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## "

In October this year, the World Economic Forum published a report ranking Taiwan first in Asia and fourth in the world in terms of innovation. The report further listed Taiwan as one of the top four "super innovators" along with Germany, the United States, and Switzerland. Despite limited resources, Taiwan has achieved outstanding results in the views of others. We can create an environment suitable for our development and contribute to the society.

This is also why last year, the Ministry of Science and Technology hosted the first "Future Tech Expo," a stage to showcase the excellent scientific findings of Taiwan, featuring two indicators, "scientific innovation" and "industrial applications." During the three-day exposition, 109 key research results were presented by teams from 72 academic institutes, three major research institutes, and three major science parks. The event attracted 26,000 visits, with 4,000 people participating in the forum, and through over 2,000 matching conferences, technology transfer royalty after the expo amounted to NT \$30 million.

Following the success of last year, this year, we selected 81 pieces of research findings out of 405 submissions from schools. Along with the 42 pieces submitted by research institutes from within science parks, in 2018, there will be 123 pieces of research presented in the Future Tech Expo. The Future Tech Expo is an iconic occasion for matchmaking and networking, an opportunity for university-industry research collaboration, and the key to capturing future success.

Taiwan has many unique advantages, and the Future Tech Expo is a pragmatic approach to gain a head start with a mindset that values resources and integrates professional skills. We look forward to the alliance of industries, academia, and research centers to carry forward those magnificent research results, and we hope to see key industries in Taiwan to have friendly and exciting competition and exchange with world-class opponents around the globe.



Minister, Ministry of Science and Technology, Taiwan

Liang-Gee Chu



2018 未來科衣展 Future Tech



## Bio-tech & New Drugs



## Master in chromosomal aberration detection

Universities & Institutes

#### Academia Sinica

' Hsin-Chou Yang(Research Fellow),Mei-Chu Huang(PhD),Ling-Hui, Li(Associate Research Scientist),Chia-Wei Chen(Research Assistant)

**Technical Introduction** ALICE provides an integrated analysis of genotype and hybridization intensity based on our core technologies in coefficient of preferential amplification/hybridization, estimation of individual-level allele frequency (AF), intensity-based allelic imbalance (AI) detection, loss of heterozygosity (LOH) detection, copy number variation or alteration (CNV/CNA) detection, and genomic segmentation.

#### Scientific Innovation

The proposed AF adjustment method considerably increased the accuracy of AF estimation. The proposed quick segmentation algorithm significantly reduced computation time. The proposed CNV/CNA detection had a promising true positive and well-controlled false positive rates. The results were validated by statistical, biological, and genomic data. ALICE outperformed the international benchmark method.

#### Industrial Application

ALICE has great potentials in clinical applications such as (1) genetic screening and testing, (2) copy number alteration detection in large-scale biobank such as Taiwan Biobank and UK Biobank, and (3) cancer risk assessment and precision medicine. ALICE can be applied to new-generation population-optimized SNP arrays. We are collaborating with international teams from Taiwan, Japan, and USA.

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## Analyze big data of Enterovirus Genome in AI and construct the web platform for real-time genotyping

Universities & Institutes

#### Academia Sinica

Chung-Yen Lin, Chieh-Hwa Lin (NHRI), Zhe-Ren Hsu, Yi-Hsuan Lu, Chao Hsiung (NHRI), Shu-Hwa Chen

Technical Introduction

By integrating corrected sequences of EV family with their serotype around 48,382 records, we are the first team who have applied deep learning approach (CNN) to classify these 308 genotypes of EV family with out-performance. Moreover, we have constructed the first web application in deep learning that is fully automatic to provide precise and rapid prediagnosis on EV genotype.

Scientific Innovation

We are the first team to composited the pipeline by the filter for homology search and CNN model to ensure the submitted sequences belonged to EV family then classify them into suitable genotype. Meanwhile, we implement the web application that is fully automatic to provide precise and rapid prediagnosis on EV genotype by submissions, especially for EV-71 and D-68 as 99.3% and 97.8%, respectively.

Industrial Application

The web application of EV-CNN can perform the genotyping immediately on those long reads from biopsies in third-generation sequencers like oxford nanopore. That means we can identify and prevent those enteroviruses caused severe syndromes rapidly to reach the goal of prediagnosis. This integrated platform will be applied to clinical laboratories, research community for disease surveillance.







### Bio-tech & New Drugs

## A novel potential therapeutic antibody to combat ALS and related neurodegenerative diseases

Universities & Institutes

Academia Sinica Yun-Ru Chen

Technical Introduction

TDP-43 inclusion is pathogenic hallmark in ALS and FTLD-TDP, and found in brain of 57% Alzheimer's disease (AD) patients, who have more severe disease progression. We developed the first antibody with US and TW patents recognizing misfolded TDP-43 oligomers. Mice study showed i.v. the antibody neutralizes TDP-43 toxicity in brain. The antibody has great therapeutic potential for ALS/FTLD/AD.

#### Scientific Innovation

In 2014, we discovered full-length TDP-43 forms oligomer and developed specific antibody (TDP-O) against it (Nature Communications). The oligomers were shown in brains of FTLD-TDP, ALS, and AD patients, Our animal studies showed i.v. injection of TDP-O antibody neutralizes TDP-43 toxicity and improves motor and memory function in diseased mice model. The antibody has great therapeutic potential.

#### Industrial Application

This technology is about anti-TDP-43 oligomer antibody (US patent), TDP-43 inclusions were found in ALS. FTLD-TDP, and 50% Alzheimer's disease (AD) patients. In the mice model, i.v. injection the antibody significantly improves the motor and memory function. Anti-A $\beta$  antibody, Biogen, showed good result in clinical trial 3, therefore, antibody against other aggregates is the next blockbuster.



Contact



Yun-Ru Chen / 02-2787-1275 / yrchen@gate.sinica.edu.tw

## New Hope for Diabetes

China Medical University Universities & Institutes Professor Tin-Yun Ho, Professor Chien-Yun Hsiang The novel peptide that gives a second hit on the insulin receptor can be applied for Technical Introduction the treatment of diabetes. It can be developed as a unique drug for the control of diabetic complications, the oral replacement or complementation of insulin, or the delay of using injectable insulin therapy. Moreover, it can be directly applied as the main active ingredient of health foods and pharmaceuticals. Based on the concept of target therapy, we select insulin receptor as a target and Scientific Innovation identify the novel insulin receptor-targeting peptides from traditional Chinese medicinal herbs. The solid biochemical and structural biology data have shown that this is the first unique peptide that targets the insulin receptor, gives a second hit on insulin receptor, and effectively overcomes insulin resistance. There are 425 million people with diabetes worldwide. The global diabetes care Industrial Application market has a total value of \$548 billion. The bottleneck in diabetes treatment is insulin resistance. The novel peptide that solves these problems will provide a promising solution for this market. Clinical trial has shown that the novel technique controls glycated hemoglobin and will have great industrial benefits.







### -Novel Peptide that Gives a Second Hit on the Insulin Receptor

## RNA interference for treating myopia

Universities & Institutes

China Medical University Professor Suh-Hang Juo, Dr. Chung-Ling Liang

Technical Introduction Myopia, as a result of abnormally elongating the eyeball axial length, is a common eve disorder worldwide, especially being prevalent (~85%) in Asian countries. We have identified overexpressed microRNA-328 as a key factor for myopia. We designed microRNA-328 inhibitors and filed patents for myopia treatment. By using the inhibitor via eve drop, we successfully treated myopic mice and rabbits. No side effect or toxicity was observed.

Scientific Innovation Our team has developed a series of "small anti-sense oligonucleotides" in eve drop form to neutralize over-expressed microRNA-328 in cells and animal models of myopia. By utilizing our eve drops, we successfully treated myopic mice and rabbits. Additionally, our eve drops were shown better therapeutic effects than Atropine (the only clinically used anti-myopic eye drops). Our product by using the brand new mechanism makes a breakthrough in curing myopia.

Industrial Application

Our eve drop product is mainly used to treat schoolchildren, due to the rapid myopic development during 6-12 year olds. Because schoolchildren in developed Asian countries are requested to have periodic eve and vision examinations, full records of vision tests allow children with myopia to receive treatment immediately. Our team has developed a novel anti-myopia eye drops for myopia control. The estimated global market size is over US\$67 billion.

#### Efficacy Results







## **Engineering Cell Lines to Enhance Vaccine Production**

Universities & Institutes

Technical Introduction

Scientific Innovation

The small RNA molecule has an effect on inhibiting growth of influenza virus for treatment infection. The engineered cell line can be applied for promoting viral yield in vaccine development.

Industrial Application

Using small RNA as a target for treatment viral infection disease can reduce generation resistant viruses. This novel technology can apply to develop antivirals. We also engineered several cell lines for vaccine productions. The engineered cell lines can enhance viral yields. Moreover, the cell lines can be applied in Clinical Virology Laboratories for viral diagnosis.



### Bio-tech & New Drugs

Novel Technologies for Anti RNA Virus Infection and for

#### Research Center for Emerging Viral Infections, Chang Gung University

Dr. Shin-Ru Shih, Dr. Guang-Wu Chen, Dr. Kuo-Feng Weng, Dr. Chuan-Tien Hung, Dr. Chi-Jene Chen, Dr. Po-Ting Hsieh, Dr. Yu-An Kung, Sheng-Yu Huang

1. Novel technology - the small RNA molecule has an effect on inhibiting growth of influenza virus. The novel technology identified human-specific miR-1290 as a positive regulator of influenza virus replication and the viral titers decreased when miR-1290 inhibitor was added in cells. This technology provided a new therapeutic strategy way to treat influenza. 2. Upon Enterovirus infection, the viral translation relies on the presence of an internal ribosome entry site (IRES) element within the 5'-untranslated region. Increased IRES trans-acting factor (ITAFs) protein expression level in cells, can enhance viral vield and promote vaccine production. 3. Influenza A virus vaccines are produced by injecting viruses into eggs to amplify viruses. However, the zoonotic potential of avian influenza viruses usually leads to death of chicken embryonated eggs and the virus yield is low. If the avian influenza virus is amplified by the MDCK cells, the yield is also not good due to host-specific restriction factors, Knocking out TUFM, a human-specific restriction factor, enhances avian influenza virus and thus can be increased of vaccine yields.

Peng-Nien Huang / 03-2118800 ext 3723 / mark1005@gmail.com

Looking for the main culprit drug(s): Utilizing the lymphocyte activation test assay to accurately identify causative drug(s) for drug hypersensitivity



Linkou Chang Gung Memorial Hospital / National Yang-Ming University Professor Wen-Hung, Chung, Professor Shuen-Iu, Hung

Technical Introduction The present invention relates to a method for assessing the causative drugs of drug hypersensitivity reactions in a human subject, comprising the steps of; incubating the leukocytes with the culprit drugs or its metabolites, and quantifying the level of human granulysin in the sample to indicate the culprit drugs or its metabolite as antigens for lymphocytes activation in the sample.

Scientific Innovation The present invention directs to incubating lymphocytes with a suspected drug or its metabolite(s) in vitro to form a reactant and the use of oligonucleotide primers, probes, and capture and detection antibodies against the granulysin which is produced by the activated lymphocytes. The sensitivity of granulysin is 77.3-81.8% and the specificity is 92.9%-95.7%.

Industrial Application

In the past decade, severe adverse drug reactions accounted for ~70% compensation of Taiwan Drug Relief Foundation. This invention can provide a safe and rapid in vitro diagnostic method for identifying causative drug(s) especially for severe cutaneous adverse reactions. This invention could prevent and decrease the incidence of the drugs hypersensitivity and toward personalized medicine.



#### Contact Yen-Ling, Lin / 03-328-1200 ext8495 / yenling0119@gmail.com

Universities & Institutes

NCKU Prof. Grace Lo. ITIR Ren-Yang Horng, LDS Lighter Shen

Technical Introduction

Our concept is to introduce semi-automatic control systems into our shrimp culture facility to develop a new management system for shrimp farming. All of these systems are designed to reduce or eliminate human error and workload while maintaining optimal conditions in the grow out pond. Our system could significantly reduce FCR (feed conversion ratio). The end result for farmers will include higher growth rates, lower mortality, and improved size consistency at harvest.

Scientific Innovation

While other shrimp culture management systems typically provide only a single technological innovation, our integrated, modular approach allows the deployment of a customized suite of innovative solutions. The flexibility that this brings also guarantees our systems suitability for any size of shrimp culture operation, from a small-scale aquaculture facility of 0.01 hectares to a full-scale facility of more than 100 hectares.

Industrial Application

The modular design approach of our shrimp culture management system means that it can easily be customized for use in aquaculture facilities. A small-scale operation might choose only to deploy some of the most cost-effective semi-automatic control equipment. A large-scale operation, on the other hand, might prefer to use a combination of our integrated control systems equipments in order to maximize both yield and energy savings.



Contact

#### International Center for the Scientific Development of Shrimp Aquaculture

## Chip-based original and high efficient drug screening for one-stop new drug development

Universities & Institutes

National Applied Research Laboratories/National Nano Device Laboratories CHEN, Hueih-min(Research Fellow)

Technical Introduction

An innovative chip-based drug screening to find diseases-related compounds and further development as new drugs is established. Under this "one-stop" model for efficient drug developments, for example, a small new molecule, Cyn-1324, is found and has been experimentally confirmed to have low toxicity and high efficacy for treating with immuno-suppressive diseases such as asthma. The application of IND (investigational new drug) is under preparation.

An innovative drug screening method with immobilization of protein on chip is Scientific Innovation unique nowadays. We increase the rate of re-orientation of protein on chip using an external electric field. This leads to the best candidate drugs which can be found quantitatively. Consequently, establishment of "from original drug screening to drug commercialization" may be a valuable and sustainable model developing in Taiwan in the future.

An efficient and accurate method of drug screening can discover various fatal or Industrial Application popular diseases-related drugs unceasingly (our immuno-suppressive drug candidate, Cyn-1324, is an example). The value of a drug is huge when it can be proceeded to the stage of clinical trials. We expect to create an "unicorn" in the biotech sector in Taiwan by using this "one-stop" model.



Universities & Institutes

#### National Health Research Institutes

Dr. Hsing-Pang Hsieh, Dr. Mohane Selvarai Coumar, Dr. Yu-Sheng Chao

**Technical Introduction** 

DBPR114 is a novel small molecule multi-target kinase inhibitor. DBPR114 significantly shrank tumor growth of 8 different cancer cells in vivo by intravenous administration. These results indicate the potential of DBPR114 as a novel development candidate for various cancers, including AML, pancreatic, liver and gastric cancers, and all important cancers currently without very effective treatments. DBPR114 was approved for IND by US FDA and TFDA in 2017. DBPR114 has demonstrated broad spectrum antitumor activities against a variety of human cancer lines both in vitro and in vivo.

Scientific Innovation

Industrial Application

study.

Multi-target drugs can more effectively inhibit cancer cell proliferation, overcome drug resistance, and show better and broader anti-cancer effects, DBPR114 may provide therapeutic benefit over existing treatment modalities for the tough to treat cancers such as pancreatic, liver and gastric cancers. DBPR114 thus has the potential to be developed as first-in-class asset for GI cancers (gastric, liver, pancreas, colon, and bladder) and acute myeloid leukemia (AML).



- DBPR114 is superior to sorafenib in Hep3B (Liver cancer) xenograft study.
- DBPR114 is superior to gemcitabine in MIA PaCa-2 (Pancreatic cancer) xenograft

Ms. I-Chu Tsai / 037-246-166 ext 35798 / ichu@nhri.org.tw

## Propagation system of virus-free passionfruit seedlings in Vietnam and development of mild strains for control of passionfruit virus

Universities & Institutes

National Chung Hsing University Dr. Shyi-Dong Yeh, Yee-Hang Chong Ph. D.

Contact

#### Technical Introduction

Virus-free passionfruit seedlings were examined by molecular detection method and transferred to Vietnam. Currently, Vietnam can produce 4 million seedlings a year, becoming an important passionfruit production country. In 2018, 'Nafoods-NCHU Plant Virus Certification Center' was established to ensure the production of virus-free passionfruit seedlings. Currently, we are developing mild vaccine to protect passionfruit for sustainable production.

#### Scientific Innovation

The established of office 'Nafoods-NCHU Plant Virus Certification Center' provides several passionfruit viruses detection methods in order to assist the Vietnam companies to produce certified virus-free passionfruit seedlings. The crossprotection strategy will protect the plants against the severe virus infection which is an alternatives strategy in replacement of transgenic resistant strategy.

#### Industrial Application

The virus-free certification technology has been transferred to Nafoods company, in Vietnam by a ten-year agreement with the technology transfer fee 2.4 million Taiwan dollars to NCHU. This technology transfer will serve as a good example for the future collaboration between Taiwan and Vietnam, also to other Asean countries. Our cross protection assay indicates that the mild virus vaccine have great potential to be used for cross-protection in Taiwan and Vietnam.

#### Extablishment of virus-free passion fruit seedlings virus detection vir

## AIP4

Universities & Institutes

National Chiao Tung University Jinn-Moon Yang

Technical Introduction

AIP4 is the first comprehensively integrated platform from disease diagnosis to drug development based on our twenty years' accumulation of computational biology, drug development, clinical, pharmaceutical and industrial breakthrough progress, achievements and knowledge bases, such as patents, the cross-species drug-protein-network-disease big data database and the membrane protein-mutation-disease database.

Scientific Innovation

AIP4 accumulated about a hundred publications. We found that hundreds of molecular Interaction Building Blocks are the basic elements to form biological phenomena, equivalent to four types of nucleobase in DNA and twenty types of amino acids in protein. Based on this scientific concept, we overcome technical hurdles to investigate biological dynamic network models. We integrate from disease sub-type identification to targeted drug development, to achieve customized precision medicine.

Industrial Application

AIP4 links basic research, translational medicine and industry based on our core value. We obtained 3 US and Taiwan patents, which had been successfully applied to six major services and can be customized for different cases, so there is a wide potential customer group. We had closely collaborated to industry, hospital and academic groups, so we can immediately provide products according to customer needs, and provide the highest quality precision medical services.



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Sing-Han Huang / 03-5712121 ext 56946 / gb921.tw@gmail.com

### Integrate site-specific target therapy of both nanoparticle and antimiRNA strategy to treat autosomal dominant polycystic kidney disease

Universities & Institutes

National Cheng-Kung University Yuan-Yow Chiou.Fong-Yu Cheng.Chu-Hung Tsai

Technical Introduction

The specific miRNA can bind to 3' non-coding region of PKD-1 gene, leading to kidney cell proliferation and cyst formation, relates to IGF-1 signal pathway. We adhered anti-kidney specific protein with Fe3O4 nanoparticles to pack anti-miRNA plasmid. It can prevent the degradation of miRNA and increase the concentration of polycystin 1 in tissue to inhibit cell proliferation and cyst formation.

Anti-miRNA has been proved feasible to treat congenital developmental disease. Scientific Innovation This modified nanoparticle, encapsulated with anti-miRNA plastids and bound with target tissue protein Ab to avoid degradation, can improve the specificity of the antimiRNA plastid in kidney. Finally, the concentration of anti-miRNA in renal tubule cells will increase significantly as the purpose of precise medicine.

Industrial Application

(1) Incidence of ADPKD is 1/400-1/1000, near 15 million patients in world: (2) With the increase of age, more than half of patients will enter uremia after 50 years old and receive dialysis; (3) Patients with ADPKD, the cost of health care is higher than non-ADPKD patients; (4) If contains comorbidities (ex. cardiovascular disease) or the loss of productivity, it is very significant; (5) No satisfactory treatment.



## Human pluripotent stem cell therapy for ischemic heart disease

National Cheng Kung University Universities & Institutes Yen-Wen Liu

Technical Introduction

- stem cells (hPSCs) into cardiomyocytes (CM).
- macaque.
- function.

Scientific Innovation

Using a catheter-based infarct surgery, we successfully established a large myocardial infarction model in monkeys. Then we performed thoracotomy to intramuscularly inject 1 billion cryopreserved hPSC-CMs into infarcted hearts. Our data demonstrate that remuscularization of the infarcted macague heart with human myocardium provides durable improvement in left ventricular function.

Industrial Application

The mortality rate of end-stage heart failure patients is very high. Very small numbers of patients have the opportunity to undergo heart transplantation, so new therapy is needed. We demonstrate the therapeutic potential and feasibility of stem cells in ischemic heart disease. And the large animal model of macaques accelerates the feasibility of connecting academic research to clinical trials.





Yi-Hsein Fang / 06-2353535 ext 3653, 6712 / iverson2559@gmail.com

1. We used a cardiac differentiation protocol to differentiate human pluripotent

2. We used catheter-based infarct surgery to create large myocardial infarction in

3. Via thoracotomy, we intramuscularly injected hPSC-CMs into infarcted hearts to remuscularize the infarcted heart and provide durable improvement in cardiac



## The Mobile Platform for Rapid Detection of Harmful Cvanobacteria and Their Metabolites in Drinking Water Reservoirs

#### Universities & Institutes

#### National Cheng Kung University

Prof. Tsair-Fuh Lin.Prof. Hung-Kai Yen.Ms. Hsiu-Lian Lin.Dr. Yi-Ting Chiu

#### Technical Introduction

The platform integrates a mobile vehicle with optical, bio-molecular, and immunoassay methods, enabling on-site, quick and multi-target determination of harmful cyanobacteria and their metabolites. The platform was successfully tested for more than 100 times in 10 major drinking water reservoirs in Taiwan. Based on the information obtained, reservoir managers are able to trigger responses to the incidents of cyanobacteria.

#### Scientific Innovation

This is the world's first mobile platform for rapid detection of harmful cyanobacteria and their metabolites in drinking water reservoirs. After sampling, all important cyanobacteria, cyanotoxins, and odor compounds related information can be collected within 3 hours on-site. This technique is able to identify both the toxic and nontoxic strains of the same cyanobacterial species, for which traditional methods are not able to achieve.

#### Industrial Application

This technique can be directly applied to reservoirs and drinking water treatment plants (DWTPs), and has the potential to be used in groundwater contaminated sites (GCSs), wastewater treatment plants (WWTPs), and water recycling plants (WRPs). The numbers of reservoirs and DWTPs are more than 10,000 in Asia. In addition, the numbers of GCSs, WWTPs, and WRPs are more than 10.000 in Asia. This technique has a high potential to be used in many places.







#### Dr. Yi-Ting Chiu / 06-2757575 ext 65850,47 / yitingchiu@mail.ncku.edu.tw Contact

## Microbial metabolic engineering and bio-derived chemicals production using CRISPR technology

Universities & Institutes

## National Tsing Hua University

Technical Introduction

In this study, we wish to enhance gene engineering efficiency in E, coli and cyanobacteria by using CRISPR and CRISPRi system and achieve the purpose of biochemical production. we final combined both CRISPR and CRISPRi for metabolic engineering in E, coli and cyanobacteria, which improved the 1,4-BDO production and succinate.

Scientific Innovation

- cyanobacteria.
- in 48hr.
- 12.5 fold (≈0.58-0.63 mg/L)

Industrial Application

Recently, the key technologies for biochemical production (such as genetic engineering, metabolic engineering, synthetic biology, and metabolomics) is weaker than the others. Therefore, this research can also be used as a technical basis and further apply to develop more effective biochemical production technology and enhance international competitiveness.



Contact

Yu-Chen Hu, Claire R, Shen, Li-Yu Sung, Hung Li, Meng-Ying Wu, Mu-En Chung, I-Hsin Yeh, Chun-Hung Huang,

1. CRISPR/Cas9 can trigger foreign gene integrates into the genome of E.coli and

2. By using CRISPR system in E.coli, we enhance the titer of 1,4-BDO from 0.9 g/L to 1.8 g/L(about 100% increasing) and final succinate production reached 15 g/L

3. In cyanobacteria, CRISPR system can enhance the succinate production about

## AHEAD (Al-assisted Hematolgic Analytic and Decision Support)

#### Universities & Institutes

#### National Tsing Hua University and National Taiwan University Hospital

Department of Electrical Engineering, National Tsing Hua University: Dr. Chi-Chun Lee, Jeng-Lin Li, Chih-Chuan Lu 🗅 Department of Internal Medicine. National Taiwan University Hospital: Dr. Bor-Sheng Ko, Dr. Jih-Luh Tang, Dr. Chi-Cheng Li, Yu-Fen Wang

#### Technical Introduction

We developed state-of-art artificial intelligence from retrospective data of acute leukemia patients to create two services :

- Residual disease detection: an advanced algorithm to perform multicolor flow cytometry analysis on bone marrow specimens of acute leukemia patients.
- Relapse and Mortality Prediction: a comprehensive risk stratification and outcome prediction models for acute myeloid leukemia patients using historical examination and treatment records.

#### Scientific Innovation

- 1. The residual disease detection model could reduce the interpretation time from 20 minutes to 7 seconds for each sample with an accuracy of 90%.
- 2. The outcome prediction model could reach over 80% accuracy in next-3-month relapse and survival prediction.

#### Industrial Application

increase the report interpretation efficiency.

Our model could be applied to :

Contact

- decrease the inter-interpreter idiosyncrasy between physician.
- assist the clinicians to adjust treatment plan according to risk prediction.







#### Yu-Fen Wang / 02-23123456 ext 63576 / ahead.taiwan@gmail.com

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#### Establishment of high performance liquid chromatography (HPLC) and QuEchERS methods for rapid determination of 15 + 1 EU priority polycyclic aromatic hydrocarbons (PAHs) in foodstuffs

Universities & Institutes

National Yang-Ming University and China Medical University Deng-Jve Yang, Chow-Feng Chiang, Kuo-Chiang Hsu

Technical Introduction

PAHs in foods are produced in food processing and also caused by environmental pollution. Our established HPLC method is the fastest traditional method for 15 + 1 EU priority PAHs analysis (completed in 18 min), and the LOD and LOQ of PAH4 are lower than those required by EU. Our established QuEChERS method could also rapid extract PAHs from various food matrices (completed in 30 min). The PAHs recoveries of all testing food matrices complied the PAH4 criteria set by EU and TFDA as well.

Scientific Innovation

The established HPLC method is the fastest traditional method for 15 + 1 EU priority PAHs analysis (completed in 18 min), and the LOD and LOQ of PAH4 are lower than those required by EU. The established QuEChERS method could rapid extract PAHs from various food matrices (completed in 30 min). The PAHs recoveries of all testing food matrices also complied the PAH4 criteria set by EU and TFDA.

Industrial Application

We have established a rapid HPLC method to simultaneously determine 15 + 1 EU priority PAHs within 18 min. We also established QuEchERS methods to rapidly extract PAHs from various food matrices (each sample can be processed in less than 30 min). These methods meet the requirements of TFDA and EU, and can be used by food industries and inspection agencies/companies to quickly monitor PAHs in products. It can also be applied to the risk assessment of PAHs in products.

資品中 15+1 PAHs	2g Sample int
* Institute (B)	10 mL Wat
20 Cyclopennic.dgymae (CPP)	10 mL Acetone 家禽家畜類 水產類 豆類蛋白
11 Diseas(Leppene (Del)	QuEChERS
12 Dimenial/symmetChilly	Centrifuce
13 Discussional prome (DR7)	
14 Ditesce(a.) gener (RP)	6 mL anduot to QueCh
15 5364/daywer(1980)	Centrifuge
41 Brazijskove (bl.)	1mL extract
(Lenda 2011- JDC 66955.2011)	HPL

Contact

## Bio-tech & New Drugs



#### Deng-Jye Yang / 02-28267938 / djyang1@gmail.com

## Inhibition of macrophage inflammatory protein-1 $\beta$ improves ischemia-induced angiogenesis in diabetes.

#### Universities & Institutes

National Yang-Ming University/Taipei Veterans General Hospital Professor Jaw-Wen Chen, Ph.D. Ting-Ting Chang

Technical Introduction

Macrophage inflammatory protein-1  $\beta$  (MIP-1  $\beta$ ) is a member of the CC chemokine family, MIP-1 β directly impaired human endothelial progenitor cell (EPC) function. Inhibition of MIP-1  $\beta$  could improve the EPC function of normal subjects and type 2 diabetic patients, and enhance in vivo EPC homing and ischemia-induced neovasculogenesis in type 1 and type 2 diabetic animals.

#### Scientific Innovation

Type 2 diabetic patients with severe peripheral arterial disease often suffered from lower limb amputation and even death. Inhibition on MIP-1  $\beta$  is a novel strategy to effectively enhance endothelial progenitor cells from type 2 diabetic patients, improve lower limb ischemia, and restore blood flow in diabetic animals. It may be a new treatment for diabetic peripheral arterial disease.

#### Industrial Application

Of the world's type 2 diabetic people, 15% (about 56,000,000 to 86,700,000) are associated with severe peripheral arterial disease and diabetic foot. There are 5% new diabetic feet and 1% with amputation and even death each year. This new technology will potentially prevent the progress of diabetic foot and reduce amputation in patients with type 2 diabetes with severe peripheral arterial disease.



Contact

#### Jaw-Wen Chen / 02-28757434 ext226 / jwchen@ym.edu.tw

## Machine Learning and Mass Spectrometry in Disease Diagnosis

Universities & Institutes

#### National Taiwan University

Assistant Professor: Cheng-Chih Hsu / PhD student: Ting-Hao Kuo, Li-En Lin / Master student: Chih-Lin Chen, Yi-Ling Gao, Hsin-Hsiang Chung, Ying-Chen Huang

Technical Introduction

Mass spectrometry (MS) provides a wealth of chemical information. We combine MS with machine learning to multiple applications: breast cancer diagnosis, finding potential biomarkers in house dust, imaging fusion for high resolution MS image, and tumor margin determination by lipid isomers. In summary, our techniques provide an insight into the next-generation clinical panels.

Scientific Innovation

We developed an innovative technique coupling mass spectrometry data with machine learning to have breakthroughs in fields including 1) breast cancer prediction, giving an accuracy up to 80%. 2) linking health status with environmental chemicals of dust, 3) Imaging fusion, giving 70% increment of biomarker discovery, and 4) cancer margin determination by lipid isomer.

Industrial Application) We decided to promote commercial products and well-developed platform to the hospitals for the next generation medical treatment

- assisted by artificial intelligence.
- for newly discovered biomarkers



## Bio-tech & New Drugs

20

1. Convenient examination protocols for the hospital: high efficiency and accuracy

2. Establish therapeutic prognostic indicators: develop indicators to judge prognosis

3. Commercial machine for disease early detection; increment survival rate.

### Gene mutation viewer

Universities & Institutes

#### National Taiwan University

Wuh-Liang Hwu, MD., PhD. Ni-Chung Lee, MD., PhD. Ching Hsu, MS. Ting-Fu Chen, MS. Feipei Lai, PhD

Technical Introduction

The interpretation of next generation sequencing is a big challenge. In order to improve the molecular diagnosis of the patient, we developed the MViewer, a variant viewer and filter software with the help of Variant Prioritizer to rank the candidate variants. With these tools, we can shorten the variant interpretation time and improve the accuracy for the diagnosis.

#### Scientific Innovation

This is a user friendly software to improve variant interpretation for next generation sequencing. It has simple user interface, simple filter criteria, and a remind function for candidate variants. We optimize the software, integrate with text mining and Al function to improve the variant interpretation efficiency.

#### Industrial Application

The software can help in precision medicine, pharmacogenomics, diagnosis of genetic diseases, risk factor prediction, cancer and cardiovascular risk evaluation. It will facilitate the development of healthcare system.





## Cerebellar electroencephalography : a new technology and the breakthrough in the pathophysiology of essential tremor

Universities & Institutes

National Taiwan University MD., PhD. Ming-Kai Pan

Technical Introduction

Cerebellar electroencephalography (cEEG) is a new technique in clinical electrophysiology and measures cerebellar electric activities non-invasively. Classical EEG only records signals from cerebellar cortex. With animal-to-human translation in our tremor research project, we developed cEEG technique that may impact the research field and clinical diagnosis in cerebellar disorders.

Scientific Innovation

Abnormal cerebellar activities in patients with essential tremor (ET) were discovered in our tremor project, and can be detected by the newly developed cEEG technology. To date, this cEEG-detectable abnormality is the first and the only clinical biomarker of ET, a disease affecting 4% of adults and up to 20% of elderly population. Moreover, cEEG opens a window to clinical cerebellar researches.

Industrial Application cEEG, like classical EEG, is a clinical technique that is non-invasive and easily performed. The market is huge, for cEEG-detectable abnormality is the only biomarker for essential tremor (ET) that affects 4% adults and 20% of elderly population. This does not include the upcoming clinical utilization in other cerebellar disorders and also cerebral disorders associated with cerebellar changes.





Figure 1. Cerebellar EEG in clinical settings



## A system to facilitate next generation sequencing analysis

Universities & Institutes

#### National Taiwan University Hospital Wuh-Liang Hwu, Feipei Lai

Contact

Technical Introduction

This project established a rapid next generation sequencing analysis system, to help clinicians to have next generation sequencing result in time. It shortened the timeline to do sequencing and the time needed for analysis, to improve the quality of medical care.

#### Scientific Innovation

We perform rapid whole exome sequencing to diagnose genetic disease for pediatric critical patients. The major work aims on the establish the connection between clinician and laboratory, shorten the timeline for sequencing, variant analysis and prioritization, and interpretation. So that we can shorten the turnaround time of the test.

#### Industrial Application

With the rapidly growing next generation sequencing technology, more and more challenges encountered. In this situation, the workflow established in this project will help the healthcare, especially intensive care system. It will change the medical care in the future and provide precision medicine, and become a model for critical care.

Feipei Lai / 02-33664924 ext 419 / flai@ntu.edu.tw



## Fabrication of Nonplanar and Fully-Transparent Microfluidic Devices Using 3D Printing and Sonication-Assisted Dissolution Technique

National Taiwan University of Science and Technology Universities & Institutes Prof. Pin-Chuan Chen, Ching-Chan Chou, Yi-Chin Chen

Technical Introduction

Planar microfluidics has played an important platform for novel medical materials for decades, but the medical articles pointed out that the experiment results generated from the planar microfluidics are very different from the clinical trials. Hence the aim of this research is to develop a novel fabrication process to create a truly 3D microfluidic for state-of-the-art medical researches.

Scientific Innovation

A 3D printed ABS mold and PDMS casting were conducted to create a 3D and fully transparent microfluidic device. In the fabrication process, solvent evaporation step was used to minimize the surface roughness of a printed mold for creating a fully transparent microfluidic chip while a two-step dissolution process was used to completely dissolve the embedded and slender ABS inside the PDMS chip.

Industrial Application

The fully transparent and 3D microfluidic chip could be applied in medical research industries, such as (1) microfluidic multi-bifurcation chip could be used to study the medicine transportation phenomenon in the vessels of the lung; (2) the research related to an aneurysm inside the brain; (3) fabricating complicated microvessel system for cell culturing, blood analysis, and artificial organ.



### Bio-tech & New Drugs



## Use of high- and low-intrinsic aerobic exercise mice for discovery and innovation in evolution and chronic diseases

Universities & Institutes

National Taiwan Sport University

Professor Chi-Chang Huang, Doctor Yi-Ju Hsu

Technical Introduction

Our research team is currently the only one in Taiwan that has been developed a novel platform using the swimming exercise model for selection of mice with highand low- intrinsic aerobic exercise capacity. Our platform could be applied to study effects of exercise capacity in evolution and chronic diseases. It is also possible to be used to develop health food materials or drug development with performance improvement, anti- aging, and women's health promotion.

Scientific Innovation We have bred intrinsic high- and low-aerobic exercise capacity mice. This platform could be applied to explore the changes in the physical evolution of aerobic-exercise capacity, and apply to metabolic diseases, physical activity-deficient diseases, female diseases and advanced medicine issue. It could be used as an important monitoring indicator for future nutritional supplements or different sports training programs, and it can provide another solution for precision medicine.

#### Industrial Application

1. Sports biotechnology industry: our platform could be used to screen health care materials for improving athletic performance.

- 2. Women's health industry: our platform could be used for R&D of post-natal and menopausal women for health promotion and disease prevention.
- 3. The elderly industry: our platform could be used to find the key factors to combat aging or prevent muscle loss in elderly populations.



Contact



## Reconstruction

Universities & Institutes

National Defense Medical Center CHOU, CHUNG-HSING ; HUENG, DUENG-YUAN ; TSAI, TSUNG-NENG

Technical Introduction

We first construct the cell sheet composed of human neural stem cells, endothelial cells and extracellular matrix, which are committed to generating neurovascular networks. Such novel building blocks have been applied to surgical brain trauma and spinal nerve injuries. Improvements in neurological assessments and histological evidence of regenerating functional neurovascular tissue have been demonstrated in animal models. We are applying these novel techniques to spinal cord injury and stroke.

Compared with other technologies of cell transplantation treating brain injury, we have innovated cell sheet transplantation technology :

- avoiding the influence of the blood-brain barrier.
- injecting cells.
- reconstruction.

Industrial Application

Scientific Innovation

- engineering for reconstructing the neurovascular tissue.

3. Biotechnology - cell culture and differentiation of stem cells, regenerative medicine.





Contact

### Bio-tech & New Drugs

## Stem Cell Sheets for Cerebral Neurovascular

1. Directly targeting the lesions for transplantation, not via peripheral blood circulation,

2. Cell sheet transplantation avoids damage to brain tissue caused by acupuncture when

3. Extracellular matrix in the cell sheet provides bio-scaffold and essentials for tissue

1. Medical industry - brain tissue regeneration, transplanted cell layer to reconstruct neurovascular tissue to treat patients with stroke, degenerative brain disease, brain trauma, spinal cord injury, diabetic foot and other vascular or neurological disorders.

2. Biomedical materials - manufacturing of cell sheets, bio-materials for tissue

CHOU, CHUNG-HSING / 02-8792-3311 ext 12461 / choutpe@vahoo.com.tw

### Polysorbasome

#### Universities & Institutes

#### National Health Research Institutes

Ming-Hsi Huang, Chiung-Yi Huang, Chih-Hsiang Leng, Shih-Jen Liu, Hsin-Wei Chen, Pele Chong

**Technical Introduction** 

Polysorbasome (PSS, polymeric absorbable vehicle) is a colloidal vehicle made from polymeric bioresorbable amphiphiles (PEGylated polyesters/sorbitan polyesters). Structural features allow the vesicles to act as an immunogenic depot for sustained delivery of vaccine antigens and to be absorbed post-vaccination, suggesting new insights into innovative vaccine design.

#### Scientific Innovation

Novel polysorbasomes have versatile advantages over common vaccine formulations. as follows: Soft for easy injection. Safe for massive vaccination. Small for cell recognition. Smart for antigen immunoavailability. Simple for reducing cost. Stimulatory for eliciting appropriate immunity.

#### Industrial Application

Fields of application and market potential are biodegradable controlled-release vaccine and drug delivery systems, cancer immunotherapy and mucosal delivery.



B-cel

## cluster and small water cluster prepared therefrom.

Universities & Institutes

Taipei Medical University Yu-Chuan Liu (Distinguished Professor)

Technical Introduction

The invention provides an apparatus of treating water to obtain small water cluster (SWC) and a method of preparing the SWC and the SWC prepared from the apparatus or the method. The stable plasmon-activated water (PAW) with SWC exhibits distinct properties, examples being their high solubility, highly chemical activity and ability to scavenge free radicals. PAW works on eight animal diseases.

Scientific Innovation

We create a whole-new water-associated field of study and application based on stable and active plasmon-activated water (PAW) with distinct properties of antiinflammation. Many innovative ideas on increasing the efficiencies of hydrogen and oxygen productions from water splitting and on medical therapies can be derived from PAW. Eight animal diseases are successful by daily drinking PAW.

- physical activities, and anti-oxidative property.
- absorbed. PAW itself is energetic and anti-inflammatory.
- are easily absorbed. PAW itself is anti-inflammatory.





Industrial Application) 1. PAW machine: stable plasmon-activated water (PAW) owns highly chemical and

2. PAW-based healthy drinks: healthy components dissolved in PAW are easily

3. PAW-based cosmetics of mask, lotion and related products: care products in PAW





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# Medical Devices



#### 01 Medical Devices :

## Wearable MCG spectrum assisted mobile detection and early warning system for cardiovascular diseases

#### Universities & Institutes

#### Chang Gung University

Ming-Yih Lee (Distinguished Professor), Wen-Yen Lin (Assistant Professor), Tsai-Hsuan Tsai (Associated Professor), Chung-Chih Lin (Associated Professor), Po-Cheng Chang, M.D.

#### Technical Introduction

A non-invasive, wearable cardiac early warning system using mechanocardiography (MCG) spectrum for real-time detection of cardiovascular diseases. Physio-markers were identified and algorithms were developed to estimate LVEF and risk potential for cardiac arrest. The proposed system could be one of the break-through smart mobile devices for early detection and warning of cardiac attacks at home.

#### Scientific Innovation

By combining mechanocardiogram (MCG) and electrocardiogram (ECG) readings, the overall cardiac mechano-electrical behaviors and cardiac timing events can be identified over time without echocardiograph. Five physio-markers were proposed for estimation of left ventricular ejection fraction (LVEF). This system is also paired with a smartphone APPs to provide risk potential warning signals.

#### Industrial Application

This wearable system can detect MCG/ECG simultaneously which overcomes all commercial ECG monitoring and functional clothes in the market. Myo-cardiac physio-markers were proposed for left ventricular ejection fraction estimation and risk potential for heart failure problems. This system has enormous potential and can be used as an innovative fast screening tool for heart failure symptoms.





心震關議將徵點、心搏動時間參數與生物標記辨識演算分析消程







本項「心臟病發早期預警系統」獲美<u>國IEFE IMBH</u>期刊選為 Medical Informatics 封面亮點論文、 英國Research Impact 评估此技術在醫療領域具影響潛力並專文報導、獲107年國家新創獎及媒體報導

## Long-Acting Injectable Biomaterials for Ophthalmic **Drug Deliverv**

Universities & Institute

Chang Gung University Jui-Yang Lai (Professor)

Technical Introduction

Glaucoma is a global leading cause of blindness. This work focuses on use of biodegradable, environmentally responsive, and therapeutically enhanced biomaterials for injectable ocular drug delivery. Single application of drug-loaded gel depots/ nanocarriers is advantageous to extend release profile, alleviate postoperative complication, and facilitate tissue rehabilitation during disease treatment.

Scientific Innovation

For glaucoma treatment, current modalities including eve drop instillation and surgical intervention are limited by relatively low ocular drug bioavailability and severe inflammatory tissue response. Intracameral administration of newly developed gel depots/nanocarriers can significantly extend antiglaucoma drug release and enhance retinal cytoprotection, thereby improving therapeutic performance.

Industrial Application

To meet clinical demands for achieving minimally invasive drug delivery, an injectable biomaterial carrier is developed as a long-acting release platform for intracameral administration of antiglaucoma medications and simultaneous alleviation of disease symptoms. It will be beneficial to not only glaucoma and other ocular complications, but also economic potential of healthcare industry/ marketing.



Contact Professor Ming-yih Lee / 03-2118800 ext 5340 / leemiy@mail.cgu.edu.tw

#### Medical Devices : 03

## Breath Ammonia Measurement as a Tool for Early Detection/Monitoring of Chronic Kidney Disease and Evaluation of Dialysis Efficacy

#### Universities & Institutes

#### National Chiao Tung University

Prof. Hsiao-Wen Zan, Dr. Chang-Chiang Chen, Prof. Hsin-Fei Meng, Prof. Chia-Jung Lu (long-term support: Mr. Jolin Yen, Vate Technology Co., Ltd.)

#### Technical Introduction

We have developed an ammonia sensor to detect ammonia in the parts-per-billion (ppb) regime. The detector is realized by using a novel organic semiconductor device. The invention patents in Taiwan and the USA have been approved. We demonstrated that breath ammonia(BA) concentration, measured by this sensor, was significantly positively correlated with blood urea nitrogen in chronic kidney disease(CKD) patients.

#### Scientific Innovation A reusable gas sensor capable of detecting ammonia in ppb regime was developed. With a prototype system to detect BA, the clinical research achieved a high correlation coefficient between BA and blood urea nitrogen. Also, by improving structural configuration to enhance operational current, sensors were successfully integrated into embedded system achieving well-package prototype.

#### Industrial Application

This technology integrates the strength of Taiwan's semiconductor knowledge and medical resource. This developing medical equipment is expected to apply on selfmonitoring in CKD patients, evaluation of dialysis efficacy and early detection of CKD in high-risk populations, such as diabetic, hypertensive, and aged patients. It is considered that this technique will benefit numerous people in the future.







Universities & Institutes

### National Tsing Hua University

Ann-Shyn Chiang, Yen-Yin Lin, Wei-Kun Chang, Li-An Chu, Yu-Chieh Lin.

Technical Introduction

The developed multiscale microscopy is a patented new technology for superresolution large-field imaging. The system includes con-shell illumination microscopy, single-molecule localization algorithm, and automated tissue sectioning. Combining with FocusClear tissue clearing, our technology can analyze spatial distribution of any proteins of interest within an intact tissue such as brain/tumor.

Scientific Innovation

Most of current super-resolution microscopy can only focus on single-cell level imaging, which cannot be used at large tissue, also very expansive. Our newly patented super-resolution large-field imaging system can work independently or easily integrated onto regular florescent microscopy. Work with sample clearing methods and automated imaging/sectioning system, multiscale bio-images in one specimen can be achieved.

Industrial Application Multiscale bio-imaging system can be applied in visualizing various biology in 3D specimen massively. Users can also apply it on to ultra-high throughput, superresolution pathology. With Al aid data evaluation, this method can augment the precision of clinical decision, and pave the way to a new era toward precision medicine.





Contact

Contact Lin Yi-Tzu / 03-5712121 ext 52922 / yitzulin67@nctu.edu.tw 04

## Multiscale Bio-Imaging Technology

## Sperm motility assessment assay

Universities	&	Institutes	

National Tsing Hua University (Frontier Research Center on Fundamental and Applied Sciences of Matters) Chao-Min Cheng



The present device is a tool to estimate the sperm quality such as sperm mobility. This device, in particular, has the merits of using paper as the device material to reduce the manufacture cost, and is easy to be used as well.

#### Scientific Innovation

We have developed an inexpensive and robust sperm diagnostic device, allowing patients to easily use it at home.

#### Industrial Application

The prototype of this sperm diagnostic device has been made (licensed the technology to the company in Taiwan), and we are currently working on the clinical validation of this device.



### Contact

Chao-Min Cheng / 03-571-5131 ext 62420 / chaomin@mx.nthu.edu.tw

## RGB laser fiber coupled Narrow Band Illumination (NBI) for ultraslim endoscopy

Universities & Institutes

National Yang-Ming University Fu-Jen Kao

Technical Introduction

We have developed a compact and portable ultraslim endoscope, which takes advantages of laser coupling and very thin illumination fibers. In this way, the footprint of the endoscopy illumination is greatly reduced. The image acquisition is implemented by synchronizing the monochrome CMOS camera with the rapid switching of the RGB semiconductor lasers. Colorful images with higher spatial resolution and NBI can be realized. This endoscope is expected to find numerous applications, including ductoscopy and blood vessel imaging.

Scientific Innovation

The ultraslim endoscope prototype uses RGB semiconductor lasers as the illumination light source, which greatly facilitate the efficient coupling into illumination fibers and the reduction of illumination footprint in an endoscope. In this way, we have realized an ultraslim endoscope with the outer diameter as small as 0.49 mm.

Industrial Application The ultraslim endoscope uses RGB semiconductor lasers for illumination and is highly portable. It is widely applicable in many circumstances. Note that when the surgical wound is less than 5 mm, there is no need for suture and no scarring. The verv small outer diameter (0.49 mm) allows it to be inserted into an injection needle as well as made to be disposable. We are aiming for applications in imaging the interior of blood vessels.





Contact

## Medical Devices 06

#### Medical Devices 07

## Use of low-intensity pulsed ultrasound (LIPUS) in treating and/or preventing neurodegenerative diseases

Universities & Institutes

National Yang-MIng University Feng-Yi Yang

Technical Introduction

Low-intensity pulsed ultrasound (LIPUS) has been shown to induce neuroprotective effects against brain injury and cognitive dysfunction in rats by increasing BDNF protein levels in the brain. We demonstrated that LIPUS treatment significantly prevented memory impairment and cognitive dysfunction by transcranial ultrasound stimulation.

Scientific Innovation This technology provides the possibility that manipulation of BDNF by transcranial ultrasound stimulation (TUS) might provide a new therapeutic strategy for treating dementia. Thus, the generation of endogenous BDNF via LIPUS stimulation may represent a novel noninvasive technique for treating patients with diseases of the CNS.

#### Industrial Application

The neuroprotective effects of transcranial ultrasound stimulation (TUS) may be attributed partially to its enhancement of BDNF level. Our results suggest that TUS could be a promising new technique for treating brain disorders associated with decreased BDNF level in Alzheimer's disease.



Neur Sound





## Industrial Application

Universities & Institutes

Technical Introduction

#### Two modes :

and detect the suspicious lesion quickly.

National Taiwan University

Prof. Ruey-Feng Chang, Ph.D Yao-Sian, Huang

cloud server.





08

## **Computer-aided Detection System in Automated Breast** Ultrasound Based on the Deep Learning Architecture

After dividing image into volumes of interest (VOIs) by using multi-scale search sliding window, the VOIs are determined as tumor or not through the CADe system which is trained based on deep learning architecture, ensemble learning, and focal loss function. Then, the same tumor VOIs are merge by applying the hierarchical clustering and merge algorithm and the position of merged VOI is visualized.

Scientific Innovation Different from the conventional computer-aided detection (CADe) system which is designed according to the tumor characteristic provided by experience physician, the new deep learning CADe system not only can find the appropriate learning model automatically for tumor detection, but also improve itself by more new image to achieve faster, more robust, and higher accuracy purpose.

1. The CADe system is applied on the scanned images directly to review the images

2. The capture images will be saved in picture archiving and communication system (PACS). Then, through safety network and personal data elimination technique, the saved images can be reviewed and detected by the deployed CADe system on

Yao-Sian, Huang / 02-3366-4888 ext 402 / vichuang@ntu.edu.tw

#### Medical Devices : 09

## Bioresorbable bone graft, bone substitute and its composites

#### Universities & Institutes

#### National Taiwan University/Chang Gung Memorial Hospital, Linkou/ Stone & Resource Industry R&D Center

Prof. Wei-Hsing Tuan, M.D.&Prof. Po-Liang Lai, Assistant Research Scholar Pei-Yi Hsu, Man-Ping Chang PhD, R.A. Chia-Jung Wu, R.A. Chih-Yi Lin

#### **Technical Introduction**

Our novel technique provides alternative without creating new damage to patient. It is also possible to provide precisive medical service to each patient in need.

#### Scientific Innovation

The bone defects can be in any shape. The bone graft, proposed by our team, is either in the form of pellet or in the form of paste. Our products can be used for many bone defects.

#### Industrial Application

Contrast to the current products available from the market, the degradation behavior of our products fulfills the unmet medical need. The degradation rate is neither too fast nor too slow.



Universities & Institutes

National Taiwan University College of Medicine Chau-Chung Wu

Technical Introduction

Spatial repolarization heterogeneity greater than normal may allow early diagnosis of coronary artery disease (CAD). Traditional 12-lead ECG has some limitations. This is a newly developed multichannel ECG (MECG) system, which could detect low-amplitude high-frequency potentials and repolarization heterogeneity from the adjusted recording channels and derived data for early detection of CAD.

Traditional 12-lead ECG has limitation to quantify QT dispersion due to its low spatial accuracy. We have designed a multi-channel ECG machine, which could derive 25 to 221 channel signals from adjusting the numbers and locations of electrodes. The derived data such as smooth index of QT interval (kind of repolarization dispersion) could be used for early diagnosis of coronary heart disease.

Industrial Application

Techniques for diagnosing myocardial ischemia are important. Stress myocardial perfusion imaging or coronary CT angiography, due to its ionizing radiation and high cost, cannot be widely used in routine examinations. Our newly developed real-time multi-channel electrocardiogram can provide derived data such as SIQTc (kind of repolarization dispersion) for early diagnosis of coronary heart disease.



Contact

## Medical Devices

10

System and method for evaluating cardiovascular performance in real time and characterized by conversion of surface potential into multi-channels

Al Intelligent Appliance & Electronics & Optoelectronics



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## Al Intelligent Appliance and Electronics & Optoelectronics





## **Taiwan Information Security Center:** A Cyber Security Research Alliance

iversities & Institutes	Research Center for Information Technology Innovation Project Leader : Yuh-Jye Lee (Director),Shiuh-Pyng Shieh (Director),Tsung-Nan Lin (Director),Jung-Shian Li (Director) Inventor : Shiuh-Pyng Shieh (Professor),Yeali Sun (Professor),Shun-Wen Hsiao (Assistant Professor),Chu-Sing Yang (Professor)	Uni
echnical introduction	<ol> <li>Compared with conventional penetration tools, VulScan involves various evasion techniques and has higher penetration rate against WAFs and filters.</li> <li>This system applies machine learning to determine whether a binary file is malicious or not. The features of training samples used in this model have nearly 68,000 dimensions.</li> <li>Automated Malware Family and Cross-family Behavior Signature Generation, In-depth Semantic Analysis and Forensics.</li> <li>A NetFlow based malicious traffic detection research using Xgboost.</li> </ol>	Т
Scientific Innovation	<ol> <li>This system automatically generates combinatorial penetration and evasion techniques against target WAFs and filters.</li> <li>Without the need of repeatedly retraining, the proposed multi-task learning method can dynamically add detection and classification models to elevate recognition of malware.</li> <li>Three main contributions: 1) malware family and cross-family malicious intent related API sequence as the behavior signatures; 2) automated behavior signature generation; 3) automated semantic analysis of the lifecycle of malware family.</li> <li>By machine learning algorithm, threshold that adjusted by humans can be eliminated and increase the detection rate efficiently.</li> </ol>	
Industrial application	<ol> <li>Enhancing the ability to discover vulnerabilities for web applications or web APIs</li> <li>Providing the flexibility of involving new analyzers for future malware</li> <li>Automated malware family and cross-family execution sequence based behavior signature generation, and semantic analysis for effective and efficient malicious activities and unknown malware detection</li> <li>The proposed system was validated in practice on campus network for malicious attacks detection</li> </ol>	
Teb Security Scamer Basic payload + Basic payload + Basic payload + Basic payload - Basic payload - Basic payload - Basic payload -	Evision Technique A Fusion Technique A Filers / Waf Penetratedi Filers / Waf Penetratedi Filers / Waf Penetratedi Filers / Waf Penetratedi Filers / Waf Penetratedi Filers / Waf Penetratedi Filers / Waf Penetratedi Filers / Waf Penetratedi Filers / Filers / F	

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Contact

## Visible Broadband Achromatic Dielectric Metalens for Imaging

versities & Institutes

Research Center for Applied Sciences, Academia Sinica Prof. Din Ping Tsai.Dr. Pin Chieh Wu

echnical Introduction

Metalenses consist of an array of optical nanoantennas on a surface capable of manipulating the incoming light for focusing. We show an achromatic dielectric metalens working in a visible region. Various geometrical designs are utilized to compensate the phase requirement for different wavelengths. It's able to focus the waves onto the same focal plane. We also show full-color imaging by using achromatic metalenses to demonstrate its potential for full-color optical applications.

Scientific Innovation

We demonstrate a broadband achromatic metalens working in the visible light region. A lossless semiconductor material is used to construct unit elements to access waveguide-like resonant modes which exhibit high conversion efficiency. Various geometrical designs with different resonance modes are utilized to compensate the phase requirement for different wavelengths. The achieved continuous achromatism in visible region enables us to obtaining the first metalens-based full-color imaging.

ndustrial Application

With the advantages of light and small size, the metalenses can be used to miniaturizing optical systems such as the microscope, camera, mobile phone as well as dashboard camera. They will be small and more function, have better optical information and high applicability than conventional optical systems.





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## Block chain oriented smart health architecture bridging home, community, clinics and hospital services

#### Pingtung Christian Hospital

Universities & Institutes Chair Professor Duu-Jian Tsai, Professor Chien-Yeh Hsu, General Manager Chao-Sheng Huang, General Manager Peng Kao, Consultant Shou-Yi Fu

#### Technical Introduction

These smart technologies/solutions will serve as a collaborative foundation bridging hospitals, clinics, communities and home care services in the future. Block chain based personal health record will allow trust-based health information exchanges. These have been adopted by Ministry of Public Health, Thailand, as part of National Industry 4.0 Projects, further extending Myanmar, Lao and Cambodia.

Scientific Innovation Our solutions could accommodate medical informatics and community heath applications in ASEAN region and develop multiple layers business plans/models. More importantly, by linking into commercial supply chains, we could create service oriented system development solutions for either public or private institutions. Such designs are also attractive to China and other Southeast Asian countries.

#### Industrial Application

These applications in health industry could contribute a part to health record management, facilitate medical resource exchanges and to reduce health care cost, Exchange medical records among hospitals or institutions are emerging trends, in assisting clinicians making decisions with past health record availability. Such systems could enhance patients' abilities in self-health management.



Contact





#### Hsin-Mi Lu / 02-87721168 / estela@sea2003.org.tw

## Integrated EMG/ECG sensing and smart clothing

Universities & Institutes

#### National Sun Yat-Sen University Kaohsiung Medical University

1. National Sun Yat-Sen University : Ing-Jer Huang / Robert Rieger / Ko-Chi Kuo Professor 2. Kaohsiung Medical University : Lan-Yuen Guo Professor

Technical Introduction

Our integrated EMG/ECG sensing devices measure human physiological signals. including ECG. EMG and temperature. The devices can be attached to smart clothes and arm/leg bands to obtain the heart rate and muscle activities in living scenarios, such as daily exercise, elderly care, precision exercise and rehabilitation.

Scientific Innovation

Most physiological signal sensing devices are targeted to some single signal. Our Integrated EMG/ECG sensing is capable of sensing human body's ECG, EMG and ambient temperature. Combined with wireless transmission and analysis algorithm. our system is a highly integrated wearable sensing device that has the advantages of small size, low power consumption, and convenient measurement.

Industrial Application

Our sensing device, together with smart clothing, is a niche product for elderly care, sports training and rehabilitation by conveniently monitoring vital bio signals in casual environments. In addition, collected physiological data could contribute to the big-data analysis for human body.



Physiological signa

sensing devices

Mobile application

Signal processing algor

Smart clothing

Elderly care

Physical training



of sensing chip (AFE-5). The items included in our system module are as follows · FPGA with processor (Xilinx Zyng)

Physiological signal sensing chip (AFE-5)



## Integration of multi-axis motion-assistive platform with virtual reality imagery for rehabilitation purpose

#### Universities & Institutes

National Sun Yat-sen University

Prof. Dr.Cheng-Tang Pan, Prof. Dr.Jao-Hwa Kuang, Prof. Dr. Der-Min TSAY, Dr.Chung-Kun Yen, Pei-Yuan Sun. Hao-Jan Li.Yong-Syuan Dai

#### Technical Introduction

A multi-axis synchronous somatosensory platform combined with virtual reality image for medical rehabilitation was developed in the project, which mainly provided synchronous motion to improve patient's body function through interactive technology, spatial positioning, tactile stimulation, and situation sense. The physical and mental condition of a patient could be improved during exercise.

Scientific Innovation Three groups of crank links were applied for the platform which had three degrees of freedom, i.e., heave, roll, and pitch. The power was driven by three groups of servo motors. EtherCAT communication transmission with the motion control card was utilized to establish the motion control system. The multi-axis synchronization platform was integrated with VR images to complete the system.

#### Industrial Application

Compared with six electric cylinders, three groups of crank links and servo motors had more low cost. The movement of the platform and the VR image were synchronized to give the rehabilitation patient sense of reality. The physiological signals during rehabilitation were uploaded to the cloud for big data analysis. The physiotherapist can plan more suitable method according to the data.



## AI EEG Emotion Decoder

Universities & Institutes

National Central University

Shvu, Kuo-Kai( Professor), Lee, Po-Lei( Professor), Hsu, Hao-Teng(Postdoctoral research fellow )

Technical Introduction

Human brain is the most mysterious organ in our body. The human mind is constructed by 85 billion neurons which are tightly connected to produce the specific mental functions. With the development of intelligent technology, the artificial intelligent not only constructs the interaction between human brain and computer, but also open a window for interpreting our minds.

Scientific Innovation

Traditional techniques utilize indirect information, such as facial image or limb movements, to recognize subject's emotional states. The breakthrough of this project demonstrates the feasibility of recognizing people's motor intentions and emotion states from EEG data with artificial intelligent technologies. The proposed emotion detection platform can be combined with Facebook, Google+ and instagram to help social communications.

Industrial Application

The proposed EEG emotion decoder can be applied to improve people interaction of social community apps, such as Facebook, Google+, Instagram, etc. Future applications can be used to help self-emotion detection, assistance of clinical emotional disease diagnosis, and applications of neuroeconomics. It will provide a new dimension to help peoples social communications.



## Self-powered, active, and perfect-flexible robotic skins and actively perceiving and responsive soft robots

#### Universities & Institutes

National Chung Hsing University | Ying-Chih Lai(Assistant professor)

#### **Technical Introduction**

Mimicking human skins and molluscan, the self-powered and super-soft active robotic skin and actively perceivable and responsive soft robots are demonstrated for the first time. The robotic skins with perfect flexibility can actively sense external stimuli via self-generating electricity! The operation mechanism comes from the natural triboelectrification. The perfect integration of the robotic skins and soft actuators enables soft robots to perform various actively perceiving and interactive tasks.

#### Scientific Innovation

The robotic skin can actively sense external stimuli via self-generating electricity despite under extreme mechanical deformations or even after damage. Such ability and perfect mechanical properties are never happened before. And, for the first time, actively perceiving and responsive soft robots integrated with the skins can sense external and internal stimuli (such as motions, working states, environment, diaper conditions, and even subtle pulses) by self-generating electricity.

#### Industrial Application

The presented sensing skin that is self-powered, active, highly-sensitive, highly-flexible, practicable, manufacturable, and low-cost can meet a wide range of applications where smart interactive interfaces are needed. And, the first achievements in the actively perceiving and responsive soft robots can push the boundaries of artificial intelligence, robotics, as well as their vast applications. These works will make a revolutionary impact to human life, ranging from artificial intelligence, robots, wearable energy, smart interfaces, to palpation applications.









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## Semiconductor Manufacturing and Design for AI Edge

Universities & Institutes

Technical Introduction

PO of Semiconductor Moonshot Project, Program Director ; NCHU, Prof. Chen-Hao Chang NTHU R&D Team. Prof. Youn-Long Lin NTUST/NTHU R&D Team, Prof. Cheng-Hao Ko / Prof. Weileun Fang NCKU R&D Team, Prof. Shuenn-Yuh Lee

Twenty academic R&D teams of Semiconductor Moonshot Project will develop key technologies for Al edge. Three teams show their technologies this time.

- R&D Team)
- cardiovascular disease.(NCKU R&D Team)
- design to realize low-power speech command system.
- phone and embedded applications.
- biomarkers in urine.

Industrial Application

Scientific Innovation

- appliances, etc.
- and industrial spectral sensings.
- homecare and point of care test.





1. Speech Command Recognition System with Low-power Deep Learning Accelerator.(NTHU

2. SpectroChip Technology and Applications. (NTUST/NTHU R&D Team)

3. Portable and wireless urine detection system and platform for prevention of

1. Integrate NN design/training, speech processing, model compression and accelerator

2. The world-leading state-of-the-art SpectroChip (Spectrometer Chip) technology for smart

3. Microfluidic sensing chip and intelligent platform with biomarkers relative to cardiovascular disease; Evaluating user's risk of cardiovascular disease by detecting

1. The speech command recognition can be widely used in communications, vehicles, home

2. Smart phone-based applications for homecare pre-diagnostics, food safety inspections

3. The system and platform can be applied for the prevention of cardiovascular disease,

## An automatic continuous monitoring system for PM2.5 compositions

Universities & Institutes

National Chiao Tung University Jonathan Yang( General manager) ,Chuen-Jinn Tsai( Chair professor)

Technical Introduction

This instrument is a high-efficiency PM2.5 particle collection and automatic chemical composition monitoring system. It collects PM2.5 by using a dry electrostatic precipitator to charge and capture particles which are then extracted by by using pulsed water jets into liquid samples. Finally, the liquid samples are analyzed for chemical compositions manually or automatically.

Scientific Innovation

This system breaks through the difficulty of collecting PM2.5 particles into liquid samples by using the semi-dry electrostatic precipitator. It has lower instrument detection limits and higher accuracy for precursor gas monitoring than other commercial systems.

#### Industrial Application

- 1. It can be used for continuous automatic monitoring of PM2.5 chemical compositions in the ambient air and stack exhaust gas.
- 2. It can be used for continuous automatic monitoring of the clean room air in the semiconductor industry to improve the product yield.
- 3. This domestic instrument can replace other imported commercial instruments which are much more expensive.



You-Lin Zhou / 03-5712121 ext 55524 / david830915@yahoo.com.tw

## Using Silicon Photonics Technology to Increase Transmission Capacity in Data Center Networks and Network-on-Chips

National Chiao Tung University

Prof. Chi-Wai Chow, Dr. Jiun-Yu Sung, Prof. Chien-Hung Yeh

We have seen a significant increase in bandwidth demands in the data center networks. Reducing power consumption while increasing transmission capacity is required. Here, we focus on the development of advanced multiplexing technique and advanced modulation format on silicon photonics, known as mode-division-multiplexing and 4-level pulseamplitude-modulation, to 2.6Terabit/s. It is a 26 times increase in capacity when compared with present 100G based optical modules.

Scientific Innovation

Universities & Institutes

Technical Introduction

Industrial Application

position.

The bandwidth demand is increasing rapidly recently. Operating data centers are becoming more and more expensive. This research develops silicon photonics technologies, using alloptical schemes to increase the transmission capacity to > Terabit/s. These technologies could be possible to replace the existing technologies used in the present data center networks.



To increase the transmission capacity, traditionally, time-division-multiplexing (TDM) and wavelength-division-multiplexing (WDM) are used. Here, we propose and demonstrate using mode-division-multiplexing (MDM) in silicon photonic chips. Related research works have been published in first tier photonics SCI international journals, illustrating our leading

## Next-generation Perovskite Solar Cells : **Devices, Modules and Applications**

#### Universities & Institutes

National Chiao Tung University | Wei-Guang Diau

#### Technical Introduction

For large scale solar cells, the high light absorbance and cost-effective material, perovskite MAPb13, was introduced as light-harvesting layers. Once combined with the technologies of laser etching, screen printing and 3D dispensing, we are able to develop a commercilizable procedure for making large scale module with active area 15.12 cm2. This module shows excellent PV performance with Voc 7 V and PCE 11 % under indoor light irradiation.

#### Scientific Innovation

All the fabrication procedures for preparing of the carbon electrode based perovskite solar cell modules are under the ambient atmosphere conditions. The nonencapsulated modules showed 11% PCE under indoor light illumination and still maintained great enduring stability with PCE over 90% when the device was stored at 20°C and 50% RH for near 2000 hours.

#### Industrial Application

In the future, internet of things (IoT) would require lots of radio frequency identification (RFID) devices for the needs of data transfer and feedback. Our technique may provide solutions to replace the traditional one-time used battery and solve the environmental issue of using the primary batteries. Our modules can combined with super-capacitor or small energy store devices for IoT applications. Furthermore, the great optoelectonic properties of perovskites also have high potentials for other optoelectronic applications.

# Large Scale Fabrication Lead-free World Champion Cell



## Intelligent Disease Risk Early Detection System using **Deep Learning and Big Data Techniques**

Universities & Institutes

Technical Introduction

This system iDeepCare integrates deep learning and big data analytics methodologies, coupled with various techniques of image processing, time-series mining and text mining to provide intelligent disease risk prediction functions by analyzing medical data like the medical imaging, vital signs, and medical records. The system carries the merits of high accuracy as well as real-time response for early detection of disease risks in smart medicine applications.

Scientific Innovation

The developed disease risk prediction techniques carry high degree of innovation in smart medicine. For example, the image recognition technique can identify the property of colectral polyps from endoscope images with high accuracy of 97% and real-time response time (&It; 0.5 second). This technique has been published in the top journal Gastroenterology and reported by Reuters Health with high recognition in technical innovation and clinical application potential.

Industrial Application

The developed techniques can be applied in various Smart Medicine areas. For medical sides, it can reduce the diagnosis error rate and raise efficiency; For patient sides, it can enhance early detection for better treatments and lower cost; For IT service side, it can be expanded as medical analytics and decision support system for integration with medical systems like HIS (Hospital Information System) PACS Image System and CIS (Clinical Information System), and targeted for global industries in Smart Medicine.



Contact

National Chiao Tung University

Prof. Vincent S. Tseng, Henry Horng-Shing Lu, Prof. Shinn-Ying Ho, Prof. Chien-Liang Liu, Hung-Yu Kao (National Cheng Kung University), Peng-Jen Chen (Tri-Service General Hospital)

Prof. Vincent S. Tseng / 03-5712-121 ext 54765 / vtseng@cs.nctu.edu.tw

## Deep-learning-based object recognition, behavior, and 360-degree video SLAM technology for autonomous driving

#### National Chiao Tung University

Jiun-In Guo \ Po-Hung Lin \ Po-Chun Shen \ Chien-Chih Liao \ Ching-Kai Tseng \ Ricky Lee \ Chun-Yu Lai

#### Technical Introduction

Universities & Institutes

ezLabel features automatic route prediction and fitting algorithm, which reduces the time to label and ensure the quality, collects various samples, and help to customize AI function. Rear vehicle overtaking prediction uses C3D-based deep learning network with 16 rear camera images. It can be applied in E-mirror products to ensure safer driving. Besides, a 360-degree video SLAM technology solves the drawback of finite FOV video SLAM, achieves better accuracy, and speeds up 3D map establishment.

#### Scientific Innovation ezLabel:

- 1. Route prediction: label all video objects with only 2 frames;
- 2. Fitting: speed up and guarantee data labeling guality.
- Rear vehicle overtaking prediction:
- 1. Heat-map showing overtaking:
- 2. 3D CNN implementation:
- 3. Achieve 95% accuracy at day and night:
- 4. Detect object and recognize behavior at the same time. 360-degree video SLAM:
- 1. Supporting different number of cameras:
- 2. Positioning with panoramic image;
- 3. Saving 50% time of establishing map;
- 4. Increasing stability of pure rotation positioning.

#### Industrial Application

ezLable won the first Audi Innovation Award, Taiwan, ezLabel as the basis of developing deep learning-based video function tool is able to speed up and guarantee the guality of labeled data. These AI systems can be applied in to industry 4.0 for AGV or store warehousing robot, self-driving wheelchair in hospital for the patients, the disabilities, or the weakness, airport for luggage transfer, and autonomous car for locating.







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## Life-Long Learning System for Go ---CGI Go Program and Its Applications

Universities & Institutes

National Chiao Tung University

I-Chen Wu, Ti-Rong Wu, An-Jen Liu, Guei Hung

Technical Introduction

from the beginner to super-human experts.

handicap games.

Scientific Innovation

entropy parameter.

(about 8 kyu) to super-human experts (professional 13 dan).

AAAI 2019. (Acceptance rate: 1150/7095 = 16.2%)

Industrial Application

national Go team level.

system for amateur players.

beginner to professionals.



Contact

- \* Develop a new technique that uses an entropy parameter to control Go program strength without playing with a similar similar style. Offer up to 40 different ratings,
- \* Develop the first-ever system that can identify Go players' strengths.
- \* Develop a multi-labelled value network to improve strength and support the

Develop a ""life-long Computer Go learning system"" by a new method using an

- \* The first-ever system that can offer up to 40 different ratings from the beginner
- \* The first-ever system that can identify players' strengths from game playing.
- \* The paper about this work is to be presented in the top international AI conference,

\* Can be used to train Go professionals, e.g., the national team, to promote the

- \* Can be used in Go local communities and associations to serve as a tutuoring
- \* Can be used in large Go online playing websites, that can use to train player from

Cindy Ko / 03-5731603 ext 31603 / icwu@cs.nctu.edu.tw

## **PHOENIX** CubeSat

#### Universities & Institutes

#### National Cheng Kung University

Prof. Jyh-Ching Juang, Prof. Jiun-Jih Miau, Yun-Peng Tsai, Ming-Yang Hong, Ya-Tzu Hung, Jung-Chen Liu, Kai-Chun Wu, Chia-Heng Yeh, Cheng-Ting Wu, Ming-Xian Huang, Jordan Vannitsen

#### Technical Introduction

The PHOENIX CubeSat system contains scientific payload and subsystems of structure/mechanism, electrical power, data handling, attitude control, tracking/ telemetry & amp; command, thermal control subsystem, and flight software. The system engineering endeavor is a series of design, analysis, assembly, integration, test, launch, and operation. The PHEONIX CubeSat has been operating for more than one year, indicating a high technical readiness level.

#### Scientific Innovation

The payload of the PHOENIX CubeSat is an ion and neutral particle mass spectrometer that is capable of measuring the density of ions and neutral particles in the thermosphere. The measurements are crucial for a better understanding of the atmosphere and solar radiation with good spatial and temporal resolutions, paving the foundation for researches on global warming, space weather, hypersonic flight, space travel, and debris prediction.

#### Industrial Application

The CubeSats have made a disruptive innovation in the space science, engineering, and business communities. With its low cost and short development time, CubeSats have become enablers in many low-earth-orbit missions and space exploration missions. The PHOENIX CubeSat development experience will further be exploited by taking advantages of the domestic information, computer, and communication technologies for business development.



## Cracking The Mind's Code

Universities & Institutes

National Cheng Kung University Shulan Hsieh, Torbjörn Nordling, Tanya Wen, Jose Chang, Howard M.C. Hsu

Technical Introduction

Magnetic resonance imaging (MRI) images were acquired using a GE MR750 3T scanner. For each participant, a resting-state functional connectivity (RSFC) matrix was created from 8 minutes of resting-state functional MRI images. These matrices were entered as features into multivariate pattern analysis (MVPA), a machine learning technique, to predict an individual's age and his/her cognitive performance.

Scientific Innovation

This technique can accurately predict an individual's age and cognitive performance based on fast resting-state acquisition and multivariate analysis. Our current predictor has the second highest accuracy among published MRI-based age predictors around the world.

Industrial Application) This technique can be applied in clinical practice for detection and screening purposes. In the future, this technique could help prevent dementia and psychiatric diseases through client-based intervention programs utilizing individual predictions.



## The method and device for automatically recycling lithium from the sea/wastewater

Universities & Institutes

National Cheng Kung University Hong Paul Wang, P.-A. Chen

#### Technical Introduction

Here, we report a simple method for capture of lithium from sea/waste water by the new ion-sieves with additional photocatalytic abilities for splitting of water to hydrogen during the lithium capture processes. The ion-sieves can maintain 85% of its best performance in the cycles of Li capture and enrichment. The new photoactive ion-sieves have many promising applications in the areas of selective capture and recycling of metal ions from waste and contaminated waters.

#### Scientific Innovation

The key technologies in the new device for the automatic lithium mining from sea/wastewater include: (1) High shape-selectivity for desired ion recycling; (2) Low-cost, simple and high-automatic operation. (3) Lithium can be captured by precipitation with CO2 to yield Li2CO3 for direction utilization; (4) Economically attractively and environmental friendly; (5) Photocatalytic ability for splitting of water to hydrogen for self-supported electricity.

#### Industrial Application

The photoactive titanate ion-sieves have many applications for selective capture of metal ions from sea/waste waters. The new lithium mining technology has many advantages for commercialization such as: (1) High shape-selectivity; (2) Low-cost and simple with a high-automatic operation; (3) Lithium precipitated with CO2 to yield Li2CO3; (4) Environmental friendly; and (5) Photocatalytic splitting of H2O for H2 energy for self-supported electricity.

## **Demonstration Device for Capture** A new green process for of Lithium from Sea (waste) wate Recycling of Li, Ni, Co, and Mn from spent batteries

Contact

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Candlelight OLED Triggering Lighting Renaissance

#### National Tsing Hua University

Jwo-Huei Jou Chun-Yu Hsieh

Our innovative technology has integrated the advantage of blue-hazard free oil lamps and candles. In addition, we also combine the feature of energy saving nature of electric lighting that started 150 years ago. With these characteristics and our original patents of high band-number pseudo natural light OLED. we here develop the first electric-driven pseudo candlelight which is high efficiency, soft and blue-hazard free. It is comfortable for long-term reading and not hurting the eyes.

Scientific Innovation

Universities & Institutes

Technical Introduction

The scientific breakthrough of this technology is that it is the first blue-hazard free planar light source around the world, which is indicated as an innovative light source for women's breast cancer by Cancer Journal for Clinicians (CA) with the highest impact factor. Moreover, this technology had won many international rewards and received the attention of Professor George Brainard, the host of International Space Station Lighting Program, highlighting its importance in multi-applications.

Industrial Application

To safeguard the human health, it is vitally important to use healthy lighting source that can be devoid of blue light. The present lighting product is blue hazard free and therefore, it has numerous advantageous over the conventional lighting product. It can be used as a desk lamp for reading or indoor lighting for working for a long time. More importantly, it is friendly to melatonin secretion and hence suitable for home lighting after dusk.



Contact


## 3D room layout and camera pose estimation from 2D images

#### Universities & Institutes National Tsing Hua University

#### Technical Introduction

We propose a geometry-aware framework with deep networks to estimate the indoor room layout in the 2D as well as 3D space. We decouple the task of 3D layout estimation into two stages, first estimating the room layout in the 2D space and then estimating the 3D cuboid model parameters, all done with deep learning. Our experiment shows that the proposed model can provide not only competitive 2D layout estimation but also 3D room layout estimation in real-time.

#### Scientific Innovation

This technology is based on estimating 3D indoor geometric layout from a 2D image. Our method employs deep learning to estimate 2D and 3D indoor layout. We decouple the 3D layout estimation into two stages, first estimating the 2D room layout and then estimating the 3D layout cuboid model parameters. The proposed two-stage architecture for 3D room layout estimation is novel. It can be applied to 3D indoor layout estimation with the advantages of high accuracy and fast computation.

## Industrial Application

This technology can be applied to applications that require real-time 3D reconstruction and positioning from 2D indoor images. For example, it can be applied to the indoor robot navigation, that builds a model of the 3D scene from the 2D indoor images to achieve the 3D positioning of the robot. It can also be applied to augmented reality or virtual reality applications, since they require instant camera and room relative 3D geometric relationships for real-time camera or user 3D positioning.



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# from 360° Videos

Universities & Institutes

National Tsing Hua University

Technical Introduction

We proposed a self-supervised learning approach predicting depth and camera motion from a 360 video. We convert images from an equirectangular to cubic projection to avoid distortion. We propose "spherical photometric consistency". Hence, no pixel will be projected outside the image boundary. Finally, we propose camera pose consistency to ensure the estimated camera motions reaching consensus.

Scientific Innovation

To the best of our knowledge, predicting depth from a monocular 360 camera has not been well studied. We proposed a novel self-supervised learning approach for predicting the omnidirectional depth and camera motion from a 360 video. We introduce three key features to process 360 images efficiently.

Industrial Application

All autonomous systems, including self-driving cars, robots, need to perceive the surrounding to act in the world safely. However, this introduces extra cost and technical challenge to maintain a stable and well calibrated multiple camera system. In this case, modern 360 cameras are a great alternative since they are wellcalibrated, low-cost.







Contact

## Self-Supervised Learning of Depth and Camera Motion

Hou-Ning Hu ,Fu-En Wang, Hsien-Tzu Cheng,Juan-Ting Lin ,Shang-Ta Yang ,Meng-Li Shih ,Hung-Kuo Chu ,Min Sun

Fu-En Wang / 02-2578-6427 / fulton84717@gmail.com

## Boron-containing compound, emitting laver of organic light emitting diode and organic light emitting diode device

## Universities & Institutes

National Tsing Hua University (Frontier Research Center on Fundamental and Applied Sciences of Matters)

Prof. Rai-Shung Liu, Prof. Chien-Hong Cheng, Dr. Tien-Lin Wu, Dr. Chih-Chun Lin

### Technical Introduction

The present technology relates to a boron-containing compound with thermal activated delayed fluorescence (TADF), an emitting layer of an OLED. Rod-like diboron compounds bearing carbazole- or amine-type groups have been designed. OLEDs by using the emitters show high efficiency with a low efficiency roll-off. The outstanding OLED performance makes it attractive for color-display applications.

### Scientific Innovation

The present technology is a design and synthesis of a novel diboron material with TADF. A TADF material with a small triplet-to-singlet gap can harvest triplet energy via reversed intersystem crossing (RISC). These emitters greatly improve the internal guantum efficiency of the OLEDs and surpass external guantum efficiency limit (5%) of the conventional OLEDs. The rod-like molecules enhance the device out-coupling efficiency to achieve EQE exceeding 30%.

#### Industrial Application

The diboron materials are composed of common elements (C, H, N and B) without using precious metal. The synthesis steps are simple and convenient, the gram-level or even a larger amount of preparation can be achieved in the laboratory, which greatly reduce the cost of emitting materials. It is expected to promote the local material production and upgrade the Taiwan's panel and lighting industry.



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## Interactive inquiry-based experiment learning system: Expanding the border of science classrooms

Universities & Institutes

National Changhua University of Education Meng-Tzu Cheng, Mei-En Hsu

Technical Introduction

The system includes a teaching unit, an experiment record unit and an assessment unit. The user learns about the scientific content from the teaching unit through gaming, and then carries out the experiment in a real laboratory and inputs the results in the experiment record unit. Finally the user understands the correctness of the experiment through the system's real-time feedback function.

Scientific Innovation

The system has the benefit of providing repeated practice and instant feedback and retains the hands-on skills developed in experiment, and thereby achieves the effects of virtual and real-life interactive learning. Technological breakthrough includes using technology to design and implement diverse assessments, and providing students an alternative method to demonstrate their capabilities.

Industrial Application

The system which is filled with scientific concepts and numerous elements in developing various inquiry skills effectively integrates gaming with science learning. At an industry level, it can be used in the digital learning industry and various educational settings, as a new form of media for facilitating the development of scientific abilities and attitudes.





Mei-En Hsu / 04-7232105 ext 3437 / biobiomultimedia@gmail.com

## Customizable Laser Scanning Confocal SpectroMicroscopy

Universities & Institutes

National Taiwan University Research Fellow Yu-Ming Chang

## Technical Introduction

Our laboratory has successfully developed an optical platform: LSCSM, which is capable of performing rapid absorption, reflectance, fluorescence, Raman, SHG, multi-photon absorption fluorescence, and fluorescence lifetime spectroscopy and microscopy, under our home-build laser scanning confocal microscope. This optical platform can be customized based on the research and development request.

### Scientific Innovation

The main advantages are fourfold: (a) we offer simple and friendly user interface so the end users can just focus on their R&D; (b) the complete system is designed and constructed in Taiwan: (c) the system can be customized based on end user's special request; (d) we provide prompt maintenance service and on-site technical training to enhance the R&D capability and efficiency of our customers.

### Industrial Application

To promote our LSCSM, we have established "Photonic Workshop@CCMS.NTU" platform, where Taiwan companies can propose their photonic request via four R&D stages: professional consultation, technical service, research project, and technology transfer. Up to now we have delivered more than twenty LSCSM systems to both the research labs of universities and the R&D labs of photonic companies in Taiwan.



National Taiwan University Universities & Institutes Professor Pei-Chun Lin, Wei-Hsi Chen, Hung-Sheng Lin, Yun-Meng Lin, Ke-Jung Huang, Ting-Hao Wang, Ding-Gong Sung A mobile platform, which can adapt to various terrains, such as indoor, outdoor, Technical Introduction natural and artificial environments, is presented. Techniques are as follows: 1. The innovative leg - wheel transformable mechanism with bio-inspired control architecture is designed. 2. The platform is able to switch to different operating modes and to select an optimal moving direction automatically. Scientific Innovation The techniques that make the mobile platform unique to the international realm of robotics are stated below: 1. The innovative leg - wheel transformable mechanism reduces both structural mass

- 2. By using central pattern generator (CPG), the control system is simplified.
- 3. The platform is capable of agile and robust motion on different kinds of surfaces.

Industrial Application



- and system complexity on platform.
- The techniques construct a mobile platform, which can adapt to various terrains. Furthermore, the function of the platform could be extended by installing sensors (sensing device) or manipulators (operating device) depending on the requirements.

## Drone-based Object Counting by Spatially Regularized **Convolutional Neural Networks**

Universities & Institutes

National Taiwan University

Meng-Ru Hsieh, Yen-Liang Lin, Winston H. Hsu

Technical Introduction Drone-based object counting is vital due to the prevalence of drones. We propose Layout Proposal Networks (LPNs) to simultaneously count and localize target objects (e.g., cars) in drone-view videos. The method can be extended to other valuable objects such as cows, tanks, etc. We leverage the spatial layout cues (e.g., cars often park regularly) to augment the network design. We also present a new large-scale dataset (CARPK) that contains nearly 90K cars captured from different parking lots.

### Scientific Innovation

To our knowledge, this is the first work that leverages spatial layout cues for droneview object region proposal. We improve the average recall of the state-of-theart region proposal methods (i.e., 59.9% to 62.5%) on a public PUCPR dataset. We contributed the large-scale dataset (CARPK) containing more than 90K cars, the first drone-view dataset. Moreover, it out performs state-of-the-art object detection methods such as Faster RCNN, YOLO, etc.

## Industrial Application

The core technologies significantly improve the object detection and counting based on the advanced convolutional neural networks and outperformed the state-of-theart. Besides vehicles, the technology can be customized for valuable objects such as cows, pineapples, tanks, etc. It can also be extended to the medical domain and reduce the tedious labeling tasks for the radiologists and pathologists.



## **OmniEyes - Next-Generation Mobile Video Platform**

Universities & Institutes

Dr.Chun-Ting Chou

Technical Introduction

OmniEves collects and digitizes live street videos, and converts them using Al technologies to location-based information. Our lightweight & guot; fog&guot; Al along with cloud machine learning engines for interconnected mobile cameras is applicable to many verticals including digital map, fleet and logistics management, mobile advertisement, navigation and advanced driver assistance systems (ADAS). etc.

Scientific Innovation

OmniEves develops next-generation networking technologies including group-based communication (GBC) and fast intelligentnetwork switching (FINS). By developing artificial intelligence (AI)-assistedsearching/query and transmission technologies, we can jointly deal with networking, computing and storage (caching) needs. Compared to the existing digital maps and APPs, the update cycle can go for months, OmniEves provides instant updates from a few seconds to a few minutes.

Industrial Application

OmniEves is a Next-Generation Mobile Video Platform with complete front-end image capture and wireless transmission function, as well as back-end model creation and data storage capabilities, that providing instant updates and street views.

Industrial applications include enterprise-side digital map producers, service providers such as maps and streetscapes, smart cities (fleet management), and general users. Instant maps and maps are obviously highly economical in the future.

## **OmniEves Architecture**





## Graduate Institute of Communication Engineering, National Taiwan University

## Automatic image processing and pest detection algorithms for X-ray fruit images

#### Universities & Institutes

## National Taiwan University/Chung Hsing University

Ta-Te Lin, Joe-Air Jiang, Cheng-Ying Chou, Man-Miao Yang, En-Cheng Yang

### Technical Introduction

The technology can automatically identify areas infected by pests in the X-ray images. The operation principle includes several consecutive image processing procedures. Because pest left an obvious contrast in X-ray images of fruit with certain damage type patterns, they can be utilized by image processing technology to render computerized aided image recognition. Therefore, the pest infected areas can be automatically found to screen out those containing pests.

## Scientific Innovation

The system offers the very first fast, objective and non-disruptive fruit inspection method to substitute the labor-intensive dissection method to substantially lower return and destroy rates. The accuracy exceeds 99% and our pest database facilitates further big data analysis. The commercialization of developed technology in the fields of agricultural product guarantine and plant health inspections has great impact and can help to achieve 100% full inspection instead of sampling inspection.

## Industrial Application

- 1. X ray is moving into a portable, PC-based direction and cost less.
- 2. Available for international promotion such as Thailand and US Dep. of Agriculture to effectively reduce loss caused by insect pest. Know-how accumulated can be further applied to medical sector and customs inspection.
- 3. Agricultural application requires no FDA which increases industrial investment willingness.



Contact

## Invention Patent No. 1621405: 3D Sculpturing Garment Manufacturing Method and System thereof

Universities & Institutes

Ying-Chia Huang (Assistant Professor)

Technical Introduction

This research collaborates with the Down Syndrome Foundation Republic of China and Professor Lee, to design smart clothing for age of 12, 22 and 32 Down syndrome male users. This study takes smart clothing as an intermediate tool to monitor the Down syndromes' actives ether life and sports issues, via sportswear, electronic devices, and its mobile application.

Scientific Innovation

This study establishes smart sportswear for Down users to improve 21% garment fitting for users' body via pattern-making technology of the Sculptural Form Giving Method. It adopts 22g electronic module to establish a smart clothing collection. The Down users intend to wear for a long time and improve the users' willingness to visualize and to monitor their daily sports activity.

Industrial Application

The technology of pattern-making of the Sculptural Form Giving Method is able to create unique garment silhouette, slash and details to improve users' life quality via clothing. This customized garment is a foundation for collecting big data and further data analysis. It also can be used to design for various users, such as athlete, baby, children, elderly and patients.





Fu Jen Catholic University, College of Fashion and Textiles, Department of Textiles and Clothing

Metal Chemical Industry & Innovative material



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## Thermo-responsive Fluorescent Inks based on Semiconducting Polymer Dots Applied on Anti-counterfeiting

Universities & Institutes

National Sun Yat-sen University 詹揚翔副教授、楊鈞棊碩士

### Technical Introduction

This study utilizes Pdots with fluorescence and then incorporate combine with thermochromic dyes. These hybrid nanomaterials exhibit significant changes both in absorption and emission. Specifically, at room temperature, deep red color but no fluorescence could be seen. At the temperature higher than 37°C, these materials become transparent accompanied by the appearance of strong emission.

#### Scientific Innovation

This study utilizes different types of Pdots with RGB fluorescence and then incorporate combine with thermochromic dyes. Upon the temperature changes, these hybrid nanomaterials exhibit significant changes both in absorption and emission.In addition, we have successfully applied this material to printers.

## Industrial Application

This study successfully removed the environmental hormones of bisphenol A. In addition, the low biotoxicity of the semiconducting polymer nanoparticles used in this experiment was also confirmed by literature journals. And this hybrid nanoparticle has good repeatability when it used in other materials, indicating that it has potential to apply on food, medicine or daily necessities.



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## Friction Stir Welding(FSW) Process and Development of Customized FSW Machine Tool

Universities & Institutes

National Chung Cheng University Dr. Chih-Wei Huang / Dr. Zhen-Wei Zhuang

Technical Introduction Based on the long-term research knowledge-base of Advanced Institute of Manufacturing with High-Tech Innovation(AIM-HI) in the topics of machine tools, FSW and related processes, and seeking the corporation of the mature and flexible capability of the precision machine industry, this research group aims at the development of advanced customized intelligent machine tool and innovative friction stir processing.

Scientific Innovation

- of FSW.

Industrial Application

Friction stir welding technology has been widely applied in many industries. including space, aviation, maritime, military, railway, etc. It is a revolution in welding technology.





Friction Stir Welding can join materials that are difficult to fusion weld, for example, 2XXX and 7XXX aluminum alloys, the mechanical properties of welded joint is excellent, and there is no arc or fumes during the processing.

· We provide total solution for friction stir welding, with the expert system to optimize process parameter, and design the customized welding machines by using Computer-aided engineering(CAE), which is according to the characteristics

## Foam injection quality characteristic evaluation AI system

Universities & Institutes

National Chung Cheng University Pro. De-Shin Liu / Dr. 7i-Hau Chen

### Technical Introduction

Foam injection guality characteristic evaluation AI system that would pore through expert system to deduce "recipes" for producing particular materials. Beside, This system has to process different types of knowledge; making process parameter and material behavior. The system is under test and first results show that it can be used as an adequate tool for foam materials design and optimization.

#### Scientific Innovation

In previous formulation development, no considerations were taken into account on the impact of parameters caused to processing. However, this system is able to provide process parameters recommendations to obtain better manufacturing quality. shorten the mold tooling time, reduce material wastes, and be more environmentally friendly.

#### Industrial Application

Among the relevant auxiliary products required in the elderly society, high-value assistive products for personal mobility have received considerable attention. Therefore, if the product can be customized through a simple and rapid foaming material development and utilization, it can effectively overcome the industrial gap and produce the relevant assistive products at reasonable prices.



## **3D Reconstruction and Virtual Reality Visualization System Development for the Motion Simulation of Machine Equipment**

Universities & Institutes

Advanced Institute of Manufacturing with High-tech Innovations Prof. Yung-Chou Kao \ Prof. Pei-Ju Chiang

Technical Introduction

The technique of mechanical arm and 3D structure light scanning reconstruction of the workpiece can be directly applied to the scanning of the machine tool online. The developed algorithm improves the speed of the scan. Combined with immersive virtual reality technology, it simulates 3D motion, deformation of workpieces and collision detection.

- of the exhibition.
- reconstructed models.

Industrial Application

With the designed user interface, the status of the workpiece, robot, and the background can be visualized. Thus, the geometrical error can be analyzed through comparison of CAD model and used for error compensation. 3D visualization technology can reduce the cost of exhibitions and the limitations of the exhibition space, such as machine tool processing, multi-machine display.







Scientific Innovation 1. Let customers freely view mechanical equipment from different perspectives. 2. Various mechanical equipment can be displayed, no longer limited by the scale

> 3. Capable of 3D measurement in situ without the need of unloading the workpiece. 4. Capable of geometrical error analysis through comparison of CAD and





Khong Mun Hooi / 05-2720-411 ext 23348 / aimhikwh@gmail.com

## Composition and Process for Preparing a Non-conductive Substrate with Reduced Graphene Oxide for Electroplating

Universities & Institutes

## National Chung Hsing University

Prof. Wei-Ping Dow.Wei-Yang Tseng.Shih-Cheng Chang.I-Yung Chen

## Technical Introduction

Non-conductive substrates are chemically modified by rGO. Hence, they can be directly electroplated. The rGO grafting process possesses many advantages, such as short process time, no chelator, no toxic agent, even it is a barrier layer for Cu diffusion. It is a wet process that has no organic solvent, which is environmentalfriendly and beneficial for industrial production.

#### Scientific Innovation Comparison with current technology

Non-conductive material (NCM) is metallized by ELS. ELS uses Pd as catalyst and HCHO as reducer, respectively. It produces  $H_2$  gas and its waste water is difficult to treat.

Highlight of this work

NCM is modified by GO. The grafted GO is reduced to rGO without organic solvent. The rGO process has short process steps, low cost and easy mass production capability.

Industrial Application The specification of thermal reliability of chip stacking and 3D chip device become higher and higher. Graphene has outstanding heat and mechanical properties. The rGO process uses water as solvent, so its toxicity is low. This technology can be applied to semiconductor, chip packaging, printed circuit board, heat dissipation device and negative electrode of Li-ion battery.



## Application of biotecnology for waste gas removal and biogas purification

National Chiao Tung University Universities & Institutes Ching-Ping Tseng

Technical Introduction

The physical absorption or chemical scrubbing to remove odors and volatile organic compounds (VOCs) have high cost of consumptive supplies and produced pollutions. Thus, we have developed a novel bio-filtration system which can remove odors, reduce VOCs emission and for biogas purification. The advantages include lower energy consumption, high removal efficiency and low cost for maintenance.

Scientific Innovation The new technics have been published on peer review journals. The total citations by other papers are more than 1400 times. This bio-filtration system has been reported by IEEE Spectrum in 2012 which was the largest bio-system in the world to reduce VOCs waste gases. Also, the specific microorganisms used for bio-filtration system are ten times efficiency higher than active sludge.

Industrial Application The bio-filtration system has been used in composting fields and wastewater treatment. Also, this system has been applied to reduce VOCs waste gases produced from electronic industries. To establish the wastes recycling and bioenergy production technics in Taiwan, we constructed a demonstrated fielded of biogas purification system to remove H2S and used for electricity generation.





Odor removal system for wastewater treatment plant





Chia-Wen Lin / 04-2284-0510 ext 905 / cwlin@dragon.nchu.edu.tw Contact

VOCs removal system for electronic industry



Biogas purification system

## **Integrated Magnetic Gear Motor Drive**

Universities & Institutes

National Cheng Kung University Mi-Ching Tsai, Yi-Chang Wu, Po-Wei Huang, Chan-Chin Tsung, Ming-Hsiao Tsai

- Technical Introduction Electric motor, the most common source of mechanical power, coupled with gear sets forms drive systems with desired speed and torque. We pioneer research in developing innovative transmission module such as: an integrated magnetic gear motor with reduced structural volume and possess overload protection. In addition, with its unique feature of various possible combinations of power input and output, continuously variable transmission and differential transmission can be realized.
- Scientific Innovation The integrated magnetic gear motor input/output ports are interchangeable. This increases its application flexibility in power couplings, and consequently achieves active regulation of power transmission. Also by implementing power coupling control designs, the followings can be accomplished and meet the requirements of a multi-functional motor module for multi-directional transmission: (1) Fixed speed reduction ratio, (2)Electrical continuously variable transmission (ECVT), and (3) Differential transmission.

Industrial Application The integrated magnetic gear motor features overload protection and no wear problem, which is suitable for power-controlled applications with unstable load such as electric auxiliary vehicles (electric bicycles, wheelchairs, etc.). The non-

such as electric auxiliary vehicles (electric bicycles, wheelchairs, etc.). The noncontact transmission reduces dust and noise and requires no lubrication and less maintenance. In addition, this design utilizes few components, lightweight, high power density, and is able to enhance the endurance of electric vehicles.







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## high entropy oil well bearing and products

Universities & Institutes

Technical Introduction

National Tsing Hua University Professor Jien-Wei Yeh

This high-entropy oil well bearings are used for supporting the long shaft mounted with tandem rotors. The environment is harsh, so the bearing needs heat resistant, wear resistant, corrosion resistant and no magnetization. The typical alloy for this bearing is Co-6 which contains about 60%Co. As the present product contains much lower Co content, the cost is largely reduced and the cobalt resource will be less required. In addition, high-entropy gear cutters, wire drawing dies, protection hard coating tools, colored coatings, vibration films of ear phone, non-sparking tools, worm gears, implants of artificial joints with high cost-permance ratio are all new value-added products.

Scientific Innovation

Used the concept of high-entropy alloy to design a low-cobalt high-entropy alloy to replace the expensive and resource-consuming Co-6 alloy. Similarly, many breakthrough products with high C/P ratio could be designed and produced.

Industrial Application Used in th





Ivie

Used in the industries of oil well, transportation, machine, civil, energy, etc.

Professor Che-Wei Tsai / 03-5715131 ext 35370 / jwyeh@mx.nthu.edu.tw

## Thermo-shapeable spacer fabric for orthopedic support

Universities & Institutes

National Taipei University of Technology Svang-Peng Rwei Professor

### Technical Introduction

To use 3-D spacer fabrics and then coat a specifically designed polymer (Low melting temperature) to produce the shape thermoplastic 3D mesh fabrics, which can be easily re-shaped repeatedly vby hair dryer or hot water. The target product is a shape thermoplastic 3D orthopedic support (thermoplastic cast or spine correcting clothing) with light weight and breathability.

### Scientific Innovation

- 1. Synthesizing special low melting temperature polyester
- 2. Special weaving technique of 3-D spacer fabric.
- 3. Special coating and dipping technology.

#### Industrial Application

Such product can be used in an advanced material for medical treatment. The technology demonstrates that the feasibility to produce a thermoplastic and recyclable fabric/resin composite.



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## **Renewable Materials based Flexible Electronic Devices**

Universities & Institutes

#### National Taiwan University

Professor Wen-Chang Chen, Postdoctoral Project Researcher Chien-Chung Shih, Assistant Professor Wen-Ya Lee, Researcher Cheng-Jyun Huang, Researcher Guang-Way Jang

Technical Introduction

This technology develops the biomass polymer, polyethylene furanoate (bio-PEF), and process it into film or non-woven fabrics for high valued wearable electronic applications. The bio-PEF polymers were successfully synthesized with different molecular weights to meet the criteria of film or processing, including reactant concentration, catalyst composition and reaction temperature.

Scientific Innovation

The most prevailing substrate for soft electronic components is mainly made of plastic materials such as PET. Our developed PEF/Ag NWs conductive film was employed to fabricate organic field effect transistors or solar cells, and reveals far better properties than the PET substrates. Its gas barrier effect is better than the available substrates in the market, possessing more potential advantages.

Industrial Application Flexible electronic devices for wearable electronic applications are the mainstream research direction in recent years. Our developed PEF/Ag NWs film has high conductivity, flexibility, mechanical strength can replace brittle ITO electrode to provide high economic benefits and environmental friendliness. Meanwhile, it can also replace the commercial PET, having great value for commerciallization.





Contact

## The renaissance of string instruments in the 21st century: replicating the acoustics of Old Italian violins using modern material science

Universities & Institutes

National Taiwan University Hwan-Ching Tai

## Technical Introduction

We combined material analysis and acoustic analysis to decode the secrets of Stradivarius violins and Chinese gugin. In comparison to modern wood, Stradivari's wood has undergone chemical manipulations and aging. Acoustic analysis revealed how Stradivarius imitates human voices. In the future, we expect to reproduce the unique materials of Stradivarius violins and apply acoustic analysis for quality monitoring.

### Scientific Innovation

By cooperating with Chimei Museum and violin experts, we obtained wood chips and scale recordings of famous Italian violins. The effects of aging and unnatural elemental compositions in Stradivarius violin were uncovered. By linear predictive coding, we discovered that Stradivarius violins have higher resonance frequencies, giving them a more feminine and brighter voice.

### Industrial Application

We have tried various chemical treatments on modern wood to simulate the properties of Stradivarius violins and achieved some similarities. Once the technique becomes mature, we will further cooperate with violin makers. By offering the techniques of wood chemical treatment and acoustic analysis as a verification, it may be possible to reproduce the unique sound of famous 18th-century violins.



## High Entropy Superalloys and Armoured Materials

Universities & Institutes National Tsing Hua University Jer-Ren Yang, An-Chou Yeh

Technical Introduction The technology is advanced High-Entropy-Alloys (HEAs) for high temperature engineering applications. Alloy design utilizes the four core effects of HEAs, multiphase strengthening mechanism, and minor addition of elements to adjust high temperature mechanical properties, cost, density, and cost-performance. The high entropy CoCrFeMnNi alloy has been developed and can be produced in a large mass scale. It is a potential armoured material for application in bulletprotection.

Scientific Innovation

Alloy design utilizes the four core effects of HEAs, multi-phase strengthening mechanism, and minor addition of elements to adjust high temperature mechanical properties, cost, density, and cost-performance. We have achieved properties of HEAs to be similar to those of commercial superalloys, but with lower cost in raw materials.

The high entropy CoCrFeMnNi alloy has been tested and proved to be a potential armoured material for application in bullet-protection.

Industrial Application

sectors.

The high entropy CoCrFeMnNi alloy is a potential armoured material for application in bullet-protection. The alloy can be fabricated to be the plates in mass production.





Contact Jen-Hsuan chung / 02-3366-8684 / r0622315@ntu.edu.tw 12

Dept of Materials Sci and Eng, National Taiwan University. Dept of Materials Sci and Eng,

This technology can be applied at high temperature systems such as turbo-charger, gas turbine engine, so we can supply critical materials for our energy and aerospace

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2018



# Smart Hospital



Taien University

## Smart Disease Care Q&A Dialogue Expert Feedback System

### Universities & Institutes

Jhing-Fa Wang I i-Chai Chen Bo-Hao Su Che-Wen Chen Yu-Shan Lin Yuan-Ta Xu

## Technical Introduction

This system is mainly divided into two parts: Disease diagnosis and merchandise inquiry. Disease diagnosis, can infer whether the user is having the related disease through multiple rounds of voice conversation, and recommend related drugs or health foods. For merchandise inquiry, you can directly ask about the merchandise. such as the placement and price of the merchandise.

## Scientific Innovation

The disease Q&A system and The drug consultation system is provided on the Smart Disease Care Q&A Dialogue Expert Feedback System. The disease Q&A system is to understand the symptoms of the patient and estimate the patient's disease in multi-round voice dialogue. Health foods that people can purchase in a pharmacy by the needs of the patient or previously inferred disease.

#### Industrial Application

Our technology is based on the Smart Disease Care Q&A Dialogue Expert Feedback System proposed by Smart Pharmacy and Smart Hospital, can be applied to various fields. On the other hand, it can be customized according to the needs of customers. and can be adapted to various fields by changing the training text, so as to save human resources. The application fields include navigation services, family services, public services and care services.



## Smart Pillow Pad

## Universities & Institutes

Chung Yuan Christian University Cheng-Yuan Chang and Sen M. Kuo

Technical Introduction

This work develops a smart pillow pad to reduce snore from the bed partner. This pad is small and portable: can be placed behind a pillow to create a quiet zone surrounding the sleeper's both ears. This pad can also play music and comfort sound for improving sleep quality and integrates with hands-free voice calls for bedridden clients. We can also develop APP to analyze the recorded snore sound for several medical purposes such as sleep apnea detection at home, http://anvc.ee.cvcu.edu.tw

Scientific Innovation

- senior people.
- appea detection.

Industrial Application

- medical tasks such as sleep apnea detection at home.
- for senior people.





Cheng-Yuan Chang / 03-2654838 / ccy@cycu.edu.tw

1. A portable active noise control device to reduce snore by utilizing virtual sensing technique to create and transfer the quiet zone to cover the sleeper's head. 2. Integration with entertainment, sleep guality detection and improvement, and

hands-free communication functions to avoid accidental fall when get up for

3. Combine with APPs to analyze recorded snore for medical tasks such as sleep

1. For Consumer Electronics Industry: A portable device to reduce snore, integration with entertainment, sleep quality detection and improvement.

2. For Home Care Industry: Combine with APPs to analyze recorded snore for

3. For Senior-oriented Industry: Provide sleep improvement and hands-free communication functions for bedridden clients, avoid accidental fall when get up



## Intelligent Vision based Healthcare and Physiological Information Monitoring System

Universities & Institutes

National Chiao Tung University Bing-Fei Wu

With the technology of computer vision, the system can effectively monitor the status Technical Introduction and behavior of users by face detection and recognition, image-based physiological information measurement, behavior recognition, fatigue detection, and painful expression analytics. If the detected status is abnormal, the system will warn the users, medical staff, family in real-time, or send the messages to the authority concerned. It can also light another bright lamp for the long-term care road in nowadays aging society.

### Scientific Innovation

- The features of our technology are as follows :
  - 1. A single camera can measure heartbeat, and HRV.
  - 2. 90-degrees angle for face detection and real-time processing of the arbitrary motion face recognition.
  - 3. The heartbeat can be measured as high as 180 or more.
  - 4. Big data of cloud and artificial intelligence analysis for individual health status.
  - 5. Manage the physiological signal at any time.

## Industrial Application

Face recognition combined with physiological information detection can be applied to a variety of fields. Currently, we work to develop the market of [smart healthcare] for helping users do the self-health management, home care needs, or sports fitness planning in the area of remote healthcare, asthma, OSAS, elder healthcare. Also, developing the [smart traffic] market to reduce fatigue driving, and focus on the market of public transportation, fleet management, and logistics. In addition, [Smart Retail], [Smart Finance] are the market gaps we will break through in the future.









## Carotid artery stiffness detector





A carotid atherosclerosis detector bases on ultrasound technology, measuring the pulse wave velocity of the carotid artery and assessing the degree of stiffness, for the diagnosis and prevention of cardiovascular and cerebrovascular diseases.

1. Unlike the mainstream machines in the market, our system uses ultrasound technology to measure the carotid PWV (Pulse Wave Velocity) and instead of the

2. The functions of our system is simplified, which makes it easy to use and run

For diagnosis and prevention of cardiovascular and cerebrovascular diseases. 2. There is no restrictions for the system on the place of use, and it is applicable to

## Evaluation and Training of Vestibular, Visual, Postural alignment and Gait Stability during Over-ground Walking

## Universities & Institutes

## Taipei Veterans General Hospital/National Yang-Ming University

Chung-Lan Kao, Shun-Hwa Wei, Chung-huang Yu, Li-Wei Chou, Po-Yin Chen, Yi-Shun Chung

## Technical Introduction

We established a wireless and moving sensory platform which can evaluate functional performance in healthy and diseased individuals during dynamic activities. The device can provide valuable data for custom-made training modules. Furthermore, we can establish an interactive training program according the results for improvement of functional performance.

## Scientific Innovation

- 1. Interdisciplinary integration: The technology include estimate, prescription design and training program.
- 2. Telemedicine for rehabilitation.
- 3. Dynamic estimate and training program.
- 4. Integrate wearable sensor and wireless technology.
- 5. Robotic platform can follow the subject automatically.
- 6. Science evidence and patent : 25 papers (SCI>5:4 papers). Taiwan and USA patent.

## Industrial Application

Recently, in Taipei Veterans General Hospital and National Yang Ming University, our technology were already applied and validated through trials of normal and disabled subjects. It not only distinguish the patient whether with vestibular hypofunction but also improve functional performance. Besides application in hospitals, it can integrate with AI and cloud technology become AI-based telemedicine. The estimated market demand will reached 90 million NTD.









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## Tomographic digital impression scanner system and the using method thereof

## Universities & Institutes

National Yang-Ming University Shvh-Yuan Lee, Chih-Wei Lu, Yu-Chen Lai

Technical Introduction

through the restrictions that require gingival retraction to take the mode. The system is non-invasive and non-radiation. The system is also applicable to oral disease detection. Like, early oral cancer, detection of gingival calculus, periodontal disease prevention, dental cracks, etc. In the future, our system can be combined with AI identification function to complete automated diagnostic capabilities.

Scientific Innovation Our system completes the optical path correction. This correction capability can realize the OCT modeling ability for the teeth appearance in the gingiva. Generally, oral scanner cannot obtain information under the gingiva. The team completed the surface position analysis algorithm, which can make accurately position to under 30 µm accuracy level, which can achieve the same level of accuracy as the commercially oral scanner, which is better than the previous OCT system(~100 µ m).

Industrial Application This system can be used for dental model establishment and dental measurement. It's non-radiative, non-invasive, The dental model function is built to have the same function as a general oral scanner, but the application is wider than oral scanner. Oral disease measurement such as initial oral cancer, gingival calculus, dental cracks, etc., can assist dentists in diagnosis. Therefore, the system has more extensibility functions than the general oral scanner.







Dong-Yuan Lyu / 02-28267000 ext 5392 / sylee@ym.edu.tw

Our system uses infrared laser, which can penetrate a certain depth of tissue, breaking

Univ

# Smart surgical glasses combined with surgical robots to implement liver puncture surgery research and development program

ersities & Institutes	Taiwan Main Orthopaedic Biotechnology Co., Ltd Ming-Liang Wang	Universities & Institutes	Wiltrom Co., Ltd. Huang-Chien Liang
hnical Introduction	<ul> <li>The implementation plan "Smart Medical Glasses Combined with Surgical Robots to Implement Liver Puncture Surgery Development Program" is mainly constructed by the following four main technical contents:</li> <li>1. Smart surgical glasses hardware establishment</li> <li>2. Stereoscopic tracking algorithm</li> <li>3. AR location tracking algorithm</li> <li>4. Computerized tomography 3D reconstruction</li> </ul>	Technical Introduction	Spinal fusion is surgery to join verte been cleared out, surgeon implant a cage usually contains autograft. Aut We designed a cage and a BMP-2 be substitutes delivery device can tran prevent to release the BMP-2 to cont
cientific Innovation	<ol> <li>Smart surgical glasses hardware establishment</li> <li>Stereoscopic tracking algorithm</li> <li>AR location tracking algorithm</li> <li>Computerized tomography 3D reconstruction</li> </ol>	Scientific Innovation	The BMP-2 bone substitutes del substitutes (quintuple of traditional By this device, the area of filling BM
ustrial Application	With the wearable device "Wisdom Glasses" and "CT Image 3D Reconstruction" software, it can be used for medical school case teaching and allows young doctors to use the above techniques for surgical rehearsal training in a short period of time, shortening the need for young doctors to go through real surgery cases.	Industrial Application	<ol> <li>Combination products</li> <li>Increase product value</li> <li>Combine with other MIS surgury</li> <li>Traditional metalworking factory of</li> </ol>
	<complex-block><complex-block><complex-block><complex-block></complex-block></complex-block></complex-block></complex-block>	14 12 前 4 8 端 6 5 4 2 0 律統手術	利用 Increased to 5 times 創新微創购機椎椎籠 及其周遠輔助 5 械





## BMP-2 Bone Graft & Cage System and Its Instrument -Holder and Bone Graft Delivery Device

ertebrae into one single structure. When the disk has it a cage between the two adjoining vertebrae. This Autograft is associated with several disadvantages. 2 bone substitutes delivery device. The BMP-2 bone transfer more BMP-2 bone substitutes to cage and contact nerve or muscle.

delivery device can transfer more BMP-2 bone nal surgery) to cage and reduce the operation time. BMP-2 bone graft in the disc is more than 75%.

y ry upgrading and transformation



# Remote controlled minimally invasive osteosynthesis bone cement injection system

## Universities & Institutes Wiltrom Co., Ltd. / Point Robotics MedTech Inc.

#### Technical Introduction

Remote controlled minimally invasive osteosynthesis bone cement injection system re-design a set of devices for remote control of bone cement injection for minimally invasive osteoporotic vertebrae. The pre-planning allows physicians to understand the patient's bone status. Then the distance and injection pressure of bone cement are remotely controlled and monitored during the operation.

#### Scientific Innovation

On the hardware, remote control is expected to be applied to devices that require remote control of injection in various operations, whether it is bone cement injection, artificial bone substitute injection or even used in different surgical sites. In the reconstruction and simulation system, it is expected that the plan including osteoporotic bone or bone cement injection can be established in the system.

#### Industrial Application

Long-distance control bone cement injection system is mainly used in spinal surgery. The whole technique includes preoperative planning and intraoperative remote control, so the reconstruction and simulation of preoperative planning software can be effectively applied in application. The technology related to orthopedic surgery and the intraoperative long-range control is expected to be applied to the control needs of different injection types, even on the robot arm.







## Small Incision flapless refractive femto laser system

Universities & Institutes George Huang

Technical Introduction

The small incision flapless refractive femto laser system applied matrix scanning method (Grid Matrix Scanning Method) for SMILE, LASIK and Cataract surgery. It have the advantages of machine size and mobility.

Scientific Innovation

The first small incision flapless refractive femto laser system that are selfdeveloped in Taiwan. It have not only improved the shortcomings of the ZEISS VISUMAX about the big machine size and heavy ,but also have the advantages of being able to move and operate between clinics. The cost of surgery for each doctor can be shared by renting and offering a reasonable price of SMILE surgery for the patient.

Industrial Application

The latest ophthalmic laser SMILE surgery improved the shortcomings of the old PRK and LASIK surgery. With precise femtosecond laser three-dimensional cutting, only 2-4mm wounds are retained, the corneal integrity and strength are preserved, and the postoperative recovery are quickly. The patient feels comfortable and can rub his eyes and wash face the night after surgery.

Contact

03-6107168 ext 211 / hytai@wiltrom.com.tw

Contact Phil Teng



## ACELLULAR CORNEAS, METHODS OF PRODUCING THE SAME AND USES THEREOF

Universities & Institutes

ACRO Biomedical Co., Ltd. Dar-Jen Hsieh, Fan-Wei Tseng

## Technical Introduction

ACRO Biomedical develops a proprietary SCCO2 extraction technology to remove cells. fats and non-collagenous proteins from animal tissues and organs, leaving the intact collagen scaffolds as biomaterials for tissue engineering. This technology is applied on porcine cornea to develop Collagen Ophthalmic Matrix for corneal transplantation, which is entering human clinical trials, in hoping to serve as an alternative solution to human donated cornea.

### Scientific Innovation

ACRO's Collagen Ophthalmic Matrix is the first product to apply the SCCO2 decellularization technology for the completely removal of the cells from porcine cornea without using any chemical detergent. The natural collagen scaffold structure is retained undamaged for corneal repair. The success of this corneal tissue decellularization process is a pioneering work in Taiwan's biotechnology community. and can also be applied to TERM in the near future.

## Industrial Application

ACRO Biomedical provides the best natural scaffold for cell to attach, grow, and differentiate. Collagen Ophthalmic Matrix will soon enter clinical trial phase, which is the last challenge before entering the market. When launching the product to the market, the shortage of the human donated cornea, the long waiting time, and the rejection reaction will no longer exist.



Contact Fan-Wei Tseng / 07-6955-569 ext 232 / koli@acrobiomedical.com

## Microneedle patches and manufacturing method

## Universities & Institutes

Technical Introduction

Win Coat Corporation Ta-Jo Liu.Hsiu-Feng Yeh.Chia-Yu Wu,Ying-Hua Hsu

Microneedle patch (MNP) is a novel drug delivery system. These needles can pass through skin and effectively deliver the drug, but not long enough to touch the nerve system so there are no painful feelings. WCC has developed an effective method to produce MNPs. FDA approved materials can be mixed with drugs or vaccines to make MNPs and the amount of drugs or vaccines that are be delivered into skin can be accurately controlled.

Scientific Innovation

Win Coat Co, has developed a unique process technology for dissolving microneedle patches. MNP is produced by a unique coating/casting process, which has the advantages of high yield and fast production. Dissolved MNP is made of biomedical polymer materials, which are safe to use. Due to the superiority of the process, it is more flexible in the design of the needle structure. According to different application requirement, MNP features can be adjusted, including needle length, alignment, etc.

#### Industrial Application

The microneedle patch is a drug carrier for the purpose of controlled release of the drug. MNP is used in a wide range of applications, including insulin, analgesics, vaccines, etc. The microneedle patch is similar to the transdermal patch, and the patient can operate at home. The advantages of the patch are that it is easy to carry, transport and store in a small size.





Hsiu-Feng Yeh / 03-579-5276 ext 200 / info@wincoatco.com

## MonoStereo<sup>®</sup> 3D Endoscope Visualization System

#### Universities & Institutes MedicalTek Co., Ltd.

### Technical Introduction

MonoStereo<sup>®</sup> 3D is easy to install with a most of the pre-existing 2D endoscope system. It allows the surgeons to use endoscopes with different angulated optical lens  $(0^{\circ} - 30^{\circ} - 45^{\circ} - 70^{\circ})$  during the intervention. It also allows a surgeon to easily switch from 2D to 3D mode throughout the surgical procedure, surgeons can leverage the 3D visualization in the complicated situations and use the 2D visualization in rest of the surgery if their eyes get fatigued.

### Scientific Innovation

MonoStereo<sup>®</sup> 3D Endoscope Visualization system upgrades and integrates the 2D endoscope systems into 3D to provide surgeons depth perception which lack in traditional MIS surgery. It is not only to provides more clear and accurate images for surgeons, but develops the product that can be closer to the needs of surgeons.

MedicalTek Co.,Ltd

eep 2D, See 3D

## Industrial Application

Endoscopic Visualization in Minimally Invasive Surgery



Contact

#### 04-2560-3641 / mdtk.kathy@gmail.com

## Horus Digital Medical Imaging Set DSC 200P

### Universities & Institutes

Medimaging Integrated Solution Inc. Chu-Ming Cheng Chairman/CEO and Co-founder

Technical Introduction

Horus Scope adopts an new optical design and innovative integration of mechanical and electronic system. It's the world's first and currently the only handheld digital camera with 5 Mega-pixel resolution. The control unit has 3.5 inch full-color touch screen can display videos and still images in real-time. The shared fuselage product design can also replace the lens to perform different functions of the inspection, and the provincial resources of green design concept.

Scientific Innovation

The core competence of MijS is that we provide a total solution of digital medical scope products integrated with a high-quality optical system, real-time imaging processing and high safety following the medical certification. MiiS devotes itself to eye care total solutions, AI medical solutions, and mobile medical services to improve remote medical care.

Industrial Application MilS creates a user-friendly platform for all patients and doctors. Combining with image analysis and cloud processing, our products provide doctors the best diagnosis and treatment tools. In addition, we also share resources with many organizations for preventive medicine and remote medical care.





Contact

Erin Liu / 03-579-8860 ext 1207 / erin.liu@miis.com.tw

## Medical Image illustrator & VIML VR Viewer

Universities & Institutes	National Applied Research Laboratories, NARLabs Po-Ying Li, Charlie Chang, Cheng-Wei Ku ,Kuen-Long Tsai,Chia-Yang Sun.	Universities & Institutes	COMDEK INDUSTRIAL CORPORATION KUO, YI-SUNG
Technical Introduction	A total solution for biomedical image processing, visualization and interaction in VR include two software, MiiL(Medical image illustrator) and vvViewer (Visualization and interactive media lab's VR Viewer). With MiiL software, users could directly import, label and segment DICOM image. After processing by MiiL, results could be imported to vvViewer for visualization and interaction in 3D VR anvironment.	Technical Introduction	COMDEK Intelligent Patient Care measurements and also involve interne measuring and monitoring technolog monitor's ability. Through real-time of patient's condition and suggests odd fi
Scientific Innovation	MiiL and vvViewer changes habits of traditional medical image presentations. 3D medical images could be semi-automatic labeled and segmented by MiiL. vvViewer provides an immersive way of visualizing 3D medical image and an intuitive way of exploring the image data with VR controller.	Scientific Innovation	In order to achieve medical prevention real-time diagnoses using multiple vit breakthrough to offer the Intelligent Pa The IoT platform and the hardware in
Industrial Application	Image labeling and segmentation Al training data preparation Virtual Reality Educational purposes Preoperative planning Doctor-Patient relationship		and nursing resources. The concept patients who really need the attention Furthermore, the concepts provide the a Distance Diagnose. Through the big da exactly diagnose and bring the early tre
	Image: state of the state of		80 96 7 7 7 8 37 1 30 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1





## The COMDEK Intelligent Patient Care Systems

ient Care System offers not only vital sign signal olve internet ability. Embedded the Internet with current technology, The IoT Integration extends the patient real-time diagnoses, the system is able to evaluate the ests odd findings.

al prevention and prediction, we focus on developing nultiple vital sign signals. The IoT integration also is a telligent Patient Care System beyond patient monitor.

hardware integration significantly reduced the medical e concept is able to focus on medical assets on the ne attention and is able to increase the medical quality. rovide the ability of Long-Distance Caregiving and Longthe big data analysis, the technology is able to provide the early treatment option to patients.



## Portable Multifunction Patient Monitor System

## Universities & Institutes

Technical Introduction COMDEK portable patient monitor provides a lightweight integrated system for confident decision-making without wasting critical time. The monitor includes 7 non-invasive parameters with wireless capability that can easily link with Smart Link to analyze patient's data in real time. The integration concept offers the best Long-Distance Caregiving and Long-Distance Diagnose.

### Scientific Innovation

Realize the modular design on multifunction patient monitor, it results in downsizing monitor's physical size. With the connection technique breakthrough, we are able to upload vital signs signal to the cloud. Through Smart Link program, the software can provide medical grade analysis and diagnose in real time.

#### Industrial Application

The improvement of technology in vital signs monitor and hardware-software integration provide Long-Distance Caregiving and Out-of-Hospital Emergency Care. Based on the real-time data driving analysis, the monitor offers not only the exact decision and effectiveness but also evolute city to a smart city.



## oh care oh check & oh oral products

Universities & Institutes

General Biologicals Corporation

oh check, a molecular diagnosing platform for monitoring and characterizing oral bacteria in periodontitis patients. A non-invasive oral testing to monitoring oral conditions, and based on the result, providing recommendations for suitable oral products. All oh oral products contains P113+, an antibacterial protein patented in Europe and USA that inhibits growth of bacteria and fungi that cause periodontitis, bleeding gum and tooth decay by 99%.

Scientific Innovation

Technical Introduction

Periodontal disease is caused by chronic bacterial infection. Pathogenic bacteria. We used the real-time PCR method to detect periodontal patients ' changes before and after treatments of basic periodontal therapy and oral regular maintenance, and make a criteria of each kind of bacteria via clinical trials.

Industrial Application

The oral gene detecting platform can be the index of periodontal disease. It makes a criteria of each kind of bacteria. We can offer precise oral medical suggestions, provide tracking service for high-risk group of periodontal disease, and help populations to prevent periodontal disease early.







## Needle dislodgement and blood leakage detection device

Universities & Institutes

AcuSense BioMedical Corp. www.acusense.com.tw

## Technical Introduction

The sensing patch technology combined with flexible carrier and multi-loop circuit technology is used to detect the venous needle dislodgement and blood leakage. We have developed multi-channel sensing technology to detect customized leak detection (0.5-1mL) accurately for avoiding false alarm. At the same time, with IoMT multibed monitoring system can be applied in hospital environment and home hemodialysis patients.

#### Scientific Innovation

The traditional leakage detectors are mostly single-point detection and buzzer warning. Acusense takes the lead in building IoMT leak detection multi-bed monitoring system, which can communicate with the hemodialysis equipment according to the requirements of IEC / PAS 63023. It is not only provide hospital safer environment but also reduce the disputes. In the future, the concept can be extend and applied in IV fluid leakage with disposable gauze for better convenience experience.

## Industrial Application

Acusense is a full range detection system for fluid leakage and needle dislodgement. The portable device accurately delivers the alert to attending medical staff through combination of cloud and IoT technology. The continuous monitoring provides safe treatment environment for patients and alleviates the workload of medical professionals.

# Smart Leakage Detection System cusense ned. Further PCT application in progr



ISO 13485-2003

## Negative pressure treating device for obstructive sleep apnea

versities & Institutes	Somnics Inc. Chung-Chu Chen
chnical Introduction	The iNAP is designed to provide OSA patients. During sleep, the i to stabilize the tongue and soft disordered breathing.
Scientific Innovation	<ul><li>iNAP is an Innovative treatment</li><li>advantages.</li><li>1.Natural Breathing</li><li>2.Operation Without a Mask</li><li>3.Superior Wearing Comfort</li><li>4.Compact and Travel-friendly</li><li>5.Discreet and Quiet</li><li>6.Portable and Battery power</li></ul>

Industrial Application

Un

With the features of iNAP, compact, travel-friendly, operation without mask and battery-powered, patients can be no longer bothered by the side effects from the traditional treatment. iNAP is a novel and ideal treatment for OSA patients convenience and comfort.







a quiet and comfortable treatment without mask for iNAP creates a gentle vacuum within the oral cavity tissues and free the upper airway to prevent sleep-

nt for Obstructive Sleep Apnea (OSA by following

## Spine Navigation System

Universities & Institutes

INTAI Technology Corp. Chuang, Shih-Chang

## Technical Introduction

Spine navigation system provides pre-surgical planning, images fusion and image guiding. Furthermore the system that have high compatibility with general x-ray equipments, compare with the orther compete products no need expensive intra 3D imaging equipment.

### Scientific Innovation

The system feature technical is special 2D/3D images registration software provides segmentation vertebral on the 3D CT images and use 2 c-arm images to corrected images position furthermore that have high compatibility with general x-ray equipments compare with the orther compete products no need expensive intra 3D imaging equipment.

## Industrial Application

For the global market spinal surgery annually more than million procedures. The ratio for the spine minimally spine surgery is growing every year. The benefit from spine navigation can effect improved screw placement accuracy and decreased radiation exposure that causing the system demand increase.









Chen, Hung-Yi / 04-23595336 ext 23412 / ivor@mail.intai.com.tw





# Quantum Technology



## Advanced Quantum Technology Innovation

Universities & Institutes

National Tsing Hua University Io-Chun Hoi, Ying-Cheng Chen, Chih-Sung Chuu

## Technical Introduction

- Qubit as microwave amplifier: the basic unit of quantum computer, qubit, is shown to be able to amplify microwave. This can be potentially used to amplify the output signal of quantum computers.
- High storage efficient optical quantum memory: Use ultra cold atoms as the medium to store the coherent light pulse with high efficiency to retrieve the state of the light pulse.
- Highly purified single photon source at room temperature: technique based on semiconductor quantum dots is developed to create highly purified single photons. This can be potentially used as the single photon source for quantum communication.

## Scientific Innovation

- Qubit as microwave amplifier: Unlike the amplification mechanism of laser, the mechanism does not involve population inversion. Instead, 4-wave mixing is able to convert pumped microwave energy to the probe microwave energy, resulting in the amplification.
- High storage efficiency optical quantum memory: By using the mechanism of the electromagnetic induced transparency (EIT), we realize coherent light quantum memory with world record of the storage efficiency 92% and storage time to pulse width ratio 1200.
- Purification technique of single photon source at room temperature: Single photon sources generated by semiconductor quantum dots at room temperature have been plagued by low purification in comparison to the same technique at low temperatures. By using an acousto-optic modulator, we are able to generate single photon at room temperatures with highest purification.



**邪科**衣属

Future Tech

# National Applied Research Laboratories



## Dayu "the smart flood system"

Universities & Institutes

National Applied Research Laboratories, NARLabs Wheng-Chi Yang, Hong-Ming Kao, Tsun-Hua Yang, Ming-Chang Wu

Technical Introduction

When the Central Weather Bureau has issued a typhoon warning, one cannot help but worry about whether this typhoon will bring flood damage. The Dayu cyber-physical technology can provide you with the most instant and reliable water information, and automatically advise you how to save yourself in the first time.

### Scientific Innovation

Introduce Cyber-Physical System (CPS) in Science Parks, including monitoring, data preprocessing, cyber-physical systems, decision support, and automatic disaster prevention. Combined with technologies of Internet of Things (IoT). Precipitation Ensemble Forecas, Inundation simulation and Business Continuity Plan, Interdisciplinary cooperating in monitoring, software engineering and services providing, to create an applicationable system of inundation disaster prevention and rescue.

## Industrial Application

smart city disaster prevention industry

urban plan

#### 虛實整合系統的5C結構 主動式防減災 · 監督式控制系统 人工智慧 自我修復 0.59183 決策支援系統 根據使用者需求,產製資訊圖表 專家知識(經驗、心理學) 4. 認知層 操作方法 大禹智慧水情系統 • 作爲資訊中心,整合默對點的影測資料 3. 虛擬層 • 作為時光機,產製現況與未來資訊 資料採勤技術 風險評估 巨量資料或理平台 • 數據前處理 2. 轉換層 \$P15 \$2 17 軍點示警 災害物酸緩 • 監測網 (地點、類型與規格) 1. 連結層 多元的原则器 無據、無限制的傳輸技術 (修改自 Jay Lee et al. 2015)



Data Buov

Data Buoy collects meteorological data includes wind speed, wind direction, air temperature, humidity, air pressure, solar radiation, sea surface temperature, 500 meters water temperature profile of the upper ocean and single-point current velocity information. All data transmits via iridium satellite network in near-real time.

Scientific Innovation

Due to the special environment, the communication technology commonly used on land cannot be used in the ocean. Only the satellite communication network can instantly return the observation data. The system integrates sensor data and transmits via satellite network. Related technologies can extend the development of other ocean observing systems.

Industrial Application

The application target is for research and weather forecasting operational organization, providing the necessary real-time ocean observation data for academic research and forecasting modes.





Contact



## **Observation Class ROV**

Universities & Institutes

National Applied Research Laboratories, NARLabs Yu-Hung Hsiao, Po-Chi Chen, Jia-Pu Jang, Hsu-Kuang Chang, Yu-Lin Sung, Feng-Cheng Li

Technical Introduction

The main function of the Observation Class ROV is to instantly monitor various information such as temperature, depth and real-time video in the water. Depth rating is design to 200 m, and cable is able to transmit signal and power. ROV can moving and exploration in the water with four thrusters and embedded control system.

## Scientific Innovation

Independent research and development of Remotely Operated Vehicle system can save cost, be easy to maintain and expand.

## Industrial Application

Observation Class ROV is used in marine science education and seabed biological observation.





## **BroadBand Ocean Bottom Seismograph (BBOBS)**

National Applied Research Laboratories, NARLabs Universities & Institutes

Technical Introduction

The broadband Ocean Bottom Seismograph is a marine instrument that collects natural earthquakes or artificial sound sources.OBS project has been leading by TORI, Academic Sinica, and National Sun Yat-sen University from designing, testing to success. OBSs have been deployed and recovered in several research cruises and obtained the great results.

Scientific Innovation

Application of a high reduction mechanism to design leveling device, with full 360 degrees restoring leveling device, and 0.1 degree accuracy, will auto-leveling from all possible orientations.

Industrial Application

The technology can be used in academic research to increases the observation area on the sea, and also used in marine resource exploration. The application targets research institutes and the marine energy industry.





04

Jia-Pu Jang, Po-Chi Chen, Hsu-Kuang Chang, Chau-Chang Wang, Feng-Cheng Li, Hsin-Hung Chen, Yu-Lin Sung, Pei-Ying Lin



## **Global Messages Collection System**

#### Universities & Institutes

#### National Applied Research Laboratories, NARLabs

Hsin-Chia Lin, Principal Engineer:Chen-Joe Fong, Research Fellow:Ming-Shong Chang, Associate Researcher:Herny Chen, Associate Engineer

### **Technical Introduction**

Use satellites and ground stations to globally collect the environmental monitoring messages all over the world via the Automatic Identification System (AIS) on the water, Automatic Packet Reporting System (APRS) on the land, and the Automatic Dependent Surveillance - Broadcast (ADS-B) system in the air.

## Scientific Innovation

Use cheap CubeSats to collect messages from moving objects all over the world to achieve global coverage.

## Industrial Application

The systems can be used to monitor the dynamic status of vessels, cars and airplanes the all over the world. The big data can be used for business management, traffic control, emergency rescue, homeland security, environmental monitoring, ...etc.



## Development of Key Components and System for Satellite Green Propellant

Universities & Institutes

National Applied Research Laboratories, NARLabs Tien-Chuan Kuo, Research Fellow, Hsiu-Jen Liu, Associate Researcher, Chih-Kang Pai, Associate Researcher, Yao-Chung Hsu, Assistant Researcher

Technical Introduction

NSPO works with the domestic industrial, academic and research / institute partners to perform the tasks including the system design, hardware manufacturing, and assembly, integration and verification for the components and system, NSPO also plans to carry out the propulsion orbital flight demonstration on the FORMOSAT-7R satellite in the near future.

Scientific Innovation NSPO has produced all required components and assembled the demonstration system. The development pattern is different from the typical ways, which is to procure all components and assemble them into a system, for acquiring a propulsion for satellite applications. The existing achievements on the hydrogen peroxide propulsion system have a leading position in this area at present satge.

Industrial Application NSPO has built techniques and products, such as special metal welding technology, sealing material formula, anti-oxidation materials investigation, long-lifetime with high-temperature sustainable catalyst formula, assembly technology that can withstand in severe vibration and temperature environments, etc. Through these cooperation with the domestic manufactures may expand their technical scopes and capabilities, and enhance their industrial competitiveness.



Contact



## **PDX Banking and Research Services**

## Image Product Online Preview System

#### Universities & Institutes

National Applied Research Laboratories, NARLabs Chih-Hua Huang Assistant Engineer

Technical Introduction

In order to effectively provide convenient and rapid image services, developing an automatic generating production system and establishing a standard process could produce FORMOSAT satellite imagery as a cache tile and display on the web platform to give users to guery/preview and interface services.

### Scientific Innovation

Automatic generating image tiles system provides more effective services, combines the functions of generating image tiles and system interface, and browses limited areas according to users' authorization.

#### Industrial Application

Monitoring & Surveillance Agriculture Forestry



## Universities & Institutes

National Applied Research Laboratories, NARLabs Jui-Ling Wang, Associate Technologist

Technical Introduction

PDX is currently the best tool for drug screening and discovery for its better representing of individual genetic, physical and biological conditions. The National Laboratory Animal Center (NLAC) has established the first open-for-sharing PDX bank in Taiwan with services of PDX model generation, cryopreservation, drug test and technical supports.

Scientific Innovation

Currently, all major PDX banks have collections mostly from patients of the western countries. It is important to establish local collections to develop the best therapeutic strategies for local populations. The NLAC has set up the first local PDX bank by collaborating with medical centers in to obtain tumor tissues in Taiwan.

Industrial Application

The PDX bank of NLAC is open for local tumor tissue donation and sharing. In addition, the NLAC provide PDX model generation and research services. The easy access of local tumors and technical supports will benefit the fast growing biotech and pharmaceutical companies.





Contact

#### 09 National Applied Research Laboratories

## A Safety and Disaster Prevention Management System for Intelligent Bridges

#### Universities & Institutes

#### National Applied Research Laboratories, NARLabs

Chun-Chung Chen, Associate Researcher; Sung, Yu-Chi, Assistant Professor; Kuang-Wu Chou, Associate Researcher; Chia-Chuan Hsul, Assistant Researcher

### Technical Introduction

The developed system can deal with the problems of material deterioration, earthquake, and flood and so on. Moreover, benefits bridge authority doing decision-making on bridge maintenance. All the information of bridge status during the different period of life-cycle can be preserved, in other words, the whole resume of bridge status is possible to be established and fulfills life-cycle maintenance.

### Scientific Innovation

Metadata is a novel information technology which is applied and integrated with bridge inspection record photos on-site in the developing system of this study. The meaning of the terminology Metadata is data or information that provides information about other data, which puts the external field and inside office work of bridge inspection projects can be easily integrated with the high efficient division of labor by using such technologies.

## Industrial Application

One of the primary purposes of the developed system is to enhance the efficiency and the quality of bridge inspection work, to evaluate the capacity of bridge disaster resilience and to improve the exactitude of bridge information with code consistent result. The developed system provides the functionality of evaluating the time-variant structural capacity for bridge management and disaster prevention.





## Smart City Earthquake Disaster Simulation Platform

Universities & Institutes

National Applied Research Laboratories, NARLabs Ren-Zuo Wang, Research Fellow

Technical Introduction

Smart City Earthquake Disaster Simulation Platform is to simulate urban building damage under different seismic. Using nonlinear dynamic analysis is to predicting building damage. VR visualization and 3D model are used to show simulation results. Al technology and simulation results are to provide earthquake disaster prevention planning.

Scientific Innovation

Smart City Earthquake Disaster Simulation Platform is developed. It can be use to build 3D GIS automated modeling. Nonlinear dynamic analysis is to simulate the huge building damage in urban area. VR visualization and 3D model are used to show simulation results.

Industrial Application

This technology can promote the application of 3D GIS to the earthquake disaster prevention industry. It can provide NCDR, police and fire protection units, Taiwan Railway, high-speed rail, MRT, schools and other units. NCREE can develop a smart disaster prevention technical service team to provide service.



Contact

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## National Applied Research Laboratories

## Data Management and Large Scale Visualization System for XBrain Image Data

#### National Applied Research Laboratories, NARLabs Universities & Institutes

Nan-yow Chen Research Fellow, Guo-Tzau Wang Associate Researcher, Shuen-Tai Wang Principal Engineer, An Cheng Yang Assistant Researcher

### Technical Introduction

Data management system : Fast I/O with parallel file system; A new database software dedicated to perform imaging-based research; A new platform dedicated to data sharing and research cooperation.

Large scale visualization system : Ability to handle the large images 100GB~1TB; Fast image rendering with parallel I/O and processing; Remote and interactive; Web-based / multi-clients / sync operation.

#### Scientific Innovation From FlyCircuit to MouseCircuit.

Industrial Application

Data management system: Fast I/O with parallel file system: A new database software dedicated to perform imaging-based research; A new platform dedicated to data sharing and research cooperation.

Large scale visualization system: Ability to handle the large images 100GB~1TB; Fast image rendering with parallel I/O and processing; Remote and interactive; Web-based / multi-clients / sync operation.







National Applied Research Laboratories, NARLabs Universities & Institutes Researcher, Hsi-Ching Lin, President, Heaven Jen, Vice President, Tony Li Technical Introduction Effectively combine geospatial information and observation data, import big data into 2D/3D platform presentation, and introduce data timing and virtual and real integration technology to realize the information auxiliary ability. Scientific Innovation The 2D/3D system combines sensor information and data timing to be 4D data display, uses perspective and penetration to display underground data, integrates real image and 3D model to provide the most real display. Industrial Application It can be applied to many kinds of information display such as environment simulation, monitor data, urban plan, smart city and disaster prevention industry.



Smart City







Custom digging inspection pipeline



## Integrated Application Platform of Multidimensional



3D building model

Underground active fault



Virtual reality integration

Yi-Liang Shih / 03-5776085 ext 275 / 1703064@narlabs.org.tw

## Mixed Reality/ Floating Volumetric Display

#### Universities & Institutes

#### National Applied Research Laboratories, NARLabs

Associate Researcher Yu-Hsuan Lin, Assistant Researcher Chun-Han Chou, Researcher Fellow Chia-Chen Kuo Associate Engineer Jr-JungYang, Research Assistant Cheng-Ru Li, Research Assistan Fang-Chi Su, Prof. Jong-Woei Whang and Researcher Fellow Kuo-Cheng Huang

Technical Introduction

It is a real-time floating display. A virtual image can be projected into the physical world. If you touch the virtual image projected in the air, your hand will pass through it. The system composes of a image source, polarizer and a floating glass with precision structure. The working principle is that the imaging information is emitted by a source and reflected twice inside the floating glass. Finally, all rays concentrate on the air and construct a floating image.

### Scientific Innovation

Compared with the international traditional floating projection technology, this novel technology can achieve more dimensional elasticity, lower cost and better quality floating projection imaging.

## Industrial Application

It can be applied to applications such as exhibitions, advertisements, and industrial user interfaces.



## Contact

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## Monitor and Analysis of Particles in High Vacuum System

Universities & Institutes

## National Applied Research Laboratories, NARLabs

Researcher Fellow Ming-Hua, Shiao; Prof. R.Y. Chou; Associate Researcher Che-Chin, Chen; Researcher Fellow D.Y. Chiang; Researcher Fellow F.Z. Chen

Technical Introduction

This technique mainly monitors and analyzes the sub-micron particles generated during vacuum valve operation, and real-time test various types of particles and pollution sources. Through "data collection and feedback product design" model. manufacturers could guickly understand the product guality and treat results as the bases for product improvement.

Scientific Innovation Similar system was announced by VAT group to measure particle sizes from 10 nanometers to 10 micronmeters. This technique is the first system in Taiwan to measure minimum particle size of 1 nanometer and maximum particle density of 107 particles/cm3. We also introduce standard testing procedures for monitoring and analyzing particles processes to improve the pollution issues in high vacuum systems.

Industrial Application

The technique combines industry, academia, and research institute to cultivate industrial equipment self-made and independent research and development capabilities. In the future, integrating equipment industry to drive key components development locally from upstream to downstream and eventually fulfill the goal of equipment and key components local independent supply and enhance Taiwan industrial competitiveness.



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## NARLabs Innovative Medical Device Accelerator

## Universities & Institutes

National Applied Research Laboratories, NARLabs | Researcher Fellow Jiann Shiun Kao

## Technical Introduction

In order to accelerate the pace of commoditization for Taiwan's biotechnology medical device industry, National Applied Research Laboratories (NARLabs) started to establish the facilities for developing medical devices since 2014. The accelerator also includes an alliance which comprises 30+ members across government, industry, academia, and research institutions.

## Industrial Application

In order to accelerate the pace of commoditization for Taiwan's biotechnology medical device industry, National Applied Research Laboratories (NARLabs) started to establish the facilities for developing medical devices since 2014. Startup teams' products will be able to evolve from "innovations" to "valued creations". In result will generate a trillion dollars of the output value for the medical equipment industry.



## Semiconductor Sensing Chips

Universities & Institutes	National Applied Research Laboratories, NA Jia-Min Shieh, Yu-Sheng Lai, Shao-Hui Hsu, Jui-Min Liu, Cheng , Chih-Ting Kuo, Chih-Chyau Yang, Jin-Ju Chue
Technical Introduction	Based on the key technology of multi-fu package, interface circuit and multi-env low power, high sensitivity multi-sensit technology smart application demonstra Application Exhibition (1): Smart Robot Application Exhibition (2): iSOMA CUE Application Exhibition (3): PaS (Plug a
Scientific Innovation	<ol> <li>Breakthrough of Multi-sensing Funct</li> <li>Zero-energy Sensor without External</li> <li>Low Cost Sensor by 3D Vertical Het</li> <li>Low Power Mode Support by using I</li> <li>Accurate Sensing Support with AI Second Sensor S</li></ol>
Industrial Application	<ol> <li>Disaster Prevention Industry(Real-tin Earth and Stone Flow )</li> <li>Vehicle Electronics(Abnormal Vibration)</li> <li>Intelligent Fabrication(Early-stage W during Fabrication, Smart Assembly)</li> <li>Al Intelligent Sensing(Home Safety,</li> <li>Wearable Sensing Devices (Personal Pas Demonstratio</li> </ol>
Sm	art Home & Intelligent Fabrication







### ARLabs

g-Ming Huang , Chen-Chia Chen, Gang-Neng Sung, Yu-An Kuo Assistant

unction sensing, combined with heterogeneous ironment wafer level sensor and low-cost. ng system, finally complete the three sensing ation.

- F
- nd Sense)

tions in a Single Chip Technology in Taiwan Power Supply

- trogeneous Package Technology
- Embedded Firmware Auto-detection Technique elf-Calibration Technique
- Precise Locating

me Bridge Safety Inspection, Early Warning of

tion Behavior of Car, part displacement) Narming of Machine Failure, Adaptive Control

Home Entertainment, Smart Sensing)

Health Care System, Environmental Sensing) with Mobile Phone



National Synchrotron Radiation Research Center



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# National Synchrotron Radiation Research Center





## Challenge to Moore's Law! - Application of Synchrotron Light Source in Advanced Semiconductor Technology

## Universities & Institutes

National Synchrotron Radiation Research Center Bor-Yuan Shew Associate Research Scientist

Technical Introduction

EUV lithography is the mainstream process technology for 3 nanometer devices in the future. NSRRC not only provides a synchrotron EUV light source but also assists vendors in the development of EUV photoresist, photomask and light source. NSRRC also provides cutting-edge analysis technologies to assist Taiwan semiconductor vendors in addressing key materials issues by high-precision, non-destructive and insitu analysis of ultra-thin semiconductor materials.

## Scientific Innovation

The power of existing plasma EUV light sources is limited and the resulting pollution is severe. In contrast, the accelerator light source using free electron laser mechanism, which can increase the power by more than kW greatly to meet the highvolume production demand. Moreover, the advanced light source can analyze physical, chemical and electronic structures of ultra-thin materials accurately to assist vendors in developing the most advanced nano chips.

## Industrial Application

In recent years, NSRRC cooperated with domestic/international companies to seek accelerator EUV light source technology. Moreover, the NSRRC has executed research projects commissioned by TSMC for more than five years through the use of cuttingedge accelerator light source analysis technologies to help resolve key materials issues at the nanoscale, and has created miracles repeatedly in the highly competitive semiconductor industry.



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## Disclosing the Secret of Advanced Materials -Nano-probe Technology

Universities & Institutes

Technical Introduction

National Synchrotron Radiation Research Center Cheng-Maw Cheng Associate Research Scientist

Nano-probe technology based on synchrotron-based microscopy and microanalysis included scanning transmission X-ray microscopy (STXM), nano-focus angleresolved photoelectron spectroscopy (nanoARPES), X-ray nano-probe and nanodiffraction techniques. Through these tools, the physical and chemical phenomena in the nanoscale region are well studied for emergent quantum materials, green energy materials, and the composition of air pollution PM2.5, etc.

Scientific Innovation

Deep insight into the electronic, optoelectronic and magnetic property in energy materials can be obtained by using photoelectron and absorption spectra and diffraction patterns with nanoscale light spot for the next generation of electronic devices and green energy materials. It can provide a systematic analysis for novel electronic and optoelectronic materials, energy and conductive polymers.

Industrial Application

Nano-probe technology can resolve the structural change and strength in novel materials effectively for industry. Through these tools, we can understand the charging-discharging process of battery to short the charging time of battery in the future and to improve the stability of battery. In addition, we also use these tools to detect the composition of PM2.5 in the air to find the possible pollution sources for environmental protection.





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## Magic Magnetism School

## - Changeable Magnetic Field Design and Application

Universities & Institutes

National Synchrotron Radiation Research Center Jvh-Chvuan Jan Associate Research Scientist

Technical Introduction

The magnet group of NSRRC, which is one of the top teams for design, manufacture and measurement for electromagnet, superconducting magnet and permanent magnets in the world. NSRRC is capable of designing various magnetic fields and can design mechanical structures in conjunction with low temperatures or vacuum environment. Together with the accurate magnetic field measurement technology, the guality control and improvement for various magnets can be carried out.

### Scientific Innovation

The magnet group of NSRRC is one of the top magnet design team in the world, has achieved considerable results in the design, manufacture, measurement and operation. Particularly, various types of magnetic field distributions can be designed according to user requirement. The magnet group has experiences in designing superconducting magnet, permanent magnes, magnet in vacuum and electromagnet. All types of the designed magnets have been operated in a long time.

#### Industrial Application

The application of Nuclear Magnetic Resonance (NMR) is currently trended to highresolution, high-field MRI and easily portable low-field NMR. The low-field NMR has relatively low cost, small volume and acceptable resolution so that there are markets and needs. A low magnetic field NMR can be applied in product inspection for industrial production, food safety detection, biomedical medication, scientific research and other fields.



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## **Tiny Powerful RF Power** - Small to Large RF Power Source

Universities & Institutes

Technical Introduction

National Synchrotron Radiation Research Center Tsung-Chi Yu Assistant Scientist

High-power RF transmitters were replaced by many lower power base stations gradually. The solid-state technology in semiconductor industry is also increasing its unit RF/microwave power. The generation of huge microwave/RF power in a proper combination of lower power solid-state power sources becomes practical. NSRRC performs R&D independently by combining multiple power sources into tens of kilowatts RF power for replacing vacuum tubes.

Scientific Innovation

NSRRC integrates full-plane balun to achieve push-pull operations of amplifiers with high efficiency, low noise, and low harmonics RF power source. The integration of RF power chips and liquid cold plates also has superior heat dissipation capability. performance improvement, and life time of power chips etc. The development of multi-port power combiners with equal phase at various power levels is also carried out, allowing the RF power to be extremely extendable.

Industrial Application

The solid-state RF power module and RF power combiner can operate reliably in continuous wave mode. Based on basic power unit, RF power sources with various power requirements can be created. In accelerator application, a RF power source with high quality and high stability can be provided for electron beam acceleration. Industrial applications including aeronautical communication, plasma excitation, laser generation and microwave heating etc.





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# Magic Metallic Gasket - Innovative Clean-Machining Process for the Aluminum Ultrahigh Vacuum System

Universities & Institutes

National Synchrotron Radiation Research Center Gao-Yu Hsiung Research Scientist

Technical Introduction

An ultra-high vacuum system provides a vacuum pressure of one over trillion (ppt) of 1 atmosphere that maintain an extremely clean surface of its chamber. An oil-free alcohol CNC machining process generates a low-carbon aluminum oxide layer as the clean surface and executes an environmentally friendly process without waste chemical pollution. The innovative design of aluminum diamond-edge gasket sealing provides superior features for the large coating systems.

#### Scientific Innovation

Manufacture of the aluminum vacuum chamber and part by the oil-free alcohol CNC machining produces a low-carbon clean surface and achieves the ultra-high vacuum of extremely low outgassing directly after welding, evacuating and baking. Besides, an innovative design of diamond-edge gasket sealing with a flat flange can substitute the conventional knife-edge conflat flange and be applicable for non-circular shape and directly machined the flange on the chamber.

#### Industrial Application

Large aluminum ultra-high vacuum system can be applied to the large accelerators, the manufacturing industries for semiconductor, photovoltaic, flat panel display, which reduce the contamination from residual molecular impurities in the system. Moreover, the reliability of ultra-high vacuum system can be greatly improved if an oil-free ethanol CNC machining process combined with a unique sealing with the diamondedge gasket be adopted for the chambers.





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# The Integrated Information Platform & Interactive Robot for Disaster Reduction

Universities & Institutes

National Science and Technology Center for Disaster Reduction Wen-Ray Su (Researcher)

Technical Introduction

National Science and Technology Center for Disaster Reduction through cross-cutting synergies has set up the most comprehensive system for disaster management in Taiwan. In recent years, the system has been broadly applied for decision-making at all levels of governments. An integrative robot for reporting disaster information, named "Xiao jin gang", is displayed to demonstrate a more easier approach to get disaster related information for the public.

# Scientific Innovation Intelligent dialogue robot for disaster reduction \_ Xiaojingang (an value-added application of semantic analysis design technology) is linked to "Disaster Information Platform" (a main service platform of NCDR) to provide instant and accurate disaster reduction data, maps, charts, images for users to acquire diversified everyday disaster reduction information.

#### Industrial Application

The "Disaster Information Platform" provides diverse and complete value-added information and achieves many outcomes, such as (1) real-time monitoring data and early warning system to facilitate disaster reduction and related industries to develop their own early warning and disaster reduction systems and Apps; (2) accuracy im[rovement of risk assessment and loss model calculation to assist insurance premium classification and to increase insurance companies' bargaining power to reduces

reinsurance rate.

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# 3D Visual System of Rain Clouds to Enhance Quality of Early Warnings and Emergency Operation

Universities & Institutes National Science and Technology Center for Disaster Reduction Yi-Chiang Yu (Division Head)

Technical Introduction

A combination of high resolution simulation and the 3D visual system can offer clearer structure profile and moving path of typhoon, which is beneficial to the impact assessments of typhoon including information of intensity, typhoon path, and warnings during disaster operation.

Scientific Innovation

The WISSDOM can optimize meteorology data derived from Model, Sounding, and Wind profiler. The interaction between typhoon circulation and topography can be observed more clearly. Therefore, the ability of disaster warning for extreme rainfall will be enhanced.

Industrial Application

The simulated 3D typhoon can be displayed into the air by means of the Hypervsn holographic projection technology, which is launched by the company of Kino-mo. The projection technology is adopted by many companies. Based on the combination of innovative meteorological technology and holographic projection, typhoon intensity and possible impacts can be analyzed more clearly. More detailed and more realistic information on disaster warning will then be presented.







## SAVE & SAFE - Resource Matching Platform

Universities & Institutes	National Science and Technology Center for Disaster Reduction Tzu-Yin Chang (Division Head)
Technical Introduction	SAVE & SAFE, a resource management platform, is designed to be a resource matching platform that can make better use of material resources and avoid waste during disaster events.
Scientific Innovation	SAVE & SAFE is an emergency resource management and matching platform. Public and private, cross-government and non-government agencies, all can provide resource information to this platform for [supply] and [demand]. One stop and open data can provide near real time information with standard "EDXL- RM", that can deliver materials to disaster sites quickly and avoid the waste.
Industrial Application	SAVE & SAFE can be a material bank in our daily lives , and a resource matching platform for emergency. Through the convenient logistics and online shopping management concepts, resources can be effectively flowed and used. Resource can be directly shared to those in need.

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総種食物 ♥ 用255

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