-EMBS國際年會IFMBE最佳中國學生論文一等獎
2. The Golden Health team, supported by the cuffless BP measurement technique, won the 2nd prize in the Vice-Chancellor's Cup of Student Entrepreneurship Competition 2005 and won the 1st prize in "e-challenge 2005" organized by the Young Entrepreneurs Development Council (YDC) of Hong Kong
   在本項目無袖帶血壓測量技術的支持下，Golden Health團隊參加了二零零五年香港中文大學校長杯學生創業競賽，獲得二等獎及榮獲二零零五年青年企業家發展局"E-Challenge"競賽冠軍
3. BAO Shu Di won the "Young Investigator Award (YIA)" and "YIA Best Presentation Award" at the 6th Asia-Pacific Conference on Medical and Biological Engineering in 2005
   鮑淑娣獲得二零零五年第六屆亞太地區生物醫學工程大會青年研究者獎及青年研究者最佳報告獎
4. WONG YM Mico was awarded the "YIA Applicants Encouragement Award" at the 6th Asia-Pacific Conference on Medical and Biological Engineering in 2005
   黃綺雯獲得二零零五年第六屆亞太地區生物醫學工程大會青年研究者獎

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Wireless Multifunction Stethoscope
無線多功能聽診器

An Innovative Wireless Multifunction Stethoscope with its Applications in Telemedicine and Home Healthcare
新型無線多功能聽診器及其在遠程醫療和家庭保健中的應用

This project aims at developing an innovative, affordable and effective telemedicine system. It includes noise-resistant electronic stethoscopes and continuous blood pressure meters with improved patient comfort. They are wearable wireless multifunction monitors for noninvasive and remote measurements of vital signs, including heart sound, lung sound, blood pressure, and electrocardigram signals.

本項目旨在發展一套創新有效的低成本遠程醫療保健系統，例如可抗噪聲干擾的電子聽診器以及改善用戶舒適度的連續血壓測量儀等。這些可穿戴式無線多功能監護儀可提供心音、肺音、血壓及心電信號等關鍵生理參數信息。

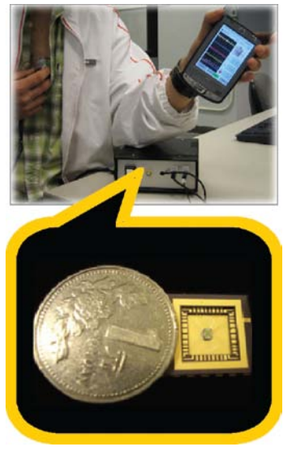

Fig. 1
The chip designed for the key measurement unit
為關鍵測量單位而設計的晶片

Features
特點

1. Separation of heart and lung sounds
   聽診器的心肺音分離
2. Continuous monitoring of arterial blood pressure and other physiological parameters based on the stethoscope design
   使用電子聽診器連續監測動脈血壓以及其他生理參數

Applications
應用範疇

1. Home healthcare and remote health monitoring
   家庭醫療保健以及遠程健康監測
2. Hospital teaching
   醫院教學

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with Bird International Ltd, Daka Development Ltd, E-care Company Ltd, Hong Kong Health Care Services Ltd, City University of Hong Kong (Prof TSO Siu Kit, Department of Manufacturing Engineering and Engineering Management) and The Chinese University of Hong Kong (Prof NG Ho Keung, Telemedicine Center)
由創新科技署資助。合作夥伴為波導國際有限公司、Daka Development Ltd、E-care Company Ltd、香港保健服務有限公司、香港城市大學(曹紹傑教授、製造工程和工程管理學系)及香港中文大學(吳浩強教授、遠程醫療中心)

Target Users
目標用戶

Hospitals, clinics, retirement homes, chronic or long-term disease sufferers and also individuals, who are concerned about their own health and fitness, will be the main target user groups
醫院、診所、退休長者、長期慢性病患者以及對自己健康較關注的人群將是主要的目標用戶

Award and Patent
獎項及專利

1. CUHK Vice-Chancellor's Cup of Student Innovation 2005 - with the project "A Novel Wireless Multifunctional Device for Tele-monitoring of Physiological Signals"
   二零零五香港中文大學校長杯學生創新比賽獲得校長杯，項目名稱為"一種新型無線多功能遠程生理參數監測裝置"
2. First Class Award in the 9th Challenge Cup - with the project "A Novel Wireless Multifunctional Device for Tele-monitoring of Physiological Signals"
   第九屆"挑戰杯"全國大學生課外活動學術科技作品競賽一等獎，項目名稱為"一種新型無線多功能遠程生理參數監測裝置"

Patented
已擁有專利

Prof. CHAN Kai Ming
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機械與自動化工程學系

Sensor System for Ankle Sprain
防足踝扭傷感測系統

Development of an In-shoe Sensor System for Real-time Ankle Supination Torque Measurement in a Sprain-free Running Shoe
防足踝扭傷智能跑鞋的內置即時踝關節外翻力矩傳感監測系統的設計

The research team proposes an innovative intelligent sprain-free shoe to prevent ankle sprain with a three-step mechanism: (1) Sensing; (2) Identification; and (3) Correction. The first part of this proposal develops an in-shoe wireless sensor system to detect external forces and ankle motion, and to estimate ankle supination torque during running.

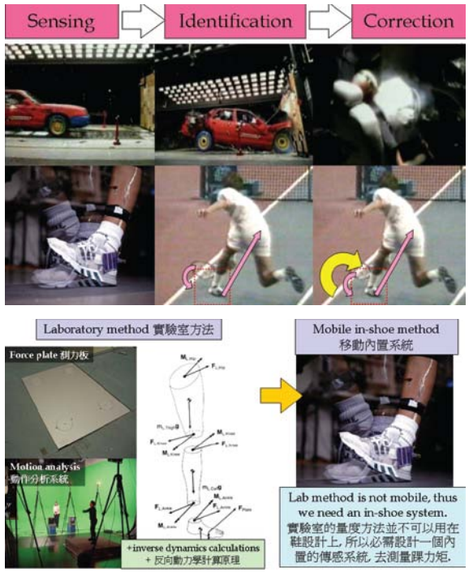
本研究組正設計防足踝扭傷智能運動鞋，它的機制可分為(一)感應，(二)識別，及(三)修正。本課題研發第一部份，開發一個內置於運動鞋的傳感系統，以感應足踝外在作用力及動作，及計算足踝外翻力矩。

Features
特點

This study employs pressure and motion sensors in human biomechanics calculation which is traditionally done in laboratory and could hardly be done on-field
這研究應用了壓力及動作傳感器以計算人體運動力學，並把這傳統實驗室技術移至運動場地應用

Applications
應用範疇

The technology is useful for the development of the sprain-free sports shoes which aims to reduce ankle sprain incidence during running
這研究成果將用於開發防足踝扭傷運動鞋，以減低跑步時足踝扭傷的發生率及所產生的危險



Target Users
目標用戶

In short term, the target users will be sensor company and footwear company that develop the sprain-free shoe. In long term, the final users will be recreational participants in sports, especially in running and marathon runner
短期用戶包括傳感器及鞋產品工業，以發展防足踝扭傷智能跑鞋。最終用戶是運動參與者，特別是跑步及馬拉松參加者

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with Hong Kong Polytechnic University (Prof ZHANG Ming, Health Technology and Informatics), Sengital Ltd and Dr Kong Footcare Ltd
由創新科技署資助。合作夥伴為香港理工大學(張明教授,醫療科技及資訊學系)、Sengital Limited以及 Dr Kong 足健科研開發有限公司

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Airbag Systems for Reduction of Fall-Induced Injuries
防止跌倒引致骨折的隨身安全氣囊

Mobile Human Airbag System for Reduction of Fall-Induced Injuries based on MEMS Motion Recognition Technology
以微機電系統移動測量技術為基礎之流動安全氣囊系統

Fall-induced hip fractures are very common among the elderly. In Hong Kong, there are 4,000 cases per year. This leads to HK$150 million medical and rehabilitation expenditure.
Current hip protectors are made of hard plastic or soft foam which is uncomfortable and inconvenient to wear. This Mobile Human Airbag System is designed to overcome this problem.
The sensor can detect the fall and trigger the airbag to protect the user against impact.

長者因跌倒引致的髖關節骨折是很常見的。香港每年有多達四千個案例，相關的醫療及康復支出每年高達一億五千萬港元。
目前市面上的髖關節保護產品皆由塑膠或泡沫塑料製成，由於配戴起來並不舒服和方便。這設計輕巧的移動安全氣囊系統就是解決這個問題。
當使用者跌倒時，感測器可偵測下跌過程並啟動安全氣囊來保護使用者。

Fig. 1

Fig. 1
The hip is protected by air-bag system
安全氣囊系統提供髖關節保護

Fig. 2
Air-bag System
安全氣囊系統

Features
特點

1. MEMS-based Motion Sensing Technology
   微機電系統為基礎之慣性測量技術
2. Novel Mechanical Air-release mechanism design
   新型機械空氣發放設計
3. Advanced Human-motion Recognition Algorithms
   先進人體活動識別演算法
4. Belt packet airbag design - slim and flexible
   腰帶式安全氣囊設計 - 輕巧、具彈性
5. Fall is detected by the sensor and the projected air-bag can instantly protect the user against impact
   當感測器偵測跌倒時，安全氣囊便迅速啟動來保護使用者

Applications
應用範疇

Hip Protection for elderly
保護長者髖關節

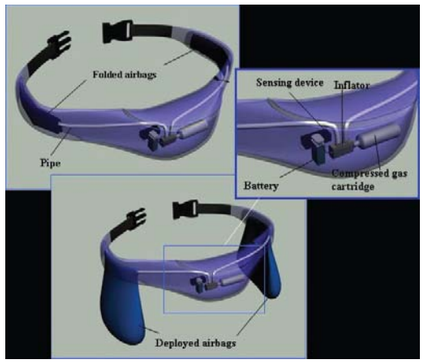

Fig. 2

Target Users
目標用戶

The elderly
長者

Award and Patent
獎項及專利

The 1st runner-up winner (postgraduate individual category) of the Vice-Chancellor's Cup of Student Innovation (VCCI) of The Chinese University of Hong Kong in 2007
二零零七年香港中文大學校長杯亞軍(研究生個人組別)

Funding Source and Collaboration
資助來源及合作夥伴

Funded by The Chinese University of Hong Kong and Innovation and Technology Commission
由香港中文大學及創新及科技署資助

Prof. LEUNG Kwok Sui
Department of Orthpaedics and Traumatology
梁國穗教授
矯形外科及創傷學系學系

Vibration Platform for Skeleton Strengthening
強化骨骼震動治療平台

An Innovative Magnetic Levitating Vibration Platform for the Application of Low Magnitude, High Frequency Whole Body Vibration Stimulation
提供全身高頻微震刺激的創新性磁浮震動平台

Fig. 1

This project aims to develop a new vibration platform using magnetic levitation for skeleton strengthening. Conventional platforms usually employ complicated mechanics that are high cost. Our new design is both innovative and simple, and achieves high energy efficiency, low maintenance, low noise and low cost.

本項目旨在發展一種建基於磁浮作用強化骨骼的新型震盪平台，用以強化骨骼。傳統震盪平台因使用複雜的機械結構而導致高成本。本設計使用既創新又簡單的新結構，從而達致高效能、低維護、低噪音及低成本。

Fig. 2

Fig. 1
The first prototype is a miniature version vibration platform, suitable for research study with small animals
最初的原型機是小型震盪平台，適合用小動物作研究試驗

Fig. 2
A large version vibration platform prototype has been developed for human use
已製成的大型震盪平台原型，適合應用在人體上

Fig. 3
Testing of the effect of vibration stimulation using rats and the miniature vibration platform
圖中正以白老鼠在小型平台上測試震盪刺激作用

Features
特點

This product is unique in using magnetic repulsion to float the vibration platform and human body above the ground. This reduces mechanical friction, making the system highly energy efficient, less prone to wear-out, and quiet in operation.
本產品特別使用了磁斥力來使平台和人體浮起，有效減少系統的機械摩擦，既節省能源，又降低磨損，更能安靜地運作

Applications
應用範疇

1. Prevention and treatment of osteoporosis
   預防及治療骨質疏鬆
2. Improvement of blood circulation
   改善血液循環
3. Improvement of muscle functions such as jumping power and balance control
   提昇肌肉功能，例如彈跳力和平衡力
4. Relief of low back pain
   減輕背痛

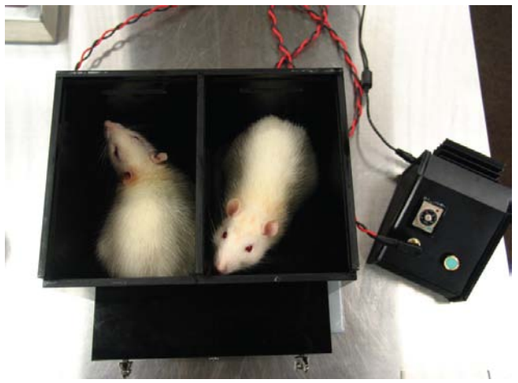

Fig. 3

Target Users
目標用戶

1. Elderly with osteoporosis or muscle wasting
   有骨質疏鬆症或肌肉萎縮的老年人
2. Post-menopausal women with low bone mass or osteoporosis
   有低骨量或骨質疏鬆症的絕經後婦女
3. Patients lacking exercise due to injuries
   因受傷而缺乏運動的病人
4. Athletes needing muscle training
   需要鍛練肌力的運動員
5. The general public who are concerned about their health
   關注自己健康的一般人士

Award and Patent
獎項及專利

The 2nd runner-up winner (postgraduate individual category) of the Vice-Chancellor's Cup of Student Innovation (VCCI) of The Chinese University of Hong Kong in 2007
二零零七年香港中文大學校長杯季軍(研究生個人組別)
Patent in application
專利正在申請中

Prof. HENG Pheng Ann
Department of Computer Science and Engineering
王平安教授
計算機科學與工程學系

Virtual Acupuncture
虛擬針灸

We have developed an advanced information system for Chinese acupuncture learning and training. A detailed virtual acupuncture digital human model has been reconstructed from Chinese Visible Human dataset. Having integrated with photorealistic anatomical data, our open and comprehensive information-enhanced digital platform can facilitate modern research in Chinese medicine.

我們開發出一套輔助學習及訓練針灸學的高新技術系統。採用中國虛擬人體資料集，我們重建出高精度虛擬針灸人體數字模型；配合解剖數據，開放式的人機交互數字平台更可推動中醫學研究。

Features
特點

1. Interactive meridian system visualization
   互動經絡系統可視化
2. Multi-planar anatomical dissection of acupoints
   任意角度腧穴斷面
3. Common diseases-therapy information
   針灸臨床常見病治療資訊
4. Needle insertion training
   針刺模擬訓練

Applications
應用範疇

Acupuncture education, clinical applications, biomedical and digital human research
針灸教學、臨床及科研的許多領域

Fig. 1

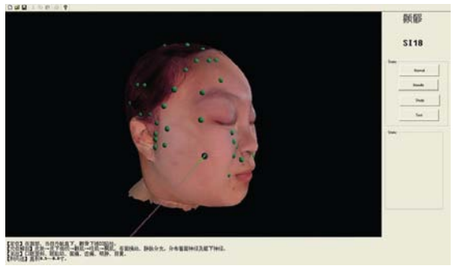

Fig. 2

Fig. 1
Anatomy details under the acupuncture point
腧穴下之解剖細節

Fig. 2
Needle puncture training
腧穴針刺模擬訓練

Fig. 3
User interface of our virtual acupuncture
虛擬針灸使用者介面

Target Users
目標用戶

Chinese Medicine students and practitioners
中醫學生及醫師

Award and Patent
獎項及專利

1. First Award in the 9th Challenge Cup
   第九屆挑戰盃賽一等獎
2. Gold Award in the 7th IT Excellence Awards (Post-Secondary)
   第七屆資訊科技卓越成就獎(大專組)金獎
3. APICTA 2005 – winner of RAD category
   亞太地區資訊與通訊技術展二零零五 - 研發類冠軍

Funding Source and Collaboration
資助來源及合作夥伴

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

Fig. 3

Prof. HENG Pheng Ann
Department of Computer Science and Engineering
王平安教授
計算機科學與工程學系

Virtual Anatomy
虛擬解剖

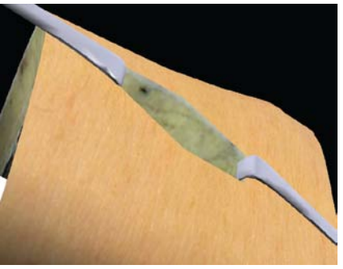

Fig. 1

By utilizing processed and compressed visible human datasets e.g. Chinese Visible Human (CVH) data, we have developed a virtual anatomy system which unveils extra-fine anatomic details on a consumer-graded PC. Having segmented and labeled different tissues, our visualization system can make the interactive anatomical exploration vital.

採用經處理及壓縮的虛擬人體資料集，如中國虛擬人，我們開發出一套可於普通個人電腦上實時地進行的虛擬解剖系統。透過分割及標示不同解剖組織，我們的可視化系統可讓使用者以互動形式在虛擬環境中探索人體的結構。

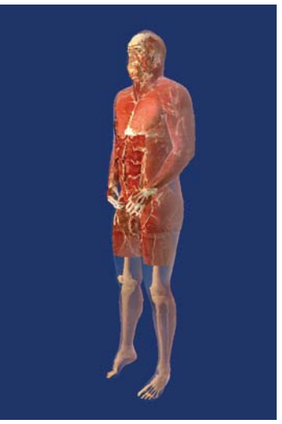

Fig. 2

Features
特點

1. Hardware-accelerated quality rendering on a consumer-graded personal computer
   利用硬體加速描繪，提升普通個人電腦上的圖像效果
2. Real-time photo-realistic anatomical visualization
   實時解剖圖像可視化
3. Interactive multi-planar reconstruction (MPR) of anatomic structures
   解剖結構的互動多平面重建
3. Automated anatomical annotation
   自動文字註釋

Applications
應用範疇

General anatomy education, cornerstone for medical simulations
一般解剖教學、手術模擬系統

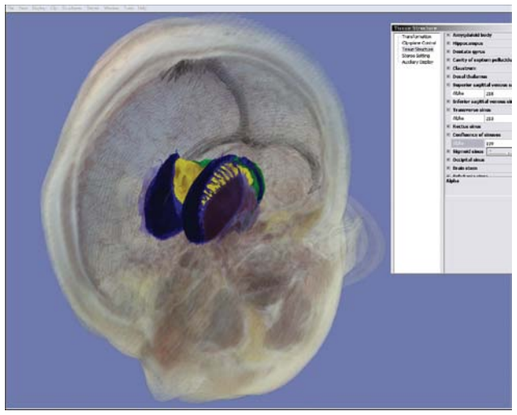

Fig. 3

Fig. 1
Application of the upper limb anatomic model on orthopedics training
虛擬上臂解剖模型於訓練整形外科的應用

Fig. 2
Layered visualization of the American Visible Man dataset
美國可視人的多層次可視化

Fig. 3
MPR visualization of the virtual brain region
虛擬大腦多平面重建

Target Users
目標用戶

Medical/Healthcare practitioners and students, radiologists, surgeons
醫療或保健人員及學生、放射治療師、外科醫生

Award and Patent
獎項及專利

Certificate of Merit
RSNA2004 InfoRAD Exhibit Award

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Shun Hing Institute of Advanced Engineering. Collaboration with Department of Anatomy (CUHK), CUHK Jockey Club Minimally Invasive Surgical Skills Centre (Department of Surgery, CUHK) and Department of Orthopaedics and Traumatology (CUHK)
由信興高等工程研究所資助。合作夥伴為香港中文大學解剖學系，香港中文大學賽馬會微創醫療技術培訓中心(外科學系)及香港中文大學矯形外科及創傷學系

Prof. LEUNG Kwok Sui
Department of Orthopaedics and Traumatology
梁國穗教授
矯形外科及創傷學系

SMARTWARD
「智能病房」

Most hospitals in Hong Kong follow a paper-based ward management process. Recently, the Department of Orthopaedics and Traumatology created a proprietary application system called SMARTWARD. It uses a mobile computing platform together with the integration of biosensors to replace the paper-based process and to facilitate the reporting, tracking, diagnosis and analysis of patient information and to provide better patient care.

由香港中文大學「矯形外科及創傷學系」發起及研發的「智能病房」項目，是以流動電腦配合生理傳感器構建而成的應用系統，它替代傳統以紙張紀錄方式記錄病歷。為病房提供簡便而全面的電子化病人資訊查詢、診斷和分析，藉此提供更好的病人護理服務。

Fig. 1

Fig. 2

Features
特點

This is a clinical management project with multiple direct patient benefits. The availability of the systematic and comprehensive clinical database will also facilitate clinical research audits
這是一個臨床管理項目，不但病人能直接受惠，全面而且具系統性的臨床資料庫將促進臨床研究和臨床審計

Applications
應用範疇

1. Manage patients' demographic information
   處理病人資料及統計資訊
2. Monitor vital signs of patients measured by Biosensors, sent wirelessly to SMARTWARD patient database and alert clinicians of deteriorating patients' conditions
   監測病人的生理狀況，由生理傳感器測量，然後經無線傳送到「智能病房」中的病人資料庫並於病人生理出現惡化情況時發出提示
3. Real-time analysis and graphic presentations of patient progress as indicated by different vital signs
   由不同的生理狀況表，實時分析病人康復進度
4. Wards resource management
   病房資源管理

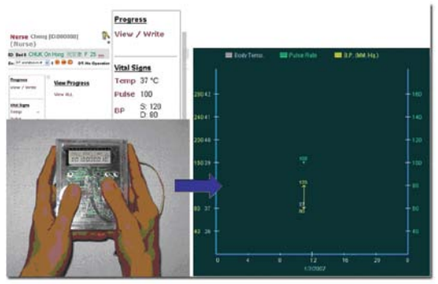

Fig. 3

Fig. 1
SMARTWARD
智能病房

Fig. 2
Pen-based Computing Platform
基於以筆手寫操作而設計的計算平台

Fig. 3
Integrated with Biosensor
結合生理傳感器

Funding Source and Collaboration
資助來源及合作夥伴

Collaboration with Department of Computer Sciences and Engineering, Department of Electronic Engineering and Electronic Services Unit, The Chinese University of Hong Kong
合作夥伴為香港中文大學計算機科學與工程學系、電子工程系及電子服務部

Prof. HENG Pheng Ann
Department of Computer Science and Engineering
王平安教授
計算機科學與工程學系

Virtual Reality Based Simulator for Training Percutaneous and Transcatheter Procedures
透視微創治療虛擬訓練系統

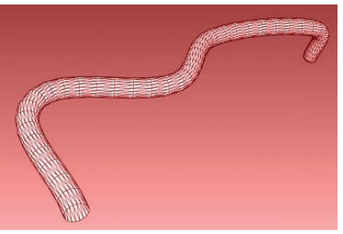

Fig. 1

The demand of Vascular Interventional Radiology (VIR), an indispensable standard component of modern medicine, increases rapidly over the past decade. We aim to develop an interactive visualization system of 3D physiological anatomy and vascular network and a multi-sensory virtual reality based simulator for percutaneous and transcatheter VIR procedures.

透視微創治療已成為現代醫學不可缺少的一項常規技術，近年來需求量迅速大增。我們的目標是開發一套融合三維血管網等生理解剖的互動式可視化系統與多重感覺虛擬現實的透視微創手術模擬系統。

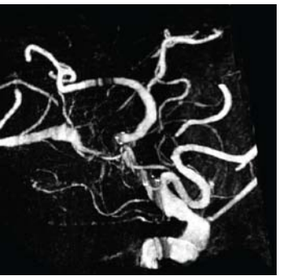

Fig. 2

Features
特點

1. 3D anatomic model reconstruction of organs and vascular network
   血管網等不同組織的三維解剖模型重建
2. Interactive navigation and visualization
   互動式導航及可視化
3. Physiological simulation (e.g. likes blood flow)
   生理功能模擬(如血流)

Applications
應用範疇

Education, training and evaluation of medical personnel in percutaneous and transcatheter VIR procedures
透視微創治療的教育、訓練及操作評估

Fig. 3

Fig. 1
Computer model for the catheter and guide wire
導管及導線的電腦模型

Fig. 2
Direct volume visualization of the vascular network
血管網立體可視化

Fig. 3
Geometric model of the vascular structure
血管組織的幾何造型

Target Users
目標用戶

Medical/Healthcare practitioners and students, interventional radiologists
醫療或保健人員及學生、透視微創放射治療師

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with The Vascular and Interventional Radiology Foundation (VIRF)
由創新科技署資助。合作夥伴為透視微創治療基金

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Robot Arm and Surgical Training with Navigation
機械臂/手術導航訓練

Development of Passive Surgical Robot Arm / Image-Guided Surgical Navigation Practice Model for orthopaedic surgical training and clinical applications
被動式機械臂/手術導航訓練平台之研發、術前訓練及臨床應用

The passive robot arm can guide the surgeon to the target position and maintain it rigidly. It also helps to eliminate physical tremor and improve accuracy of surgical drilling. With the image-guided surgical navigation practice model, the system can provide simulator to facilitate the training of difficult surgical procedures with Navigation System in vitro.

利用被動式手術機械臂，矯形外科(骨科)醫生能瞄準病人的手術位置並在斷裂的骨頭上鑽孔，用螺絲作骨折固定。手術機械臂能有效地消除骨科醫生因手持手術工具所產生的震動，大大提高手術精準度。透過專為複雜的骨科手術練習而設計的手術導航訓練平台，骨科醫生能在模擬環境下進行手術前訓練。

Fig. 1

Features
特點

Passive Robot Arm 手術機械臂

1. 6 degrees of freedom
   六個自由度
2. Serial design
   串聯式設計
3. Compatible to different computer aided surgical systems
   可結合不同電腦輔助手術系統使用
4. Precise surgical targeting
   精確瞄準手術位置

Image Guided Surgical Navigation Practice Model 手術導航訓練平台

1. Compatible to all image-guided surgical navigation systems
   兼容所有影像導向式手術導航系統
2. Simulates the scenario during the actual computer-assisted image guided orthopaedic surgery
   模擬電腦輔助手術實況
3. Cost effective
   高成本效益

Applications
應用範疇

1. Passive Robot Arm will be used for Orthopaedic Surgery. For examples, Hip Screw Fixation, Gamma Nailing, Distal Locking and Pelvi-acetabular fracture fixation, etc.
   手術機械臂可應用於骨科手術，例如：髖關節螺釘固定、Gamma釘固定、髓內釘遠端鎖定及盆骨-髖臼骨折固定等
2. Image-Guided Surgical Navigation Practice Model will be used for surgical practice and training
   手術導航訓練平台則可應用於手術前手術學習及訓練

Fig. 1
Structure of the passive surgical robot arm developed by Dept of O&T, CUHK
由香港中文大學研發之被動手術機械臂的結構

Fig. 2
Laboratory test is performed by orthopaedic surgeon
骨科醫生正進行實驗室測試

Target Users
目標用戶

Orthopaedic and trauma surgeons
矯形及創傷外科醫生

Award and Patent
獎項及專利

US Patent filed

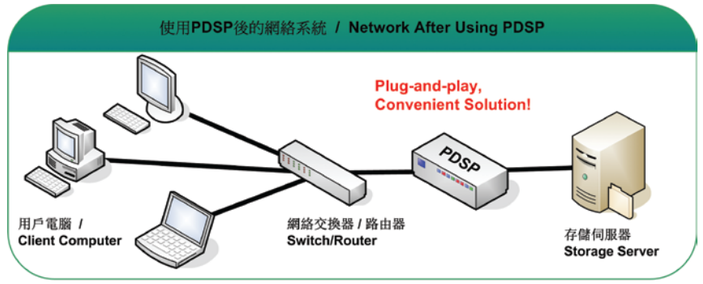
Funding Source and Collaboration
資助來源及合作夥伴

Collaboration with Electronic Service Unit and Mechanical Service Unit, The Chinese University of Hong Kong
合作夥伴為香港中文大學電子服務部及機械服務部

Fig. 2

訊息科學

Information Sciences



Plug-and-play Data Security Platform
隨插即用數據保密平台

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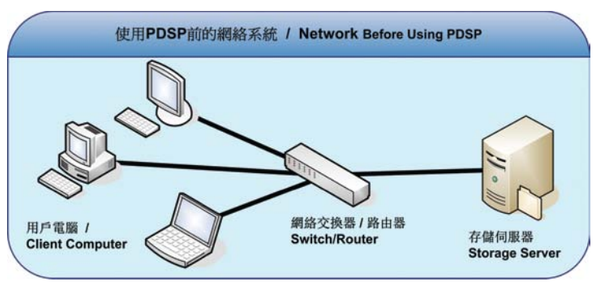
Plug-and-play Data Security Platform (PDSP) is a network device developed to secure files stored inside network storage servers, and PDSP protects files by encrypting them using military-grade encryption standard (AES encryption algorithm). When using PDSP, a user is only required a simple change in the network system. Then, every file-saving action will be protected by strong encryption.

In order to protect files effectively, every user uses his/her fingerprint as the unique file encryption key. Only users with the valid keys can read or write protected files. Otherwise, there is no way to access to the data even though the adversary owns the storage medium.

即插即用數據加密平台(簡稱PDSP)是一個由香港中文大學研發的網絡設備，其研發的目的是為保護存儲伺服器的檔案。PDSP保護檔案的方法是使用最高級別的加密法，把抄寫到存儲伺服器的檔案自動加密。使用者只需對網絡系統作出簡單的設定，即可使用PDSP，從而實現“即插即用”的特色。

為了有效地保護檔案，每個用戶必需利用其指紋，作為一個獨一無二的加密鑰匙(簡稱密匙)。PDSP只會准許能夠提供密匙的用戶存儲或讀取檔案。如果沒有密匙，即使用戶電腦或存儲伺服器被盜取，入侵者仍然無法讀取受保護的檔案。



Features
特點

1. Plug-and-play: only minimal changes of the network infrastructure are required when installing our product
   即插即用：只需輕微改動電腦網絡，即可享用本產品
2. Strong security: military-grade encryption scheme (AES) is used
   高度安全：本產品使用軍用級別的加密算法
3. Secure authentication: fingerprint identification is used as our primary authentication method
   安全認證：指紋認證是本產品識別使用者的主要方法

Applications
應用範疇

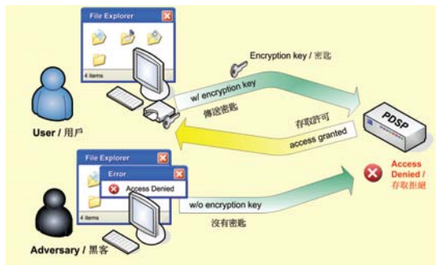
1. Prohibits the security breaches caused by the insiders
   堵塞內在的保安漏洞
2. Upholds privacy and protects the classified data
   保障私隱及保護機密檔案

Target Users
目標用戶

1. SMEs
   中小型企業
2. Government departments
   政府各部門

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with ASK Technology Ltd, EIL Company Ltd and Tanxia System Inc
由創新科技署資助。合作夥伴為亞之傑科技有限公司、星亮電子有限公司及Tanxia System Inc



Automatic Face Recognition System
自動人臉識別系統

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Prof. LIU Jianzhuang 劉健庄教授
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The objective of this project is to jump-start the local industries in taking advantage of the face recognition technology for law enforcement, security verification, and video surveillance. Compared with other biometric technologies such as fingerprint and iris scan, the capture of face image is more convenient, and requires less user cooperation.

The developed techniques and prototype demos include:

1. Face detection in still images and videos;
2. Face tracking with an active camera;
3. Face-based identity verification.

本項目目的是推動最新的人臉識別技術應用在本地司法、保安認證以及視頻監控等領域。與其他生物特徵如指紋或虹膜相比，人臉的獲取更加便捷，無需用者刻意配合。

本項目已開發的技術及原型包括：

1. 在靜態圖片和視頻中的人臉檢測；
2. 基於活動相機的人臉跟蹤；
3. 人臉認證技術；

Features
特點

1. Liveness detection to prevent photo fraud
   活體檢測技術以防止使用照片進行欺騙
2. Active Tracking
   自動人臉跟蹤技術
3. Realtime Alignment
   實時人臉定位技術

Applications
應用範疇

1. Security 保安
2. Surveillance 監控
3. Identity verification 身份驗證
4. Suspect identification 疑犯辨識
5. Family album 家庭相冊

Target Users
目標用戶

1. Police, Customs
   警察局，海關
2. Companies and organizations that require security systems
   對保安性能要求較高的公司及機構
3. Intelligent toy manufacturers
   智能玩具生產商

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with Immigration Department of Hong Kong and ATAL Technologies Ltd, Hong Kong
由創新科技署資助。合作夥伴為香港入境事務處及香港安樂創新科技有限公司

URL
網址

http://mmlab.ie.cuhk.edu.hk

Fig. 1

The Chinese University Plagiarism IDentification System (CUPIDE)
剽檢通

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

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 original report highlighting suspected plagiarized contents, and giving detailed analytic and statistical data.

剽檢通系統是為促進及維護優良的教育素質和珍貴誠信美德而設的新世代剽竊檢索系統。系統支援英文及繁簡中文剽竊檢索，能找出各篇文章中相似的內容。此外，系統提供一站式網上管理、提交和分析功課的界面，為老師帶來一個全面的課堂管理方案。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，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。完成檢索後，系統會產生一份詳細報告，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。

Features
特點

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 favourite languages used in the original report
本系統率先支持繁簡中文剽竊檢索，不但能對比繁簡中文檔，找出繁簡檔中的相似內容，更能讓老師自由選擇內讀繁簡報告，方便中港臺三地老師使用

Applications
應用範疇

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

Target Users
目標用戶

1. Schools, Teachers, and Students
   學校，老師及學生
2. Conference Committee
   研討會籌備會

Award and Patent
獎項及專行

1. Third Award in the 9th Challenge Cup 2006
   二零零六年第九屆挑戰杯三等獎
2. Champion in CUHK Vice-Chancellor's Cup of Student Innovation 2005
   二零零五年中大校長杯學生創新比賽冠軍
3. Champion in the IEEE(HK) Computational Intelligence Chapter, Final Year Project Competition 2005
   二零零五年香港電氣和電子工程師學會計算智能分會，畢業論文比賽冠軍

Funding Source and Collaboration
資助來源及合作夥伴

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

URL
網址

http://cupide.cse.cuhk.edu.hk/

Fig. 1
CUPIDE is the First System Supporting Chinese Plagiarism Detection
剽檢通率先支持繁簡的中文剽竊檢索

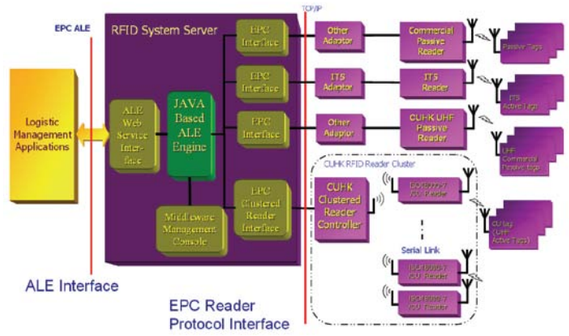

Fig. 1

RFID Technologies for Logistic Management
用於物流管理的無線射頻標籤技術

RFID Tag and Reader Technologies at UHF Band for Logistics 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

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The objective of the project is to develop the core technologies in RFID tags and readers and the related network middleware and to apply the RFID technology to logistics management. We will investigate most of the practical issues in building a RFID systems and its network implementation. Two common and complementary RFID systems, namely passive and active systems, at UHF are to be developed and applied. On top of the systems, an EPCGlobal-compatible middleware and advance logistics management platform will be implemented and tested in realistic environments.
In addition to integrating existing technologies into the prototype systems, several key technologies will be developed in the project. These include power saving techniques and sensor functionality for active RFID system, compact antennas for metal or water content background, new anti-collision method implemented in the readers, the EPC global standard interfaced middleware and application platform, and a supply/demand, shipment/receive pegging network based on RFID technology.

這個項目的宗旨在於開發無線射頻標籤(RFID)和讀寫器的核心技術以及相關的網絡中間件，並且將此技術應用於物流管理領域。我們將深入研究在實踐無線射頻系統以及其相關網絡的過程中會遇到的問題。兩種常見及互補的超高頻(UHF)無線射頻標籤系統 - 有源和無源標籤系統亦會開發。EPCGlobal兼容的中間件以及先進物流管理平台，並在實際的環境當中應用及測試。除了整合現有技術到測試系統平台外，研究小組亦同時著眼於一些重點技術的開發。這包括節能技術、附帶有傳感器功能的有源無線射頻標籤系統、適用於金屬表面或液體容器的小型天線設計、用於讀寫器上的新式防衝突方法、跟EPCGlobal標準接合的中間件與應用平台、以及一個基於無線射頻標簽技術的物流供應鏈管理網絡。

Features
特點

Special Power Saving Technology operated by an innovative power saving protocol
採用創新的低功耗技術

Applications
應用範疇

1. Personnel tracking and identification
   個人身份識別和追蹤
2. Product/Asset tracking and identification
   產品和設備資產識別和追蹤
3. Inventory management
   存貨管理

Target Users
目標用戶

This system can be applied in business operation to reduce inventory, to enhance logistics management and to support security management
此技術應用於商業運作上，以減少存貨，改善物流管理和提供商業保安

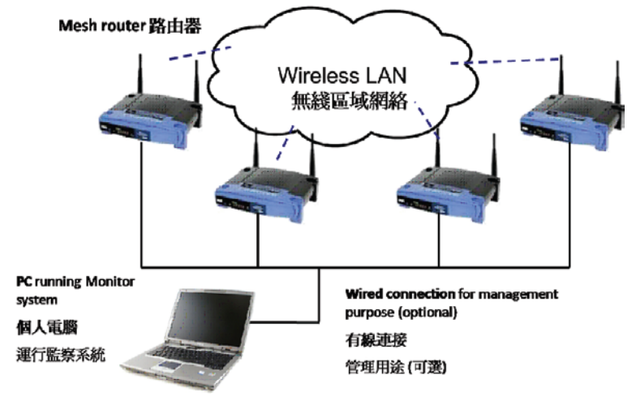
Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with IVHS Division, Mark IV Industries Ltd, Ansen Electronics Company, e-jing Technologies and Compass Technology Company Ltd
由創新科技署資助。合作夥伴為伊伏工業有限公司智能車輛—道路系統部門、安迅電子公司、易經科技及金柏科技有限公司

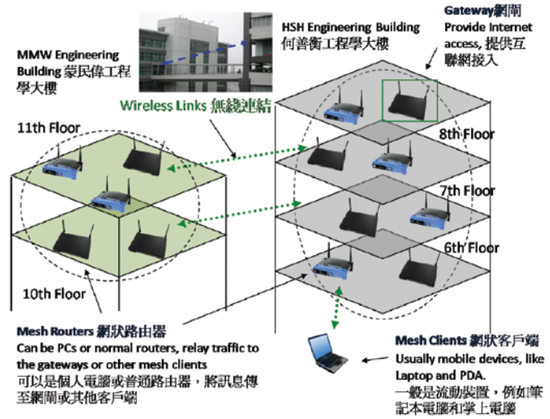
Fig. 2

Fig. 1
System architecture of the RFID system

Fig. 2
The reader hardware for reading active RFID tag



System Architecture
系統架構



Wireless mesh network (WMN) 無綫網狀網絡

Wireless Mesh Network (WMN)
無線網狀網路

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The project seeks to develop a large-scale Wireless Mesh Testbed using an open-source, flexible platform. Common ad-hoc routing protocols including AODV, OLSR and their extensions are supported. Experimental studies on various design issues of wireless meshes can be conducted over this fully-instrumented, easy-to-manage testbed. Sample research projects enabled by this testbed include:

1. Routing strategy to maximize capacity of ad-hoc multi-hop wireless networks
2. Traffic control algorithms for SoftMACs
3. Opportunistic/probabilistic routing algorithms and forwarding for mobility support
4. Path aggregation to improve efficiency of VoIP

這個研究項目透過尋找開放原始碼和彈性的平台來開發一個大型的無線網狀網絡(Wireless Mesh Network)試驗台。這個網絡除了能夠支援一般特定網絡(Ad-hoc Network)的路由通訊協定如AODV, OLSR及其延伸外，亦提供一個裝備了測量儀器和容易管理的試驗台給各種無線網狀網絡的設計進行實驗性研究。以下是一些可以在此試驗台進行的研究項目：

1. 利用路由策略去優化特定多跳無線網絡的容量
2. 用於軟體媒體接入控制的流量控制算法
3. 支援移動性的機會/概率路由算法和轉接
4. 使用聚合路徑去增進IP網絡語音傳遞技術的效率

Features
特點

1. Multi-hop wireless backbone
   多活動點的無線主幹網
2. Self-configuration/organization
   自動設定/組織
3. Fault tolerant, self healing
   容錯性，自動修復

Applications
應用範疇

1. To provide broadband internet access in scenarios like exhibitions, where network communication is needed temporarily
   暫時性的網路通訊如舉辦展覽會時提供寬頻上網
2. To expand the existing wireless network by placing mesh routers and provide last mile internet access at some dead spots
   透過網狀路由器擴展現有的無線網路，為偏遠盲點提供上網服務
3. The wireless mesh topology reduces the cost of setting up large network like city-wide wireless network
   無線網狀拓撲結構能降低設立大型網絡的成本,如覆蓋全城的無線網絡

Funding Source and Collaboration
資助來源及合作夥伴

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

URL
網址

http://mobitec.ie.cuhk.edu.hk
http://www.ie.cuhk.edu.hk/~mesh/

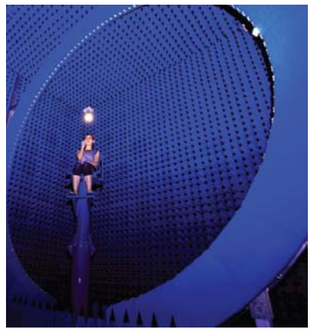

Fig. 1

Radio-frequency Radiation Research Laboratory
射頻輻射研究實驗室

Prof. WU Ke Li
Department of Electronic Engineering

吳克利教授
電子工程學系

The Chinese University of Hong Kong (CUHK) offers testing services for Antenna and Wireless Communication Devices with SATIMO SG 128 multi-probe antenna test system and associated radio communication instruments. It is CTIA compliant and supports both TIS (Total Isotropic Sensitivity) and TRP (Total Radiated Power) measurements. It is ideal for testing performance on mobile terminals (phones, PDAs, laptops, etc.), base station antennas (CDMA, UMTS, WiFi, WiMAX, RFID) and automotive antennas.

香港中文大學通過SATIMO SG128多探頭天線測試系統及相應的無線通信儀器，為天線和無線通信產品提供測試服務。該系統的測試符合美國CTIA標準要求，支持“總全向接收靈敏度”(TIS)和“總輻射功率”(TRP)測試，非常適合於移動終端(電話、掌上電腦、筆記本電腦)，基站天線(CDMA、UMTS、WiFi、WiMAX、RFID)以及汽車天線的測試。

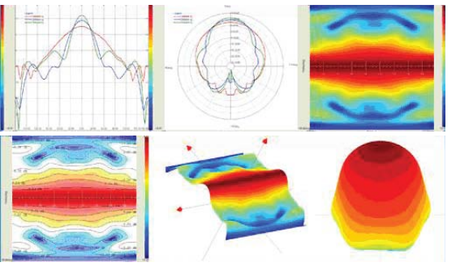

Fig. 2

Fig. 1
Inside view of the anechoic chamber for testing mobile phone RF performance over the air (with consideration of real human body influence.)
移動電話空中射頻性能測試時無反射電波屏閉房內的佈置圖(考慮實際人體的影響)

Fig. 2
Display of passive antenna test results (2D and 3D pattern)
無源天線測試結果顯示(二維和三維模式)

Target Users
目標用戶

1. Institute for research and professional education on radio engineering
   射頻無線電工程相關研究和教育培訓機構
2. Company for wireless communication device research and design
   無線通信設備研發企業
3. Manufacturers of electronic products
   電子產品製造商
4. Mobile Communication Operators
   移動通信運營商
5. Regulatory bodies for the telecommunication and electronics regulation and market supervision
   負責電子通信產品質量監督和市場監管的政府機關

Features
特點

1. Dimension of the anechoic chamber: 7m x 7m x 6m
   無反射電波屏閉房尺寸：七米乘七米乘六米
2. Frequency range of the chamber: 9 kHz to 40 GHz
   測試的頻率範圍：9kHz to 40GHz
3. Maximum size of equipment under test: 3.5 meter cube
   被測設備的最大尺寸：三點五米見方
4. The fastest and most accurate antenna test system in the industry: measurement time under 30 seconds for passive TRP measurement and under 5 minutes for active TRP measurement
   目前最快最準確的天線測試系統：儀器測試無源總輻射功率所需時間少於三十秒，而測試有源總輻射功率只需少於五分鐘

Applications
應用範疇

1. Measurement for passive antennas: Radiation Pattern, Directivity, Gain, Efficiency, Polarization, Axis Ratio (Circular Polarization Antenna), Front-Rear Ratio, Beam Width, Impedance, VSWR, PIM, Power Capacity
   無源天線測量：輻射場型、方向性係數、增益、效率、極化、軸比(圓極化天線)、前後比、波瓣寬度、阻抗、電壓駐波比、無源交調、功率容量
2. Active Test for Wireless Communication Devices: Effective Isotropic Radiated Power (EIRP) and Effective Isotropic Sensitivity (EIS) Pattern, Total Radiated Power (TRP) and Total Isotropic Sensitivity (TIS), Near Horizontal Partial Radiated Power (NHPRP) and Near Horizontal Partial Isotropic Sensitivity (NHPIS)
   無線通信設備的射頻輻射特性測試：等效全向輻射功率(EIRP)和等效全向接收靈敏度(EIS)場型、總輻射功率(TRP)和總全向接收靈敏度(TIS)、近水平區域部分輻射功率(NHPRP)和近水平區域部分全向接收靈敏度(NHPIS)
3. Supported Protocols: GSM, GPRS, EDGE, PHS, cdmaOne, cdma2000, WCDMA, TD-SCDMA, HSPA, EV-DO, Bluetooth, RFID, WLAN, WiMAX
   支持目前市場上的各種無線通信協定

Funding Source and Collaboration
資助來源及合作夥伴

Funded by University Strategic Investment Fund and Industry sponsorship
由大學策略投資及工業界贊助

Fig. 1

Talking Avatar: Crystal
電腦化身播音員

Chinese Text-to-Audio-Visual-Speech Synthesis for a Talking Avatar
適用於電腦化身中文播音員的語音及視像合成系統

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Dr. WU Zhi Yong
Mr. CAO Guangqi
Human-Computer Communications Laboratory (HCCL), Department of Systems Engineering and Engineering Management

蒙美玲教授
吳志勇博士
曹光琦先生
系統工程與工程管理學系、人機通訊實驗室

“Crystal” is a real-time Chinese Text-to-Audio-Visual-Speech (TTAVS) synthesizer. It can generate natural sounding Cantonese and Putonghua speech with an animated talking avatar whose lip movements are synchronized with the audio. The input to the synthesizer is Chinese text and the ouput includes synthetic audio speech, visual lip articulatory movements, as well as facial expressions and head movements.

「晶瑩聲」是一套實時地將中文文本轉換為音/視頻語音輸出的合成系統。它以一個三維立體的動畫化身人物「晶晶」說出自然流暢的粵語及普通話，她的嘴唇動作亦能同步配合。只要輸入中文字句，系統就能輸出合成語音，輔以晶晶發音時的嘴唇動作，以及相應的面部表情和頭部動作。

Fig 2

Fig. 1
Screenshot of the Crystal system
「晶瑩聲」系統螢幕截圖

Fig. 2
Six basic expressions synthesised on the 3D avator
立體化身人物的六種基本表情

Features
特點

1. Real-time Cantonese and Putonghua Text-to-Speech synthesis from unconstrained Chinese textual input
   即時中文文本語音轉換技術，可把隨意輸入的中文文字轉換為粵語及普通話
2. Real-time computer animation to synthesize synchronized lip movements on the avatar's face
   即時電腦動畫合成技術，嘴唇動作與語音同步的立體虛擬人臉
3. Natural facial expressions with Human-like avatar
   逼真的人臉表情合成技術令立體虛擬人臉更為生動
4. Development of embedded version (in progress)
   正在開發嵌入式版本

Application
應用範疇

1. Provide computer-based training for non-native speakers
   為非本地人士提供以電腦為基礎的訓練
2. Generation of natural sounding Cantonese and Putonghua speech such as news reporting for the visually impaired
   為視障人士提供渠道收聽自然流暢的粵語及普通話，例如新聞報道

Funding Source and Collaboration
資助來源及合作夥伴

Funded by National Natural Science Foundation of China (NSFC)/ HKSAR Government Research Grants Council (RGC) Joint Research Scheme. Collaboration with Tsinghua University
由國家自然科學基金委員會及香港研究資助局聯合研究計劃資助。合作夥伴為北京清華大學
Development of embeded version funded by Innovation and Technology Commission
嵌入式版本由創新科技署資助

Fig. 1

Fig. 2

Fig. 3

Automatic Segmentation and Tracking Tools for Real-Time Video Services
即時視像服務自動分割與追蹤

Automatic Segmentation and Tracking Tools for Real-Time Video Services
即時視像服務自動分割與追蹤

Prof. NGAN King Ngi 顏慶義教授
Prof. CHAM Wai Kuen 湛偉權教授
Dr. LI Hongliang 李宏亮博士
Mr. LIU Qiang 劉強先生
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Department of Electronic Engineering 電子工程學系

The purpose of this project is to develop techniques that are efficient and accurate in extracting interesting objects from videos in an unsupervised manner. This project may be used in multiple local IT industry sectors in the areas of security, multimedia processing, video surveillance, and video conferencing.

本項目旨在為用戶提供一種精確及有效地分割和追蹤視像目標的技術。此技術能為香港資訊科技界在保安、監控、視像會儀和多媒體處理等多個領域帶來益處。

Target Users
目標用戶

1. Telecommunication companies
   電訊公司
2. Service industries, such as banks, hotels and security agencies
   服務性行業，例如銀行，酒店及保安機構
3. Industries of surveillance, recognition or other photo-bearing certificates activities
   其他進行監控，辨認或製作附有相片證書的行業

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission.
由創新科技署資助

Fig. 1
Original image
原始圖像

Fig. 2
Facial scaliency map
人臉顯著譜

Fig. 3
Segmentation result
分割結果

Features
特點

1. Detect and segment moving objects in video automatically
   自動檢測和分割出在視像裡移動中的目標
2. Track moving objects in video fastly & accurately
   快速和精確追蹤在視像裡移動中的目標
3. Provide the latest video segmentation and tracking tools for the real-time multimedia services
   為即時多媒體服務提供嶄新的視像分割和追蹤技術

Applications
應用範疇

1. Video surveillance: allow the identification of an intruder or anomalous situation
   視像監控：根據分割結果識別可疑人物或異常情況
2. Content-based video summarization: segmenting semantic objects for content classification through video skimming and video pattern mining
   以內容為本的視像摘要：透過除去個別目標影像，發掘畫面特有模式作內容分類操作
3. Content-based coding application: each frame of a video sequence is segmented into semantically meaningful objects with arbitrary shape, which makes it possible to manipulate the object independently
   以內容為本的編碼應用：對分割對象分別進行編碼，使分割目標能獨立自由運用
4. Computer vision: such as video matting, video tooning, and rendering
   人工視覺：例如處理影像的襯邊，簡化描繪等
5. Videotelephony and videoconferencing: achieve better coding quality for the semantic objects or to be able to store a specific object, such as a face in videotelephony application
   視像電話和視像會議：對分割出來的有關目標，(如人面)可進行更佳質素的單獨編碼或存儲處理
6. Digital entertainment: replace specific objects by segmentation, such as the video games
   數碼娛樂：分割指定目標並作替換，例如視像遊戲等

Features
特點

1. Cost effective: utilize unused capacities of end-user computers to provide high-quality video streaming services
   具成本效益：利用用戶終端機上未被使用的容量，從而提供高質量的視像串流服務
2. Scalable: the system scales up with the growth in the user population
   可擴展性強：系統的規模隨著用戶的增多而自動增大
3. Fault tolerant: the system can survive from failures of multiple user computers
   容錯性：系統能在多個用戶電腦失效時仍能運作正常，並保持視像串流的質量

Application
應用範疇

1. Video-on-demand services
   視頻點播服務
2. Distributed media storage and retrieval
   分佈式媒體存儲和檢索
3. Peer-to-Peer video streaming
   點對點視像串流

Target Users
目標用戶

1. Video-on-demand service providers
   視頻點播服務提供商
2. Media content providers
   媒體內容提供商
3. Corporations and education institutions (as internal video streaming solution)
   公司及教育機構(作為內部視像串流的解決方案)
4. Residential developers (as the solution for residential media streaming)
   住宅區(作為住宅媒體串流的解決方案)

Funding Source and Collaboration
資助來源及合作夥伴

Funded by RGC Earmarked Grant
由研究資助局資助

Fig. 1

Server-Less Video Streaming System
無伺服器式視像串流系統

Design, Analysis, and Implementation of a Server-less Architecture for Building Scalable, Reliable, and Cost-effective Video Streaming Systems
無伺服器式視像串流系統之設計，分析及實現

Prof. LEE Yiu Bun Jack 李耀斌教授
Department of Information Engineering 訊息工程學系

The capacity of conventional video streaming system is limited by its video server. In this project, we investigated a radically new architecture of video streaming system that elimates such bottleneck. This server-less architecture exploits resources in the end-user machines for distributed data storage and video delivery. Thus when new hosts are added to the system, they add resources in addition to workload to the system. This architecture is suitable for building a scalable, reliable and cost-effective server-less video streaming system.

傳統視像串流系統的規模一般受制於伺服器的容量。在這項目中，我們研究了一個創新的無伺服器視像串流系統。這種無伺服器式系統利用在用戶終端機上的剩餘資源來進行分佈式的數據儲存和影像傳送。因此，每當有新用戶加入系統時，它們不僅使用現有的系統資源，還同時加入新的資源去擴大系統的容量。這無伺服器體系為建立可擴展、可靠和具成本效益的新一代視像串流系統提供可行的方案。

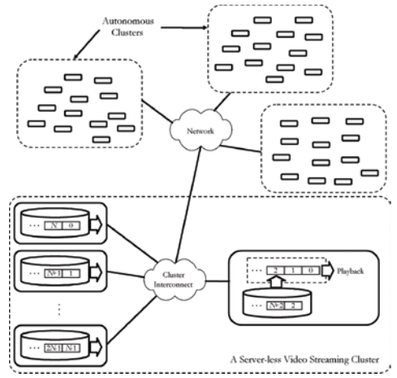

Fig. 2

Fig. 1
A proof-of-concept prototype in operation
運作中的系統原型

Fig. 2
A Server-less Video Streaming Cluster
無伺服器式視像串流簇

Fig. 1a

Fig. 1b

E-Fashion
虛擬時裝試衣技術

Interactive Image/Video Redressing Simulation for On-Line E-Fashion Applications
面向線上電子時裝應用的互動式圖像和視頻試衣模擬技術

Prof. SUN Han Qiu
Department of Computer Science and Engineering

孫漢秋教授
計算機科學與工程學系

This project investigates innovative algorithms for interactive fabric redressing simulation. It provides real-time tools for the end users to interactively edit the dressing styles and retexturing patterns based on sample images/videos effectively. The outputs will facilitate the end users to acquire rich-media dynamic information of fabric redressing when buying cloths online.

本項目研究互動式的圖像和視頻模擬試衣系統中所涉及的關鍵技術。用戶可以即時地調整圖像或視頻中服裝的樣式和布料的圖案花紋。這將會幫助用戶在通過網路選購服裝時獲取更多的可視資訊。

Fig. 2

Features
特點

1. Image/video based retexturing
   基於圖像和視頻的紋理替換
2. GPU-accelerated simulation
   圖形卡加速仿真

Applications
應用範疇

1. E-commerce
   電子商務
2. Special effects in TV/film production
   影視特效製作
3. Image/video editing
   圖像視頻處理

Target Users
目標用戶

1. Shopper
   購物者
2. Cloth/fashion industry
   服裝布料企業
3. Multimedia software
   多媒體軟體

Funding Source and Collaboration
資助來源及合作夥伴

Funded by The Chinese University of Hong Kong Direct Grant for Research. Collaboration with Department of Computer Science and Technology, Nanjing University and State Key Lab of CAD&CG, Zhejiang University
由香港中文大學研究基金項目資助。合作夥伴為南京大學電腦科學與技術系、浙江大學電腦輔助設計與圖形學國家重點實驗室

Fig. 1a
The original dressing image
原來著裝
Fig. 1b
The virtual dressing
虛擬著裝
Image-based virtual redressing
基於圖像的虛擬試衣

Fig. 2
Video-based virtual redressing
Top row: the original video clips
Bottom row: the virtual dressing
基於視頻的虛擬試衣
上排: 原來著裝
下排: 虛擬著裝

Fig. 1

Image and Video Repairing System
影像與影片修復系統

Image Enhancing and Video Completion
視頻圖像修補與完成

Prof. JIA Jiaya Leo
Department of Computer Science and Engineering

賈佳亞教授
計算機科學與工程學系

This is a methodology for repairing unseen or damaged static background and moving objects. Our repairing system consists of:

1. Image repairing: given only a single 2D image, we are capable of completing the previously occluded background, which is unobservable from the given images. Our image repairing methodology can be generalized to repair wide ranges of data or 3D images;
2. Video repairing: our repairing methodology can be extended to repair damaged videos.

此項技術能夠復原圖像與影片中看不見或受損的靜態背景與移動物件，以加強其完整性。此修復系統包含：

1. 影像修復：針對任何一張2D圖像，即使無法觀察，我們仍能重現其原在背景。這個修復方法可以被運用到大面積修復，和3D圖像修復；
2. 影片修復：我們更可進一步延伸修復受損影片。

Features
特點

1. The process is automatic or semi-automatic and is easy to use
   可選擇全自動或半自動操作，過程簡便
2. The repaired images contain sufficient visual information
   修復後的圖像含帶足夠的視覺訊息
3. Complex structures in images can also be repaired
   圖像中繁複的結構皆可被修復

Applications
應用範疇

1. Digital film restoration
   重建數位電影
2. Repairing old picture
   修復老舊照片
3. Digital photo enhancement
   優化數位相片
4. Special effects in images and videos
   圖像與影片特效製作

Target Users
目標用戶

1. Photographers
   攝影工作者
2. Developers of image or video processing software
   圖像或影片處理軟體開發者
3. Digital camera users
   數位相機使用者

Funding Source and Collaboration
資助來源及合作夥伴

Funded by RGC Direct Grant. Collaboration with Microsoft Research Asia and The Hong Kong University of Science and Technology
由研究資助局資助。合作夥伴為微軟亞洲研究院及香港科技大學

Fig. 1
2D image: given only a single 2D image, we are capable of completing the previously occluded background, which is unobservable from the given images. Our image repairing methodology can be generalized to repair range or 3D data.
靜態圖像(相片)：針對單張相片，即使背景被遮擋及不可見，我們仍能補全其內容。此圖像修復技術可以被運用到深度信息修復及3D模型修復。

Online Game-based Learning Environment
網上遊戲學習環境

Virtual Interactive Student-Oriented Learning Environment (VISOLE)
虛擬互動學生為本學習環境

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課程與教學學系、資訊科技教育促進中心

Prof. LEE Ho Man Jimmy
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Prof. LEUNG Yee
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Department of Geography and Resource Management
梁怡教授
鄒桂昌教授
地理與資源管理學系

Virtual Interactive Student-Oriented Learning Environment (VISOLE) is an innovative teaching approach that combines games with teachers' assistance. The idea of VISOLE is implemented with a game system called Farmtasia developed by the Centre for the Advancement of Information Technology in Education (http://www.farmtasia.net). The web-based game environment is a simulation of the real world in which students participate as "citizens" and take part in shaping the development of the virtual world. Operating the virtual farm with the assistance of teachers, students can develop high-level skills for communication and problem solving in addition to subject knowledge. In the game, activities planned by players will not only affect themselves but also the whole cyber world because all elements are connected and interrelated. Furthermore, the game also cultivates students' awareness of environmental protection.

VISOLE是一種讓同學在互動虛擬環境中自主建構知識的學習模式，整個學習過程以同學為中心，老師則從旁輔導。香港中文大學資訊科技教育促進中心根據VISOLE的理念開發了一個名為《農場狂想曲》虛擬世界的網絡遊戲(http://www.farmtasia.net)。透過老師的促進性指導，同學在這個虛擬世界中創建一個農場，通過對農場的經營和管理來綜合學習地理、環境、經濟和科技等跨學科的知識，並培養其資訊運用、策略研究、解決問題和批判思考等高階能力。遊戲中，農場與農場間相連並使用共同資源，所以農場主人所作的決定除了影響農場的成敗外，亦引致共同環境產生不同的好或壞的變化。透過這個遊戲，亦可培養同學對環境保護的意識。

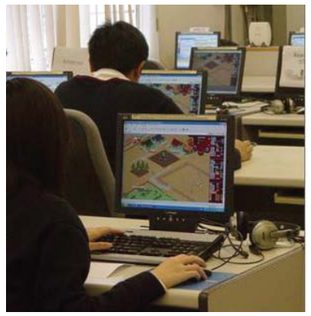


Fig. 2

Fig. 1
A scene in "Farmtasia"
《農場狂想曲》中的一幕

Fig. 2
Students at the final competition of "Farmtasia"
學生進入《農場狂想曲》比賽的最後階段

Fig. 1

Features
特點

1. Online interactive computer game
   網上互動電腦遊戲
2. Completely web-based
   網上學習
3. Integrated simulated environment for learning biology, geography and chemistry
   虛擬環境學習生物、地理、化學等知識
4. Total action recording of all players, teachers can retrieve records as case studies to be discussed during lessons
   記錄所有玩家動作，以便老師抽取遊戲記錄於課堂上作個案討論
5. Real-time hints and advices for players throughout gameplay
   遊戲過程中，即時決策提示
6. Mini games available
   附設周邊小遊戲

Applications
應用範疇

Education
教育

Target Users
目標用戶

Secondary and primary school students
中學及小學學生

Funding Source and Collaboration
資助來源及合作夥伴

Funded by RGC
由研究資助局資助

URL
網址

http://caite.fed.cuhk.edu.hk

Features
特點

1. To enhance augmented reality entertainment effects on human face via the advancement of face tracking capability from 2D to 3D
   提高人面三維追蹤的能力從而加強擴充現實的娛樂效果
2. To enable easy usage of personal 3D face model in various digital entertainment applications
   使個人三維人面模型可易於各種數碼娛樂中使用
3. Users can employ their unique face identities to represent themselves in digital entertainment environments
   用戶能使用他們獨一無二的面部特徵於數碼娛樂環境中作為身份

Applications
應用範疇

The aim of the EFFECT SDK is to solve the face manipulation tasks encountered in the "face-to-face" digital entertainment environment. The EFFECT SDK is being designed to cater various needs in digital entertainment development and it includes the functions for:

1. Face 3D tracking in video
2. 3D face model and texture capturing
3. 3D face model compression
4. 3D face model decompression

"面對面"娛樂運算技術的軟件開發工具的目標在於解決人面處理時所遇到問題。"面對面"娛樂運算技術的軟件開發工具包括以下的功能：

1. 於視像中的人面三維追蹤
2. 三維人面模型和素材的捕捉
3. 三維人面模型和素材數據的壓縮
4. 三維人面模型和素材壓縮數據的解壓

Target Users
目標用戶

Digital Entertainment Developers
數碼娛樂開發者

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with VideoClub International Ltd, WE3 Technology Co Ltd, Hong Kong Applied Science and Technology Research Institute Co Ltd, Kei Creation Ltd, Mobile Gamer Ltd and Zensis Ltd
由創新科技署資助。合作夥伴為VideoClub International Ltd、維駿科技有限公司、香港應用科技研究院有限公司、姬願有限公司、移動玩家有限公司及昇科有限公司

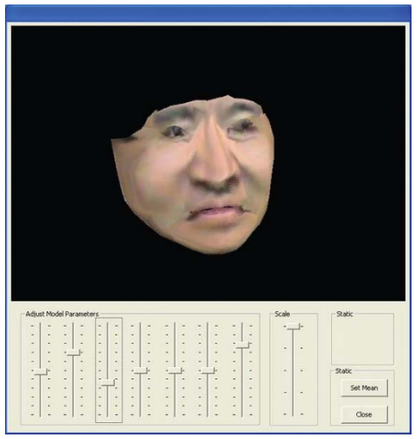


Fig. 1

Enabling "Face-to-Face" Entertainment Computing Technology (EFFECT)
面對面娛樂運算技術

Prof. LYU Rung Tsong Michael
Prof. KING Kuo Chin Irwin
Prof. WONG Tien Tsin
Department of Computer Science and Engineering
呂榮聰教授
金國慶教授
黃田津教授
計算機科學與工程學系

EFFECT is a software development kit (SDK) for video based 3D face tracking, 3D face model and texture capturing to support "Face-to-Face" digital entertainment applications. It enables the face of the user to appear in the screen and interact in real-time with the computer animation or videos.

EFFECT是一套視像人面三維追蹤，三維人面模型和素材捕捉的娛樂運算技術的軟件開發工具。它支援三維人臉素材在畫面上出現，與電腦動畫及視像作即時互動，做出不同數碼娛樂效果。

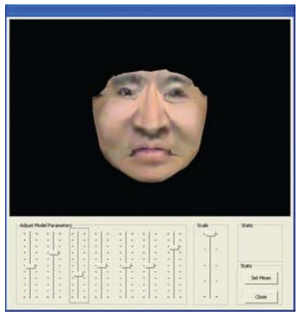


Fig. 2

Fig. 1
3D face model (side)
三維人面模型(側面)

Fig. 2
3D face model (front)
三維人面模型(正面)

地球訊息與地球科學

Geoinformation and Earth Sciences

Satellite Monitoring of Rice Yield
衛星監測水稻的生長

Prof. LIN Hui
Prof. CHEN Jinsong
Institute of Space and Earth Information Science

林珲教授
陳勁松教授
太空與地球信息科學研究所

Development of Comprehensive Methodologies for Paddy Rice Yield Monitoring Using ENVISAT ASAR Data
開發基於ENVISAT ASAR數據的水稻生長監測的綜合系統

Paddy rice is indigenous to warm and humid environment and it is impractical to use optical remote sensing satellite in those cloud-prone and rainy regions. "All-weather" Radar Remote Sensing becomes the only possible satellite data source. This project, collaborating with the Ministry of Agriculture of PRC, targets to build a Radar Remote Sensing-based methodology for paddy rice classification, growing parameters retrieval algorithm and yield estimation.

由於水稻生長在溫暖潮濕和多雲雨區域，利用光學遙感衛星來監測並不實際，全天候微波遙感便成為主要的遙感資料源。這研究項目是和國家農業部合作，目標是建立一套微波遙感系統，用作水稻分類、提取生長參數和估計產量。

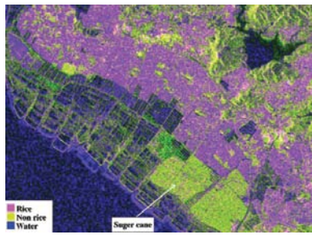


Fig. 1

Features
特點

1. A comprehensive classification algorithm for "All-weather" paddy rice growth monitoring that makes fully use of the unique features of ENVISAT Satellite including higher temporal resolution, multiple polarizations and multiple incidences angles
   充分利用ENVISAT ASAR的較高時間解析度、多極化和多入射角的優勢研發全天候水稻生長監測的綜合分類方法
2. An innovative and robust model for extracting rice growth parameters from ENVISAT ASAR images
   利用ENVISAT ASAR資料提取水稻生長相關參數的嶄新模型
3. An integrated methodology to conduct paddy rice yield estimation
   進行水稻產量估計的集成方法

Applications
應用範疇

1. Paddy Rice Yield Estimation
   水稻產量估計
2. Agricultural planning and policy making
   農業規劃及政策的制定
3. Paddy Rice Price Forecasting
   稻米價格預測
4. Decision-making support for Paddy Rice Futures Exchange
   稻米期貨市場決策支援

Target Users
目標用戶

1. Government Authorities
   政府農業相關部門
2. Agricultural Companies
   農產品生產公司
3. Agricultural Technology Companies
   農產科技開發公司
4. Paddy Rice Wholesale Companies
   稻米批發貿易公司
5. Investors of Agricultural Products Futures Markets
   稻米期貨市場投資者
6. Local GIS/IT/Environmental/Investment Consultancy Companies
   本地資訊科技/環境/投資顧問公司

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with Center for Agricultural Recourse Monitoring, Ministry of Agriculture of the People's Republic of China
由創新科技署資助。合作夥伴為國家農業部及規劃設計研究院

URL
網址

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

Fig. 1
Paddy rice field mapping
稻米耕地分佈圖

Fig. 2
Astronauts of the Shenzhou VI Spacecraft visited the CUHK Satellite Ground Receiving Station
神舟六號載人航天飛行代表團參觀香港中文大學衛星遙感地面接收站


Fig. 2

Prof. LIN Hui
Prof. ZHANG Yuanzhi
Dr. FANG Chaoyang
Institute of Space and Earth Information Science
林琿教授
張淵智教授
方朝陽博士
太空與地球信息科學研究所

Satellite Monitoring and Warning System for Fishery Disasters
衛星監測漁業災害及預警系統

Development of a Disaster Monitoring and Warning Information System for the Fishery Industry in the Pearl River Delta PRD Region
珠江三角洲地區漁業災害監測和預警信息系統

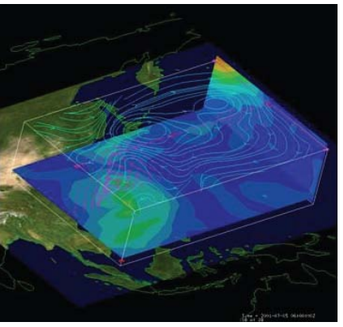


Fig. 1

Fishery accounts for 23% of agricultural production in PRD. However, with the increasing environmental crises in Southern China, ocean disasters such as red tide, oil spill and other ocean pollution problems become serious threats to the fishery industry. With the CUHK's Satellite Remote Sensing Receiving Station and South China Sea Institute of Oceanology's disaster warning models as foundations, this project aims to develop innovative technologies for near real-time monitoring and warning of ocean disasters.

漁業佔珠江三角洲農業總產量高達百分之廿三。但隨著日益嚴重的環境問題，如赤潮、海面溢油和海水污染等海洋災害對漁業構成嚴重威脅。以中大衛星遙感地面接收站及南海海洋研究所災害預警模型為基礎，本項目的目標是開發海洋災害即時監測和預警的創新技術。

Features
特點

1. Near real-time monitoring and warning models that combine the real-time ocean environmental parameters collected on site and satellite remote sensing images
基於海洋水文氣象現場實測信息和衛星遙感資料，接近即時監測和預警漁業災害
2. A fundamental spatio-temporal data model for ocean disaster that integrates multiple sources data. It is customized for ocean disaster analysis and visualization
設計開發一個既能集成多源信息管理又能適合信息分析和表現功能的時空信息模型，作為海洋漁業災害信息系統的基礎模型
3. An ocean disaster monitoring and warning software platform that supports dynamic data analysis, multiple dimensional visualization and process-based disaster warning methods
海洋災害監測/預警工作平台軟體，支援多維動態變化環境信息的分析和表現及監測和預警過程模型的建立和管理
4. Personal and web-based services are provided by Application Services Provider (ASP)
ASP服務模式提供個性化的內容增值服務

Applications
應用範疇

1. Ocean disaster monitoring and warning
海洋災害監測及預警
2. Ocean disaster information extraction, visualization and distribution etc
災害信息提取、顯視和發佈等

Target Users
目標用戶

1. Fishery industry (Fishermen, Mariculturists, Wholesalers of aquatic food products)
漁業從業者(漁民、養殖戶、水產品批發商)
2. Fishery/Oceanic Administration
漁業/海洋管理相關政府機構(漁農自然護理署、漁業局、海洋局、氣象局、海事局、港航局、打撈救助)
3. Information/Fishery Technology Development Companies
信息科技/漁業科技開發公司
4. Oceanic education and research institutions
海洋科研與教育機構
5. Maritime Industry, offshore oil and natural gas exploration, port development
海洋開發(航運公司、海上油氣開採公司、港口)

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with South China Sea Institute of Oceanology, Chinese Academy of Sciences and Guang Dong Provincial Oceanic and Fishery Administration, Oceanic and Fishery Environment Monitoring Centre
由創新科技署資助。合作夥伴為中國科學院南海海洋研究所、廣東省海洋與漁業局及海洋與漁業環境監測中心

URL
網址

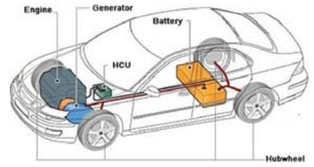
http://www.iseis.cuhk.edu.hk/groundstation/

Fig. 1
Dynamic multi-dimensional visualization of data
多維動態信息時空分析和視覺化

Prof. XU Yang Sheng
Department of Mechanical and Automation Engineering
徐揚生教授
機械與自動化工程學系

Omni-directional Hybrid Electric Vehicle
全方位混合動力汽車

Intelligent Omni-directional Hybrid Electric Vehicle (IOHEV)
一種混合動力、全方位及智能化的環保汽車



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'. Our goal is to save fuel consumption, reduce emissions and improve vehicle safety. Development of this world leading platform will have far-reaching implications on automobile manufacturing, energy saving and building an environmental-friendly society. We believe that this project will contribute to Hong Kong and China's economic development and environmental improvement.

我們今天面臨能源短缺和環境污染兩大難題。混合動力汽車正好是一石二鳥的解決辦法，它通過優化動力來節油，通過控制排放來減少污染。由於取消了傳統的機械傳動系統，其電動輪機結構將可全電動操控。我們的目標是節省油耗、減少排放和提高汽車安全性。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。我們堅信這一項研究將有助於香港及中國經濟發展和環境改善。

Features
特點

1. Intelligent energy management and control technology based on serial hybrid design for optimization of engine
串連式混合動力設計、智能能源管理和控制技術優化引擎操作
Power management and control system that optimizes vehicle performance based on output power, fuel consumption and emission
電源管理和控制系統優化車輛性能，有效地控制輸出功率、油耗和排放
2. 4-independent-wheel-drive can improve the efficiency through electronic differential instead of mechanic differential; it enables 4-wheel-steering with independent suspension for omni-directional motion
四輪獨立驅動，透過電子同步控制代替差速齒輪裝置以提高效率；車輪控制系統可使四輪全方位獨立轉向
   (a) 4-wheel drive and 4-wheel steering
   四輪驅動及四輪轉向
   (b) Antiskid control in multiple directions
   多方向防滑控制
   (c) Intelligent road condition estimation
   智能路面狀況評估
3. An automatic navigation system for parking based on the 4-wheel steering mechanism
基於四輪轉向的自動導航泊車系統
Intelligent car safety system based on the modeling of human dynamic driving behaviours
基於人體動態駕駛行為發展的汽車智能安全系統
Electronic architecture provides intelligent information platform
電子架構提供智能信息平台

Target Users
目標用戶

Vehicle Manufacturers
汽車製造商

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaboration with Sun East Technology (Holdings) Ltd, Shanghai Maple Automobile Co. Ltd (SMA), Tsin ghua University, Shanghai Jiaotong University and Tongji University
由創新科技署資助。合作夥伴為日東科技、上海華普汽車、 清華大學、上海交通大學及同濟大學

Prof. CHUNG Hau Yin
Prof. ANG Put O Jr
Dr. CHUNG Kwok Cheong
Department of Biology

鍾厚賢教授
伍澤廣教授
鍾國昌博士
生物學系

Improving the Flavor Quality of Local Cultivated Food Fish by Feed Modification

利用餌料去改良本地人工養殖食用魚的風味

Food quality covers both food safety and organoleptic quality. Cultivated seafood has been criticized by connoisseurs and consumers for its inferior organoleptic property. This project aims to develop modified feeds that will improve the flavor quality of the local cultivated food fish.

食物的品質是包括食物安全和食用風味。一般人工飼養的水產都有被食家批評其食味質素。在這項研究中，我們希望能改良養魚飼料來有效地改進食用魚的風味。

Applications
應用範疇

Modification of the organoleptic quality in cultivated fish
改進人工飼養水產的食用品嘗質素

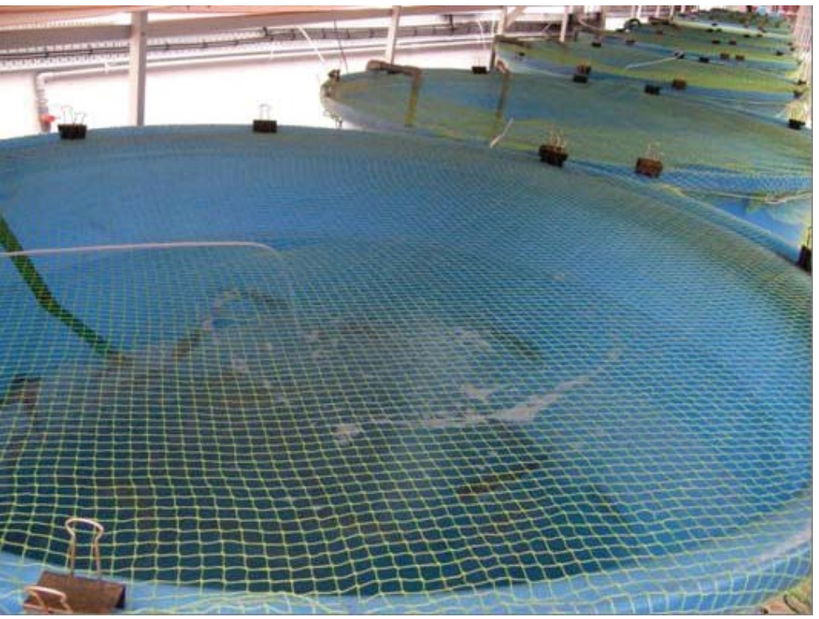


Fig. 1

Fig. 1
Testing Pool for cultivating local food fish
養殖本地食用魚的試驗魚池

Target Users
目標用戶

Local food fish aquaculturists
本地食用魚養殖戶

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission.
Collaboration with Yeungs Marine Products Ltd
由創新科技基金資助。合作夥伴為楊氏水產有限公司

Prof. SUN Sai Ming Samuel
Department of Biology

辛世文講座教授
生物系

AoE: Centre for Plant and Agricultural Biotechnology

卓越學科領域：植物與農業生物科技中心

Crop improvement is our major research priority. Since the award of the first round University Grants Committee (UGC) Area of Excellence (AoE) funding of $38.8 million in 2000 we filed 16 patents (2 granted), published more than 234 academic articles and trained over 175 skilled biotechnologists.
Building on the existing outstanding achievements and research track record, the program received for the first time the UGC AoE "Sustained Funding" of $25 million and a CUHK institutional matching of $25 million in 2007 for the establishment of a new UGC-AoE Centre for Plant and Agricultural Biotechnology (previously known as the Plant and Fungal Biotechnology Centre).
To maintain and further develop the already established academic leadership in this field, we strengthened the partnership with our Mainland counterparts while extending a global collaboration network. 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 (member of the China CAE) to improve the yield as well as the quality of hybrid rice which is grown over half of the Chinese rice fields. Apart from receiving scientific awards, our recognitions include invitation to join a national research consortium on rice functional genomics and 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.

本項目以改良農作物為重點。自二零零零年榮獲教資會卓越學科領域港幣三千八百萬科研經費以來，我們已申請了十六項專利(至今已有兩項獲批)，發表學術性科學文獻共二百三十四篇，及培訓超過一百七十五名生物科技人材。
在現有的傑出成就及科研基礎上，本項目更率先於二零零七年獲取教資會卓越學科領域"持續基金"及香港中文大學院校配對基金合共港幣五千萬以成立教資會卓越學科領域植物與農業生物科技中心(前身為植物與真菌生物科技中心)。
為確保學術上的領導地位及深化與科研夥伴的合作，本項目更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(中國工程院院士)合作，改進現佔全中國一半種稻耕地的雜交水稻的品質及產量。除屢獲科學獎項外，在二零零二年，我們更獲邀參與中國重點研究項目"水稻功能基因組研究"及美國蓋茨基金會所贊助名為Grand Challenges in Global Health Initiative "ProVita Min Rice"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。

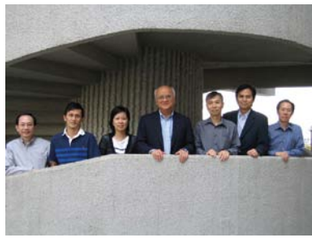


Fig. 1

Fig. 2

Fig. 3

Fig. 1
The research team
研究小組成員

Fig. 2
Central lab

Fig. 3
High lysine rice

1. We made a major breakthrough and successfully obtained the first generation of rice with enhanced lysine content reaching the WHO recommended level
   我們在這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
2. We also succeeded in establishing a "plant bioreactor" technology platform to develop high-value protein products
   另外，我們成功建立以植物生產高價值蛋白的平台
3. Through the state-of-the-art functional genomics study, important genes such as salt tolerant and disease resistant genes were identified for the genetic engineering applications
   我們亦積極開發數個抗鹽抗病基因應用，希望提高可耕地面積及作物產量

Award and Patent
獎項及專行

16 patents filed (2 granted)

Funding Source and Collaboration
資助來源及合作夥伴

Funded by University Grants Committee. Led by core team members, Department of Biology, The Chinese University of Hong Kong. Collaboration with associated team members includeing The University of Hong Kong and Hong Kong Baptist University
由大學教育資助委員會資助。由香港中文大學生物系核心研究小組統籌，合作夥伴為聯席研究小組成員(包括香港大學及浸會大學)

Economics and Finance

經濟與金融

Features
特點

1. Increased energy storage per unit dimension of the mainspring
   每尺度單位能量輸出更高
2. Constant energy deliverance
   恆穩能量輸出
3. Long lifetime
   長壽命

CNTs are firstly surface functionalized. Functionalized CNTs are then deposited onto mainspring and/or co-deposited with polymeric materials (e.g. chitosan). Further material treatment, for example ultrathin gold deposition, annealing etc. will be employed to improve the general mechanical properties of the coated mainsprings. Preliminary results show that the Young's modulus of a mainspring coated with f-CNT (5μm thick) increases by more than 40%

功能化碳納米管將以電化學方法沉積在發條上。或加上聚合材料(例如：殼聚糖)共沉積在發條上。還配合其他傳統材料處理技術，以至增強發條的整體機械性能。初部研究結果顯示，一層薄薄的碳納米管塗層(五微米厚)可增強原有揚式模量大於百份之四十

Applications
應用範疇

Besides mainspring, the technology can be extended to other mechanical springs for improvement of mechanical properties

除了應用在機械錶芯發條上，此技術也可應用於一般機械彈簧器件

Target Users
目標用戶

Watches and clocks manufacturers

鐘錶廠商

URL
網址

http://www.ipe.cuhk.edu.hk

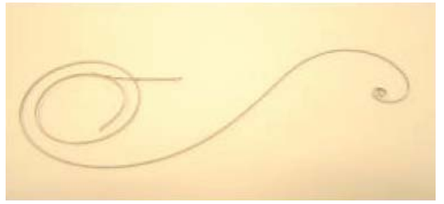


Fig. 2

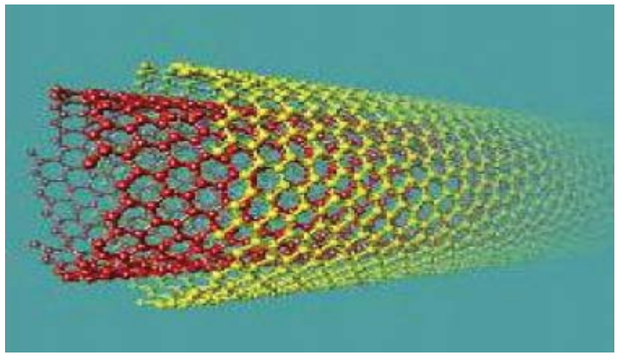


Fig. 1

Functionalized Carbon Nanotube Coating on Mainspring
發條上的功能化碳納米管塗層

Prof. DU Ruxu 杜如虛教授
Prof. WONG Ka Wai 黃家偉教授
Ms CHOI Ching Yeung Florence 蔡靜洋女士
Dr. GONG Jing Ming 龔靜鳴博士
Institute of Precision Engineering 精密工程研究所

Mainspring is the energy generator for watch movement. A good mainspring is judged by its energy deliverance and its lifetime. A new type of mainspring that can offer higher energy and longer life time with the same physical dimensions of current commercially available mainsprings, can undoubtedly upgrade the technical performance and increase the competitive edge of the watch movement employing these improved mainsprings.

發條是整隻錶芯運作的能源站。一條優越的發條，必須具備高能量輸出和特長壽命。在相同尺度大小下輸出更高能量並具有更長壽命的發條，無疑能大大提升機械錶芯的整體表現，亦能提高錶芯的競爭力。

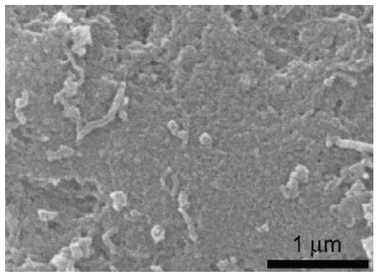


Fig. 3

Fig. 1
Multi-walled carbon nanotubes
多層碳納米管

Fig. 2
Mainspring in mechanical watch movement
機械錶芯發條

Fig. 3
Chitosan:f-CNT coating on spring
發條上的殼聚糖：功能化碳納米管塗層

Fig. 1

Micro Electrical Discharge Machining System for Watch Manufacturing
製錶用微電火花切割機

Prof. DU Ruxu
Institute of Precision Engineering

杜如虛教授
精密工程研究所

To meet the demand for small, precision machined parts (such as micro gear, micro spline, micro connector, and etc), we have designed and built a Micro Electrical Discharge Machining (EDM) system (Fig. 1).

為滿足市場對微型零件的需求(如微型齒輪、微型齒條和連接管等)，我們設計並製造了微電火花切割機。

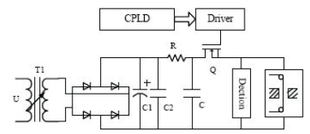


Fig. 2

Fig. 1
Micro EDM machine
微電火花切割機

Fig. 2
RC pulse generator
RC微能脈衝電源

Fig. 3
Sample of gear punch
衝頭樣本

Features
特點

In comparison to the standard micro EDM, the main features of our design are as follows:
與一般微電火花切割機相比，我們的設計有以下主要特徵：

1. Extra thin wire (0.03mm)
   超細線 (0.03mm)
2. Cost effective circulating wire feeding system
   慢循環線運輸系統
3. High Precision Piezoelectric ceramics motors
   壓電陶瓷馬達
4. V-block guide mechanism
   V型引導塊裝置
5. Precise RC micro energy pulse generator control
   精密操控RC微能脈衝電源
6. Integrated Micro EDM function and Micro Wire EDM function
   微電火花切割功能及微電火花線切割功能

Applications
應用範疇

It can precisely manufacture a ø0.38mm micro gear. This precision part can be used for die set manufacturing. Fig.3 shows a sample of gear punch with 8mm long and 0.38mm width.
此設計能夠精確加工只有點三八毫米的微齒輪，其微齒輪精確的齒形與齒輪相若。同時，微電火花切割機亦能應用於模具加工上，並在厚工件顯示出精確度。如圖三示，此切割機能夠成功加工只有點三八毫米寬及八毫米高的齒輪衝頭

Target Users
目標用戶

Manufacturers of precision machined parts
微型零件生產商

Funding Source and Collaboration
資助來源及合作夥伴

Collaboration with Harbin Institute of Technology
合作夥伴為哈爾濱工業大學

URL
網址

http://www.ipe.cuhk.edu.hk

Fi. 3

Features
特點

1. A specially designed mechanism for mirror grinding and polishing of near-meter-range size telescope mirror
   針對近米級別望遠鏡主鏡面打磨與拋光的特殊機械結構設計
2. A computer-based assembly for automatic optical test and pattern interpretation enabling closed loop figuring of large mirror
   針對大型鏡面的自動光學測試與模式判讀的技術整合
3. An end product of a 0.6m diameter primary mirror usable for Classic Cassegrain telescope
   可用於近米級別望遠鏡的點六米直徑主鏡

Applications
應用範疇

The project will develop technologies to produce near-meter-range telescope mirrors of high precision consistently and reliably
此項目能增強高精度近米級別望遠鏡鏡頭生產過程的穩定性與可靠性

Target Users
目標用戶

1. Significantly upgrade the technological know-how of Hong Kong optical industry, to stay competitive and to migrate towards up scale markets
   有效提高香港光學工業專有技術水平，使其保持競爭能力，並向高端光學工業發展
2. Promoting astronomy and space sciences in high schools, universities, and the general public in Hong Kong and China
   在中學、大學以及公眾推廣天文學與空間科學

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission and Hong Kong Astro Equipment. Collaboration with Hong Kong Astro Equipment and Beijing Institute of Technology
由創新科技署及香港天文器械資助。合作夥伴為香港天文器械及北京理工大學

Technology for Making Large Telescope Mirrors
大型望遠鏡鏡頭製造技術

Technology Development and Application for Making Near-Meter-Range Telescope Mirrors
近米級別望遠鏡鏡頭製造技術的開發與應用

Prof. YAM Yeung
Prof. DU Ruxu
Department of Mechanical and Automation Engineering
Prof. CHU Ming Chung
Department of Physics

任揚教授
杜如虛教授
機械與自動化工程學系
朱明中教授
物理學系

This project aims at the research and development of relevant technologies to make near-meter-range telescope mirrors. This includes the design and construction of a new control mechanism in the grinding, polishing and figuring processes, and the development of computer-based automated optical testing procedures. The project will serve to significantly upgrade the technological know-how of the Hong Kong optical industry.

本項目旨在研發近米級別望遠鏡鏡頭，包括針對打磨、拋光及計算過程的全新控制機械的設計及製造，以及提升以電腦為基礎的自動化光學測試過程。此項目將能有效提高香港光學工業的專業技術水平。

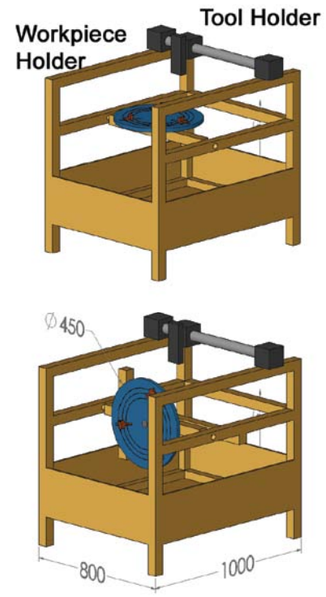


Fig. 1

Fig. 2

Fig. 1
Prototype mechanisam design for 0.4m diameter mirror
點四米直徑主鏡磨銳機的初步設計

Fig. 2
0.4m diameter mirror production machine
生產點四米直徑主鏡磨鏡機器

Photocatalytic Technology
光催化技術

Prof. YU Chai Mei Jimmy
Department of Chemistry

余濟美教授
化學系

Photocatalytic materials can absorb harmful ultraviolet radiation, degrade pollutants, and kill bacteria on contact. With support from the HKSAR Government, we have developed methods to fabricate nano-sized photocatalysts and mesoporous thin-film coatings which have immense industrial potentials. 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 (·OH) that oxidize pollutants, bacteria and viruses and convert them into harmless carbon dioxide and water.

PCO Cleaning Principle

1. Exposure to ultraviolet rays
2. Creation of Hydroxyl radicals
3. Breaking up organic compounds

光催化物料能吸收有害紫外線輻射、以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(·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
2. 產生氫氧自由基
3. 分解有機化合物

Features
特點

1. Our photocatalysts possess extremely high activities
   我們的光催化材料具有高活性
2. The materials can be modified to achieve special functions
   物料可因應需要添加特別功能

Applications
應用範疇

1. Self-cleaning building materials
   自動清洗建築物料
2. Anti-bacterial coatings
   抗菌表層
3. Catalysts for pollution treatment
   光催化污染處理

Target Users
目標用戶

This technology is ideal for the environmental health and construction industries
此技術十分適用於環境健康及建築行業

Awards and Patent
獎項及專利

1. 2002 Hong Kong Award for Industry: CMA Machinery and Equipment Design Award
   二零零二年香港工業獎：廠商會機器及設備設計獎
2. 2005 National Natural Science Award, Second Prize
   二零零五年國家自然科學獎二等獎

Patented
已擁有專利

Funding Source and Collaboration
資助來源及合作夥伴

Funded by Innovation and Technology Commission. Collaborated with Environmental Care Ltd
由創新及科技基金資助。合作夥伴為愛環保有限公司

URL
網址

http://ihome.cuhk.edu.hk/~b111268/jimyu/