

## ESP Students win IES Prestigious Engineering Award 2016 (Young Creators)

Under the supervision of ESP Associates; A/Prof Anjam Khursheed, A/Prof Chua Kian Jon Ernest, Dr Md Raisul Islam, and Mr Nelliyan Karuppiah, ESP students; Au Khai Xiang, Kwek Wen Lin and Balamuniappan Pranesh received the IES Prestigious Engineering Award 2016 for their project titled 'Smart White Cane' that caters to the needs of the visually impaired.

The white cane was invented in 1921 as a mobility tool for the visually impaired. Since its development, there has not been any significant innovation or improvement in its functionality. For Project 'Smart White Cane', the NUS ESP team redesigned the white cane to better aid the visually impaired, and their invention is a smart white cane that is capable of obstacle detection and wet surface sensing.



*Mr Ng Chee Meng, Acting Minister for Education (Schools) and Senior Minister of State, Ministry of Transport presenting the IES Prestigious Engineering Achievement Award to ESP students Mr Balamuniappan Pranesh (fourth from right) and Kwek Wen Lin (extreme right) during the National Engineering Day (NED) on 23 July 2016. Flanking them from left to right are their supervisors; Dr Md Raisul Islam (extreme left), A/Prof Ernest Chua (second from right) and IES President Er. Edwin Khew (second from left).*

The sonar white cane has its circuit hardware housed in an ergonomic mechanical body, with its operations controlled by an Arduino UNO microprocessor. Obstacle detection is made possible with a system of ultrasonic proximity sensors, which is able to detect obstacles above waist level. This feature is not attainable with the conventional white cane, and it will help aid the visually impaired to navigate his or her surroundings with ease and reduce travel time. A wetness sensor is installed at the tip of the white cane.

The team has put the device through rigorous tests. It is keen to explore partnerships in the commercial development of the smart white cane, and hopes to bring the innovation to a global audience. Currently, the filing of a technological disclosure is in the pipeline.

## ESP Alumni Achievements

Tan Chuan Fu clinched the Tan Kah Kee Young Inventors' Merit Award 2016 in the open category. This award is given to outstanding inventors seeking to inspire creativity among youths and to promote an innovative and inventive culture.

Jin Yue Jiao bagged the Highest Achievement in the 30<sup>th</sup> FoE Innovation and Research Award. She had published a journal paper - Y.J. Jin, L.W. Chen, M.X. Wu, X.Z. Lu, B. Zhou and M.H. Hong (2016). "Enhanced Saturable Absorption of the graphene oxide film via photonic nanojets," *Optical Materials Express*, 6(4), 1114-1121.

## A/Prof Ernest Chua wins WSSET Innovation Awards 2016



A/Prof Ernest Chua is the recipient of the WSSET (World Society for Sustainable Energy Technology) Innovation Award under the theme on Energy Efficiency on 21 July 2016. He received the award at the 15th International Conference on Sustainable Energy Technologies held from 19 to 22 July 2016 in Singapore.

A/Prof Chua was successful in developing a hybrid membrane composite-desiccant air dehumidification system for treatment of latent load due to humid air. HVAC (Heating Ventilation Air-Conditioning) technology can be further extended to confined spaces and mobile applications, where removing moisture from moist air is essential and critical for good indoor air quality, human comfort and sustainable operation of delicate equipment such as field hospitals, armoured personnel carriers and operation decks of navy ships and aircrafts. This research led to three patent filings and more than ten publications in peer-reviewed journals.

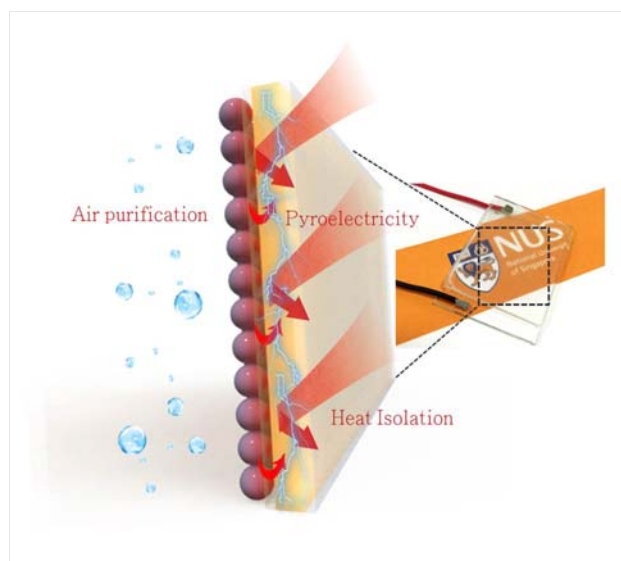
The WSSET Innovation Awards recognize the achievements of private individuals and organisations in new sustainable technologies and encourage the wider application of these new developments.

A/Prof Ernest Chua was one of the highest cited researchers for his research work on Building Energy parked under the category: Energy Science in the Shanghai's Elsevier Global Ranking of Academic 2016. Prof Wang Chien Ming was also listed in the Most Cited Researchers for Civil Engineering.

## Hybrid Reflective, Catalytic and Pyroelectric Nanocomposite NRF funded project

by A/Prof Ho Ghim Wei

The urban heat island effect manifests in built-up populated areas has adversely increased the annual mean air temperature by a few degrees Celsius. One of the major factors that contribute to the urban heat island effect in Singapore is the geometric effect of tall and densely-packed buildings. These buildings unfavorably provide multiple surfaces for sunlight absorption and reflection. Other implication includes blocking of wind that leads to reduce convection cooling and air pollutants dissipation. Elevated ambient temperature can affect community's environment and quality of life namely 1) *Increased energy consumption*: Higher ambient temperature increases energy demand for cooling especially during peak periods. 2) *Increased air pollutant and greenhouse gases emission*: Increased energy demand consequently results in higher air pollutant and greenhouse gas emission. 3) *Compromised human well-being*: Warmer ambient along with higher air pollution levels can lead to general discomfort and other heat/pollution related sickness.



In view of the urban heat island effects, the granted National Research Foundation (NRF) proposal aims to develop hybrid nanocomposite for integrated cooling and waste heat-to-energy conversion technology. The nanocomposite consists of heat reflective nanostructures and polymer composites that capture and utilize reflected heat for electricity generation. Additionally, the nanocomposite also functions as photocatalytic material capable of degrading volatile organic compound pollutants for improved indoor air quality. The proposed technology offers multiple benefits, including improved human health and comfort, reduced energy usage, and lower greenhouse gas emissions.

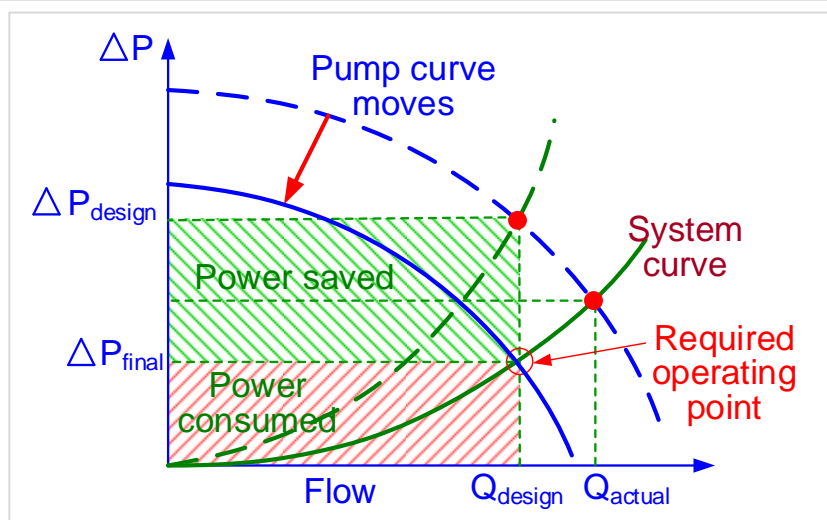
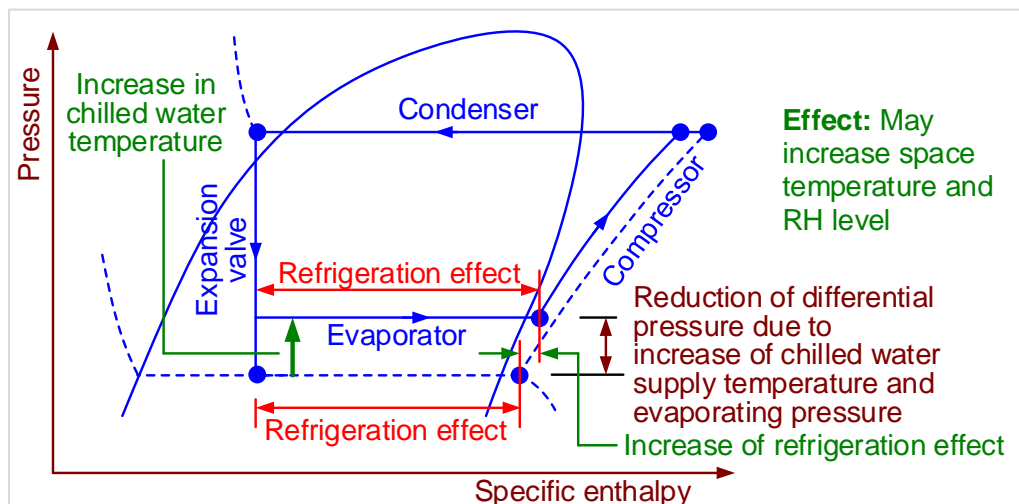
A/Prof Ho Ghim Wei was also awarded a major grant of \$ 3.08 million by the Ministry of Manpower Development (MND) for the Land and Liveability National Innovation Challenge (L2 NIC) - 2015 - 1 in February 2016. The research project is entitled "Hybrid Reflective, Catalytic and Pyroelectric Nanocomposite for Holistic Solar Heat Gain, Air Quality and Energy Sustainability Solution"

## Technology-Enhanced Interactive Learning Platform

by Dr Md Raisul Islam

“ESP4401 Optimization of Energy Systems” is a newly developed concept heavy elective module for the Engineering Science Programme and Mechanical Engineering students. The objective of the module is to prepare students professionally ready as an energy engineer for industries. This module focuses on the application of multidisciplinary engineering knowledge in the analysis of energy performance, design and optimization of industry scale major energy consuming systems such as central air-conditioning chiller plant, boiler, compressed air system and combined heat and power system. The content of the module is aligned with the “Singapore Certified Energy Manager (SCEM) - Profession Level” course which is designed by the National Environment Agency (NEA) to train Engineers for achieving Singapore Government’s target of 35% improvement in energy efficiency from 2005 level by 2030.

Usually, a number of design and operating variables play a role on the performance of energy systems. Moreover, practical interlinked control systems may automatically change a number of parameters with the change of one variable which should be reflected in the cause-effect study. The verbal explanation may not be enough for illustrating the causes and effects clearly in the classroom. Computer programming code should be developed to study the influence of different design and operating parameters. With the help of technological support, it is possible to change the variables conveniently for the entire feasible range and study the corresponding effects on the energy performance as shown in the figures below. Students will get the opportunity to vary different parameters and study the corresponding impacts not only on energy performance or efficiency but also the quality of expected outputs graphically with appropriate animations.



A technology-enhanced learning platform may help the educators to free up classroom time, effectively utilize classroom time to explain the concepts that are not clear to students, create an interactive environment in classes and engage students in solving and discussion of concept-heavy problems. Recently, Dr. Md Raisul Islam applied and won the Technology Enhanced Learning Grant (TEL-g) AY 2016/17 for the development of the Technology-enhanced online interactive learning platform for teaching the concepts in ESP4401.

## Smart and Cost-Effective Green Solution to Safeguard our Environment

ESP students, Lim Zeming and Tan Yan Han, participated in the inaugural Climate Innovation Challenge from 12 to 14 August 2016. Jointly organised by the Building and Construction Authority (BCA), JTC and National Climate Change Secretariat (NCCS), Strategy Group, the three-day hackathon - which is opened to the public - saw some 32 teams brainstormed and proposed new ideas that would help enhance innovation and sustainability in non-residential buildings and outdoor spaces.

The NUS Engineering team decided that it would be unique to address the reuse of one-sided paper, an often neglected field in the realms of climate challenges. The problem, identified by the team, is one which is common in most modern offices – a huge stack of used paper, consisting of both one-sided and two-sided used papers being discarded into the recycling bin.

Although recycling is a good initiative, the team is confident that an even larger number of trees can be saved by reusing some of the used papers. Hence, Zeming and Yan Han came up with an innovative solution. They created a scanner-like machine that could take in a stack of used papers, and sort them into one-sided use paper (for reusing) and two-sided used papers. They built a fully functioning prototype using LEGO NXT in sixteen hours, and pitched their idea to the panel of judges.

With their promising green invention, Zeming and Yan Han made it to the Final Judging. They were awarded a Special Mention prize of two thousand dollars in recognition of their ingenuity in addressing a problem in a simple and elegant manner. Their prototype is selected to be displayed at two upcoming exhibitions organised by BCA.



*ESP students Lim Zeming (second from left) and Tan Yan Han (first from right) received a Special Mention prize in recognition of their ingenuity at the Climate Innovation Challenge. With them are Mr David Tan, Assistant CEO of JTC (second from right) and Mr Tan Wan Chi from NTU Aerospace Engineering (second from left).*

## Engineering an Innovative Transport System for Sustainable Future Mobility

A group of ESP students participated in the Land Transport Authority (LTA) Engineering Challenge for Sustainable Future Mobility from NUS. The competition aims them to build up Singapore's engineering talent pool by encouraging innovation, creativity and engineering skills among tertiary students and engineering professionals to co-create projects to help create an attractive and robust land transport network.

The two challenging topics – “Sustainability Mobility” and “Future Mobility (Self-Driving Vehicles)” were given to participants to rethink how our Singapore's transport landscape would be like in the future. Under “Sustainability Mobility”, participants would explore how to make Singapore a “carefree” walkable city, where the street space is centered on pedestrians. “Future Mobility (Self-Driving Vehicles)”, on the other hand, allowed participants to use their creativity to imagine how on-demand, door-to-door mobility service provided by self-driving vehicles would transform our transport landscape.

Supervised by A/Prof Palani Balaya, the ESP students: Zhang Yiran (Team Leader); Jin Yuejiao; Zhang Xiaoyang; Liu Chong, Gwee Chia Hong, and Su Dou (from ME Dept) proposed an Auto-Smart Bus (ASB) system which had been shortlisted for Stage 2 of the LTA EC! ASB is an independent transport system, consisting of the auto-bus, which can run in fixed routes, as well as the smart calling system, that directs the nearest auto-bus to go to the corresponding stop once it is activated. The ASB system complements the country's current public transport system and will improve the efficiency of the transport system in HDB towns, particularly in areas which are not readily accessible by Mass Rapid Transit (MRT). The team cleared the first phase successfully!

Said Yiran, “In terms of public transport, the MRT system is most extensive, direct and reliable”. The bus system, which complements the MRT system, is used to serve the feeder routes in HDB towns. Instead of buses, private cars and other transport systems operating between HDB towns, the team proposed the ASB system as a replacement to provide an integrated small scale transportation system, in terms of fewer operating circle routes and small capacity buses. These circle routes are evenly arranged around the main traffic centres, namely the MRT and bus interchanges. They will be able to cover most of the residential areas, so that all the residents can reach the ASB system within walking distance. To be efficient, the circle route is approximately one square kilometer, and the operating time of one circle route is 10 minutes.

For the final stage of the competition, the teams are required to develop a prototype of their proposals, and they must be able to clearly present the key engineering principles behind their proposal, and how their ASB system complements the existing transport networks as it transforms Singapore into a livable and car-lite city. Teams with outstanding entries will be eligible for the following prize awards – Gold (S\$10,000); Silver (S\$5,000); Bronze (S\$3,000) and Commendation (S\$1,000). They will be judged using a Point System, based on five aspects: Creativity/Innovativeness; Technical Feasibility; Relevance; Effectiveness; and Quality of Deliverables. A certificate of participation will be given to all shortlisted teams in Round 2. Shortlisted entries will also be showcased at the Singapore International Transport Congress and Exhibition in October 2016. The ESP team believes they will make it to SITCE 2016!



## ESP Student Camp AY 2016/17

by Sai Sandeep

ESPolaris – the beginning of your NUS adventure! On 21 July 2016, ESP Professors, Affiliates and Senior ESPians extended a very warm welcome to the 30 Freshmen who have just joined the ESP family. ESPolaris was marked by many exciting activities ranging from group-bonding games, a night-walk and an amazing race. It started out with the ESP orientation talks. After lunch, all the Freshmen were pumped for an exciting 2-day adventure!

After checking-in their rooms at Raffles Hall, the Freshmen proceeded with the activities for the day. The ice-breaker games kicked off interactions between the Freshmen where they shared about their background and interesting things about themselves. It was great to see a diverse group of Freshmen bonding so easily and participating enthusiastically throughout the games. The different OGs - Lannister and Stark (inspired from Game of Thrones) were pitted against each other through a series of station games across the Faculty of Engineering. As the Freshmen were having fun, they got to learn about the different spots in Engineering that they would frequently visit as an ESP student for such as Techno Edge. While the engineering block still remains a maze to many Seniors and it was difficult for the Freshmen to remember the important locations that they would be frequenting as an undergraduate Engineering student, it was a perfect location for station games. After tirelessly navigating the labyrinth of Engineering block, everyone proceeded to refuel themselves by having dinner at Foodclique. We ended the day by having a simple night-walk.

The Amazing Race awaited the Freshmen on the next day after a delicious breakfast at Foodclique. Games such as stacking the nuts and building a device to prevent the cracking of egg shells when dropped from a certain height tested their perseverance and creativity – qualities that would keep them in good stead as they progress through ESP. The camp ended with a BBQ at PGP and Seniors were happy that the Freshmen were very actively participating in camp activities and bonding well with each other. The Sub-Club hopes that everyone had a great time in the camp and that the Freshmen will look forward to having a great learning experience together as ESP students.



## 11th ESP Sub-club Management Committee for AY 2016/17



President  
Fang Zhihao  
(Yr 2)



Vice-President  
Liu Xuecong  
(Yr 2)



Secretary  
Khoo Jing Shen  
(Yr 1)



Treasurer  
Shalmali Kale  
(Yr 1)



Welfare Director  
Andy Siew  
(Yr 1)



Welfare Director  
Bryan Phee  
(Yr 1)



Project Director  
Lester Low  
(Yr 2)



Welfare Director  
Zhong Yibai  
(Yr 1)



Welfare Director  
Zhou Yizhuo  
(Yr 1)

ESP family is happy to welcome the 11th Management Committee of ESP Student Sub-club members for the Academic Year 2016/17. Prof Wang congratulated the new team and he believes they will do a wonderful job like their predecessors mixing their studies with the extra duties skillfully. They will be surely appreciated for their hard work and sacrifices they have to endure in the academic year.

Prof Wang also extended his heartfelt thanks to the previous team members; Goh Yong Wee, Fang Zhihao, Christopher Sin Shi Hao, Yan Peiyan, Pan Xin-Yi, Sai Sandeep Bhagwandas Lachmandas, Chang Ho Huan, Liu Xuecong and Lam Jin Hong who have left a trail of success stories with their hard work in running the sub-club efficiently in the academic year 2015/2016.

## Great Women of Our Time Award, Science & Technology 2016

A/Prof Ho Ghim Wei of the Engineering Science Programme and Department of Electrical & Computer Engineering, National University of Singapore, was the winner of the Science and Technology, Great Women of Our Time Award 2016. The Award was presented by Ms Indranee Rajah, Senior Minister of State, Ministry of Finance & Ministry of Law on the 29<sup>th</sup> September 2016 @ the cocktail ceremony held at the Lewin Terrace, Singapore.



The Great Women of Our Time Award was created 10 years ago as a platform to show off the talents and achievements of Singaporean women. Every year, 18 outstanding, high-achieving working women are nominated for the Great Women of Our Time awards. These inspiring pioneers and game-changers females made impact in different arenas in Singapore.

## Wooden-Tower Competition—ESP Project 2109

by Ken Lam



The first prize winners Liu Xue Chong, Lam Jin Hong and Goh Yin Hao seen in picture flanked by their Supervisor Dr Shen Lei on the left and Prof Wang on the right

ESP students from Year 1 & Year 2 took part in the Wooden Tower Competition (as part of Design Project ESP2109). The competition is sponsored by the Institution of Structural Engineers, Singapore. Liu Xue Chong, Goh Yin Hao and Lam Jin Hong clinched the first prize of \$150, Tan HuQuee @Min Myint Kyaw, Wu Jia Cheng and Jennifer Tanadi received the second prize of \$90 while Kenneth Chong Wei Jie, Zhang Ji, and Phoo Hay Bryan received the third prize of \$60. The IStructE Singapore Regional Group Chairman, Prof Wang congratulated and encouraged the students on their maiden project win as he handed them the Award Certificates and Prize Money.

Some of the winners expressed the following on their maiden win:

- ◆ *The ESP2109 tower design project is a very meaningful experience to me. When I reflected on this experience, I cannot believe we went from knowing nothing about materials science and structural engineering to building a earthquake-resistant tower all on our own! The whole process is challenging and time-consuming but also informative and fun. I would like to thank my teammates Ken and Yin Hao for being so hardworking and cooperative throughout the entire project. It's really a pleasure to work with them. Together we manage to finish every task on time with high quality. I have learnt a lot from the project, for example, how to determine the material's Young's Modulus through a beam experiment, and how to optimize our design using results generated from simulation. It has also enhanced my self-learning skills and given me a chance to solve a real life problem from start to finish. I have enjoyed this project a lot and I think future batches will also find it interesting and helpful. - Helen*
- ◆ *The tower design project was truly a great opportunity to learn from both my peers and seniors. One of my key takeaways from this project is the realization on the importance of our craftsmanship. No matter how well you design your tower, should you fail to build it well, it will all come to naught! - Yin Hao*
- ◆ *ESP2109 was my first engineering design project ever in my life and it was really a great kickstart and learning experience! It exposed me to the many elements of engineering design and manufacturing, from conceptualisation, mathematical calculations, constructing the tower and even team work and coordination between team members. For freshmen or anyone looking to come to ESP, do look out for the design projects and pick it up with an inquisitive and optimistic mind! - Ken*

**For any enquiry or feedback, please contact:**  
**Engineering Science Programme**  
**National University of Singapore**  
**9 Engineering Drive 1, EA #06-10**  
**Singapore 117575**  
**Tel No.: (65) 6516 3354**  
**Fax No.: (65) 6775 4710**



**Email: [espttlv@nus.edu.sg](mailto:espttlv@nus.edu.sg)**  
**Website: [www.esp.nus.edu.sg](http://www.esp.nus.edu.sg)**