VISION
A great global engineering college for education, research and innovation

MISSION
To nurture creative and entrepreneurial leaders through broad-based, research-infused engineering education and to advance knowledge and create innovative and sustainable solutions for the benefit of industry and society

THE SMART WAY FORWARD
NTU’s College of Engineering (CoE) has had a reputation of excellence in education, research and innovation for almost two decades. Today, we continue to extend the boundaries of engineering excellence every day, as Singapore moves towards being a Smart Nation. Together with our faculty, researchers, students, alumni and industry partners, we will go The Smart Way Forward as we engineer excellence, today and tomorrow – the SMART way.
Think artificial intelligence. Virtual and augmented realities. Supercomputers. Genetic editing. This massive change, like its preceding revolutions, will transform work and life across every industry and economy. But this time, it is arriving at a speed and scale the world has never seen.

Governments and educators have to work fast and hard to prepare present and future generations to thrive amidst this rapidly transforming world. And NTU’s College of Engineering (CoE) is well-poised to help our students seize the promising opportunities of this era, thanks to our ever-growing capabilities in research, education and innovation.

A Research-intensive University
Research is one of NTU’s key pillars of excellence. We constantly strive to break new ground in this area, and our efforts are intensifying rapidly to meet new demands and expectations brought about by Industry 4.0 (i4.0).

Our faculty members and students are adept in translating knowledge from pure research into applied research outcomes that can solve real-world problems. They engage in multi-disciplinary research with researchers from other colleges in NTU, peer institutions, government agencies and industries. Such opportunities enable CoE to push boundaries in pioneering solutions; they also present students with greater opportunities to gain a sharper edge in the working world they will soon enter.

The coming years will see us providing even more resources and support to drive innovation in research, specifically through nurturing entrepreneurship and facilitating the commercialisation of research through licensing or establishing start-ups. Students will also pioneer new discoveries to solve real engineering problems in Singapore, thanks to our growing pool of partners who share our vision of moulding changemakers of the next generation.

Educating i4.0-ready Engineers
In the education arena, we constantly review and update our curricula to equip our students with knowledge and skills to thrive in the Fourth Industrial Revolution. For example, the Bachelor of Science in Data Science and Artificial Intelligence programme opens new paths for students to this exciting and rapidly expanding field that only emerged in recent years. In addition, we have introduced core education modules on digital literacy.

Beyond theory, we provide our students with a value-added and holistic experiential learning experience. We have fostered strong ties with leading industry partners — many of whom are leaders in the digital economy — such as Alibaba, Dyson, AMD, Rolls-Royce, Delta and Singtel. Such collaborations give our students opportunities to work in major corporate labs, joint labs or makers’ labs where they enrich their learning with access to advanced equipment and cutting-edge knowledge. Students also train under the guidance of industry and academic mentors to gain skills they need to excel in the professional world.

Distinguished Leaders, Passionate Teachers
CoE’s efforts to rise above the challenges of i4.0 is anchored by a world-class faculty that shares our vision of moulding a new breed of engineering talents. Our continual efforts to attract some of the leading minds in engineering into our teaching and research pool have been successful.

In 2018, CoE recruited 30 full-time faculty members. We also appointed three new Visiting Professors from various overseas tertiary institutions, and four new adjunct faculty members from research institutions and private companies. To further encourage interdisciplinary research, we embarked on inter-school hires and joint appointments.
Recognising the importance of faculty retention, the College and our six Schools constantly work to strengthen faculty mentoring, particularly for newly hired, junior to mid-level faculty. We also make it a point to reward faculty members for their achievements through initiatives such as promotions and granting of tenure.

With a strong pool of faculty members, we are in a good position to reinforce our standing as one of the top engineering colleges in the world.

Here’s to the Future
It has been truly rewarding to see CoE soar to greater heights in education, research and innovation over the years. I am confident that 2019 will be an even more fruitful year as we seize the opportunities the new Industrial Revolution brings along.

Together, we will engineer excellence, today and tomorrow – the Smart Way.

Professor Louis Phee
Dean
Professor Subbu S Venkatraman was the Chair of the School of Materials Science and Engineering (MSE) from 1 January 2018 to 31 December 2018. Professor Lam Yeng Ming is currently the Chair of MSE.
At the Dean’s Office
ENGINEERING EXCELLENCE

At NTU’s College of Engineering, we are committed to setting high standards in education, research and innovation. As we nurture the brightest engineering minds for a Smart Future, we constantly push frontiers in fulfilling our vision of being an outstanding global engineering college.
SUCCESSFUL INDIVIDUALLY AND TOGETHER

Our six engineering schools are consistently ranked top amongst leading international universities in their respective fields, thanks to our students and faculty who constantly deliver excellence in engineering education and research.

Source: Quacquarelli Symonds (QS) World University Rankings by Subject 2019

SCHOOL OF MATERIALS SCIENCE AND ENGINEERING
3rd in Materials Science

SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING
6th in Electrical and Electronic Engineering

SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING
10th in Civil and Structural Engineering

SCHOOL OF MECHANICAL AND AEROSPACE ENGINEERING
11th in Mechanical, Aeronautical and Manufacturing Engineering

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
12th in Computer Science and Information Systems

SCHOOL OF CHEMICAL AND BIOMEDICAL ENGINEERING
12th in Chemical Engineering
FACTS AND FIGURES:
Our Achievements and Milestones

We are committed to leading the way forward in creating new value and knowledge, and our accolades are testament to our consistent excellence in engineering education and research. As a College, we aim to continue pushing boundaries and seize new opportunities brought along by the new industrial revolution.
UNDERGRADUATE AND GRADUATE STUDENT POPULATION

Total 13,107

Undergraduate Students
- Aerospace Engineering: 491
- Bioengineering: 347
- Chemical and Biomolecular Engineering: 555
- Civil Engineering: 415
- Computer Engineering: 275
- Computer Science: 1,489
- Data Science and Artificial Intelligence: 24
- Electrical and Electronic Engineering: 2,271
- Engineering: 742
- Environmental Engineering: 137
- Information Engineering and Media: 331
- Maritime Studies: 336
- Materials Engineering: 785
- Mechanical Engineering: 1,920
- Renaissance Engineering Programme: 296

Total: 9,562

Graduate Students
- Aerospace Engineering: 852
- Bioengineering: 853
- Chemical and Biomolecular Engineering: 1,840
- Civil Engineering: 1,168
- Computer Engineering: 1,420
- Computer Science: 105
- Data Science and Artificial Intelligence: 24
- Electrical and Electronic Engineering: 1,168
- Engineering: 742
- Environmental Engineering: 137
- Information Engineering and Media: 331
- Maritime Studies: 336
- Materials Engineering: 785
- Mechanical Engineering: 1,920
- Renaissance Engineering Programme: 296

Total: 1,840

BREAKDOWN OF UNDERGRADUATE STUDENT POPULATION BY PROGRAMME TYPE

BREAKDOWN OF GRADUATE STUDENT POPULATION BY PROGRAMME TYPE

FACULTY AND STAFF POPULATION

- Faculty*: 1,204
- Research Staff: 558
- Professional, Administrative, Technical and Support Staff: 468

Total: 2,230

*Includes adjunct and visiting professors
Faculty Recruitment and Research

Faculty Recruitment

2014 17
2015 14
2016 30
2017 29
2018 30

Research Funding
(As at 30 Dec 2018)

Total amount secured
S$209.47 million

Ministry of Education (MOE) 19%
A*Star 1%
National Research Foundation (NRF) 24%
Defence 10%
Other Local Government Agency 24%
Industry & Foundation 18%
Others 4%

Engineering Citations

Number of Citations in All Fields
(5-year intervals)

2010-2014 132,279
2011-2015 166,531
2012-2016 199,432
2013-2017 216,862
2014-2018 237,479

Average Citations Per Paper
(5-year intervals)

2010-2014 9.42
2011-2015 11.03
2012-2016 12.42
2013-2017 12.55
2014-2018 13.20

1.8x
1.4x
11
LEARNING AS WE TEACH:
Laying the Groundwork for Success Today

In education, we nurture our students beyond academics so that they can drive more improvements, solutions and innovations in our rapidly evolving world. Here, we walk alongside our young talents in their journeys to becoming engineers of tomorrow.
Staying true to NTU’s vision of a Smart Campus, we nurture our students to be at the forefront of the Fourth Industrial Revolution, through a hotbed of technological innovations that improve the way they learn, live, work and play.

CoE offers 11 single-degree Bachelor of Engineering programmes and two Bachelor of Science programmes. Today, over 10,000 undergraduates from diverse backgrounds across six schools benefit from our broad, innovative and industry-relevant programmes. They can choose from single or double degree programmes, and even take up a second major or a minor. There is also the Renaissance Engineering Programme, which is conducted in collaboration with leading institutions such as Imperial College London, Northwestern University, University of California, Berkeley and University of British Columbia, that awards a Bachelor of Engineering Science and Master of Science in Technology Management.

Our internship programmes – the result of our strong relationships with industry partners over the years – have enabled us to arm students with industry exposure and prepare them well for their careers. Students also benefit from global immersion programmes which deliver a multifaceted experience to broaden their horizons and help them build networks that will enrich and enhance their educational experience. Additionally, to further prepare students for the Fourth Industrial Revolution, we have introduced modules on Computational Thinking; and Data Science and Artificial Intelligence.

This holistic approach equips our students with technical competencies as well as soft skills such as communication, analytical and entrepreneurial capabilities essential to take on challenges of the future.

Undergraduate Studies

At NTU CoE, we empower our students to pursue their ambitions and take charge of their own learning process, based on their strengths, abilities and interests.
GROOMING THE NEXT GENERATION OF RESEARCH TALENTS

Research has always been one of NTU’s key pillars. To further reinforce this strength, we invite outstanding second- and third-year undergraduates to participate in the University’s Undergraduate Research Experience on Campus (URECA) programme. Students in URECA can pursue independent research under the supervision of a professor over 11 months where they will experience an undisputedly stellar research environment. They are also conferred NTU President Research Scholar (NTU PRS) status at the end of the programme.

OUR REPERTOIRE

Here is the list of degree programmes offered in 2018:

**Bachelor of Engineering (B.Eng.) Programmes**
- Aerospace Engineering
- Bioengineering
- Chemical and Biomolecular Engineering
- Civil Engineering
- Computer Engineering
- Computer Science
- Electrical and Electronic Engineering
- Environmental Engineering
- Information Engineering and Media
- Materials Engineering
- Mechanical Engineering

**Bachelor of Science (B.Sc.) Programmes**
- Data Science and Artificial Intelligence
- Maritime Studies

Students can choose from single or double degree programmes, and even take up a second major or a minor.

13 Single Degree Programmes

5 Second Majors Programmes
Double Degree Programmes
- Computer Engineering and Business (with specialisation in Business Analytics)
- Computer Science and Business (with specialisation in Business Analytics)
- Engineering* and Economics

Second Majors
- Bachelor of Engineering* with a Second Major in Business
- Bachelor of Engineering in Bioengineering/Chemical and Biomolecular Engineering with a Second Major in Food Science and Technology
- Bachelor of Engineering in Materials Engineering with a Second Major in Medical Biology
- Bachelor of Engineering in Bioengineering/Materials Engineering with a Second Major in Pharmaceutical Engineering
- Bachelor of Engineering in Civil Engineering/Electrical and Electronic Engineering/Environmental Engineering/Mechanical Engineering with a Second Major in Society and Urban Systems
- Bachelor of Science in Maritime Studies with a Second Major in Business

Integrated Programme
- Renaissance Engineering Programme

* In a chosen major
# All Bachelor of Engineering programmes are accredited by The Institution of Engineers Singapore, the Singapore signatory of the Washington Accord, through its Engineering Accreditation Board. The Washington Accord is an international agreement for mutual recognition of the substantial equivalence of engineering academic programmes in satisfying the academic requirements for the practice of engineering at the professional level.
As today’s work processes get increasingly digitised, almost every aspect and function of business – from analysing consumer behaviour, tracking movements in financial markets and planning and forecasting of production – is now data-driven. As a result, the capability to extract knowledge from huge volumes of digital information to make smart decisions and propel businesses is more important than ever.

CoE’s two new digital literacy modules prepare students for this digital revolution. The Computational Thinking module builds up students’ thinking and ability to solve problems through acquiring skills in decomposition, pattern recognition, abstraction and algorithms, while the Introduction to Data Science and Artificial Intelligence module teaches students to analyse data and use Artificial Intelligence (AI) knowledge to solve real-life problems.

We also launched a new degree programme in Data Science and Artificial Intelligence to cater to the increasing demand for skilled professionals in this field. This four-year direct honours Bachelor of Science degree programme is jointly offered by the School of Computer Science and Engineering (SCSE) and School of Physical and Mathematical Sciences (SPMS). Students have the opportunity to work alongside engineers and data scientists from corporate laboratories and industry to solve real-world problems in myriad domains including science and technology, healthcare, food and beverage, business and finance. Upon graduation, they can look forward to working across multiple domains of the digital economy while doing their part in enhancing Singapore’s global competitiveness.
A HOTBED FOR STUDENTS’ CREATIVITY AND INNOVATION

Dyson’s first on-campus engineering studio in Asia

NTU and global technology company Dyson’s new engineering studio, launched in August 2018, aims to give students opportunities to work alongside industry experts in developing technological answers to real-world problems. Dyson has committed to contributing S$500,000 to the Studio for a period of five years. The Dyson-NTU Studio is Dyson’s first on-campus engineering studio in Asia. It offers a Design and Build module that gives NTU engineering students access to advanced prototyping equipment.
which can help them turn their ideas into viable solutions. This semester-long module is co-taught by NTU professors and Dyson engineers, who guide students in developing technology prototypes and testing their viability on the NTU Smart Campus.

The Studio simulates Dyson’s working environment and its research and development processes. Students work in teams to apply what they have learnt to overcome challenges – all the way from defining a problem to designing and developing their ideas from a blueprint into a working prototype. They also get to use advanced prototyping equipment such as high-resolution 3D printers and digital fabrication facilities. Learning about the latest industry software suites such as high-resolution rapid prototyping and modelling software are some other privileges.

The module takes in up to 20 students each semester. It has garnered high levels of interest and was fully subscribed to in less than a month.

Moving forward, the Studio will also serve as a platform for industry and career talks for students and researchers, as well as engineering-led competitions and tech exhibitions. Dyson is currently in talks with NTU to provide internship and career opportunities for students as well as expand the use of the Studio to students from other disciplines.

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**DID YOU KNOW?**

The Dyson-NTU Studio simulates Dyson’s working environment and its research and development processes.

Scan the QR code to view a video on Dyson-NTU Studio or visit www.coe.ntu.edu.sg/DysonNTUStudio to find out more.
PREPARING STUDENTS FOR A FUTURE IN ARTIFICIAL INTELLIGENCE (AI)

NTU-AMD Data Science and Artificial Intelligence Laboratory

NTU’s School of Computer Science and Engineering (SCSE) and global chipmaker Advanced Micro Devices, Inc. (AMD) have joined hands to launch the Data Science and Artificial Intelligence Lab @ NTU, which will nurture next-generation tech leaders equipped with the latest industry-driven digital skills.

The laboratory will leverage AMD’s hardware and AI solutions to develop courses and materials to complement SCSE’s programmes and curriculum.

SCSE students will be exposed to real-world applications such as developing software algorithms used in security fields for feature identification, voice recognition and motion detection. They will also be trained to develop clinical support solutions to aid medical diagnosis. Students will also undergo training to participate in supercomputing competitions using AMD’s versatile open source software, Radeon Open Compute (ROCm) platform.

To apply their knowledge into practice, they will take on internship opportunities with AMD’s Shanghai Research and Development Center and the Singapore Product Development Center.

DID YOU KNOW?

$4.8m data science & AI lab
150-200 students
5-year partnership
STAYING AT THE FOREFRONT OF INDUSTRY DEVELOPMENTS

Machine Learning and Data Analytics Initiative

NTU’s School of Electrical and Electronic Engineering (EEE) has established the Machine Learning and Data Analytics (MLDA)@EEE laboratory. This laboratory focuses on research and training in machine learning, data analytics, cognitive data processing and AI.

MLDA@EEE aims to train up to 100 EEE/Information Engineering and Media undergraduate students a year and equip them with fundamental skills in MLDA through technical workshops, seminars, and projects in collaboration with its partner companies. The lab provides students with a dedicated workspace and resources including an HPE Apollo d6500 GPU (Graphics Processing Unit) server with four NVIDIA Tesla V100, six GPU workstations, 18 AIO (All-In-One) computers and access to the extensive experience of researchers and faculty in EEE.

In addition, EEE has set up a student committee to drive various initiatives for MLDA@EEE. The committee will plan and organise the training and development of undergraduates via various beginner to advanced level workshops and identify collaboration opportunities with industry partners.

A series of talks and sharing sessions with students, faculty, and professionals to gain insights into industry internship and career opportunities as well as nine hands-on workshops in high-interest areas in MLDA have also been conducted.
Here, 57 percent are research students and the rest are pursuing graduate degrees through coursework. We empower our graduate students with the right connections, exposure and learning opportunities and provide them with access to state-of-the-art equipment so that they are well-equipped to take on the challenges of the Fourth Industrial Revolution.

World-Class Learning

We work closely with global partners to offer our students an enriching multidisciplinary and collaborative environment for learning. Students reading dual or joint degree programmes attend classes at both NTU and our partner universities’ campuses. This approach enables them to cultivate deeper interactions with world-renowned faculty and researchers.
LIST OF
GRADUATE PROGRAMMES
OFFERED IN 2018

COURSEWORK PROGRAMMES

Programmes by coursework lead to Master of Science (M.Sc.) degrees. The programme offerings for 2018 were:

School of Civil and Environmental Engineering
• M.Sc. (Civil Engineering)
• M.Sc. (Environmental Engineering)
• M.Sc. (International Construction Management)
• M.Sc. (Maritime Studies)

School of Electrical and Electronic Engineering
• M.Sc. (Communications Engineering)
• M.Sc. (Computer Control and Automation)
• M.Sc. (Electronics)
• M.Sc. (Power Engineering)
• M.Sc. (Signal Processing)
• M.Sc. (Green Electronics) - Joint Degree with Technische Universität München (TUM), Germany. Admit only full-time students.
• M.Sc. (Integrated Circuit Design) - Joint Degree with Technische Universität München (TUM), Germany. Admits only full-time students.

School of Mechanical and Aerospace Engineering
• M.Sc. (Manufacturing Systems and Engineering)
• M.Sc. (Mechanical Engineering)
• M.Sc. (Precision Engineering)
• M.Sc. (Smart Product Design)
• M.Sc. (Supply Chain and Logistics)
• M.Sc. (Systems and Project Management)
• M.Sc. (Aerospace Engineering) - Joint Degree with Technische Universität München (TUM), Germany. Admits only full-time students.
• M.Sc. (Project Management) - Joint Degree with University of Manchester (UOM), UK. Admits only part-time students.

RESEARCH PROGRAMMES

All our engineering schools offer research degree programmes that lead to Master of Engineering (M.Eng.) or Doctor of Philosophy (Ph.D.) degrees.

DID YOU KNOW?

close to 2,700 Graduate Students
57% Research Students
REACHING FURTHER THROUGH PROGRAMMES, PARTNERSHIPS & COLLABORATIONS

SHAPING R&D TALENTS OF THE DIGITAL AGE

Alibaba Talent Programme

In 2018, NTU collaborated with Alibaba Group to launch the Alibaba Talent Programme in Singapore with support from the Singapore Economic Development Board (EDB) under the Industrial Postgraduate Programme (IPP).

This programme, which welcomed its first intake of students in January 2019, is part of Alibaba’s mission to nurture future research and development (R&D) talents from Singapore, particularly in the field of computer science. It aims to equip postgraduate students with critical R&D skillsets through practical work experience in Alibaba projects.

DID YOU KNOW?

Students in the Alibaba Talent Programme will spend part of their studies at one or more of Alibaba’s research facilities, including the Alibaba-NTU Singapore Joint Research Institute (JRI) at NTU and various Alibaba campuses in Hangzhou and Beijing, China.
Students in the programme spend part of their studies at one or more of Alibaba’s research facilities, including the Alibaba-NTU Singapore Joint Research Institute (JRI) at NTU, Alibaba’s first facility of its kind outside of China, and various Alibaba campuses in Hangzhou and Beijing, China. This enables them to participate in exciting research projects led by Alibaba and our local universities and benefit from access to large data samples and valuable business scenarios from Alibaba.

Apart from their study grants, students each receive a monthly stipend of S$5,000, as well as mentorship by a main supervisor from the enrolled university and a co-supervisor from Alibaba. Outstanding scholars have the opportunity to continue their journey with Alibaba as full-time employees, among other compelling benefits.

The programme is open to Singapore citizens or Singapore Permanent Residents who graduated from any local university or one of the selected top-ranking universities around the world. Prospective scholars must have a Bachelor’s or Master’s degree in Computer Science/Engineering, Electrical, Electronic, Mathematics, Physics or other related subjects. They should also be pursuing postgraduate Doctor of Philosophy (Ph.D.) studies in one of the following areas: Artificial Intelligence, Quantum Computing, Internet of Things, Cloud Computing, Data Analytics, Cryptography and Security, among others.

**FORGING NEW INTERNATIONAL EXCHANGES**

**NTU-IIT Madras Joint Ph.D. Programme**

NTU and the Indian Institute of Technology (IIT) Madras have signed a Memorandum of Understanding (MoU) to launch a joint Ph.D. programme in science, engineering, management, computing and social sciences. The agreement took place on 1 June 2018 in the presence of India’s Prime Minister Narendra Modi.

Under the programme, Infosys co-founder Mr Senapathy “Kris” Gopalakrishnan, an IIT Madras alumnus, will sponsor five IIT Madras students’ studies in NTU every year.

Mr Gopalakrishnan believes this collaboration will help advance research in both institutes, given that NTU and IIT Madras are research leaders in many complementary areas.
DISCOVERING AS WE GROW: Pursuing Revolutionary Breakthroughs

We learn, discover and grow – always with the shared goal of blazing new trails for the betterment of society, industry and the world. Supported by government agencies, industry partners, peer universities and more, we are primed to engineer real-world solutions as we take on the demands of Industry 4.0.
2018 was a **fruitful year** of building on NTU CoE’s successes in various multidisciplinary programmes, especially in the areas of Artificial Intelligence (AI) and data science. We also made headway in the areas of additive manufacturing, biomedical applications, and urban solutions and sustainability, with the support of government agencies, distinguished corporations and industry partners.

**BUILDING STRONG ALLIANCES**

CoE has further strengthened our research capabilities with the support of professional bodies in Singapore and beyond. In 2018, we reinforced and established new research partnerships with various companies and institutions.

We extended our collaboration with the Civil Aviation Authority of Singapore (CAAS) in the Air Traffic Management Research Institute (ATMRI) for another five years, where we will advance our efforts in developing next-generation air traffic management solutions together. Our research will focus on AI and data science, urban aerial transport traffic management and systems, regional air traffic management modernisation, exploratory studies of emerging technologies, and talent development.

The year also saw us sealing new partnerships with industry to complement our expertise in the areas of AI and data science, 3D-printing, and sustainability challenges. We established new joint research centres and Corporate Labs including the Alibaba-NTU Joint Research Institute, HP-NTU Digital Manufacturing Corporate Lab, Surbana Jurong-NTU Corporate Lab, NTU Singapore-French Alternative Energies and Atomic Energy Commission Alliance for Research in Circular Economy (SCARCE) Joint Lab and Singapore Energy Centre.

Additionally, NTU embarked on more initiatives to tackle the challenges of an increasingly evolving and digitalised world driven by Industry 4.0. A new partnership was established with automotive electronics developer Desay SV Automotive to develop innovative solutions for mitigating cybersecurity threats faced by the automotive industry. This collaboration aims to develop new technologies to ensure robust cybersecurity and
cyber resilience in every stage of product design and development of automotive electronics. Focus will be placed on the development of secure embedded processing and communication, vulnerability analysis for cyber hardening, and security testing for autonomous vehicles.

At the same time, we worked with government agencies on various research initiatives. For example, the National Research Foundation (NRF) has set up the Strategic Centre for Research in Privacy Preserving Technologies and Systems (SCRIPTS) in NTU as a one-stop centre for research in privacy preserving technologies and systems. This Centre places us in a prime position to undertake academic research, develop skilled manpower and translate technology, as part of Singapore’s Smart Nation vision.

### MAKING BREAKTHROUGHS IN RESEARCH

More groundbreaking discoveries have been made at CoE. For instance, advancements in additive manufacturing (the process of joining materials to make objects from 3D model data) research has enabled us to work on multidisciplinary projects with various applications from water treatment, to construction and medical. Nano Sun, a water technology start-up founded by a member of our faculty, has launched a 3D printing facility to manufacture a new type of water treatment membrane. CoE has also developed a method to facilitate the concurrent 3D printing of concrete structures with multiple mobile robots. As well, we have developed a novel 3D bioprinting strategy that can create skin constructs that closely mimic natural skin in a reliable and repeatable manner.

Breakthroughs were made on the healthcare and biomedical fronts as well. We embarked on several projects to meet the demands of Singapore’s ageing population, which have resulted in revolutionary developments such as smart medical devices to aid in the early detection and intervention of predominantly age-related diseases like glaucoma and congestive heart failure.

Other breakthroughs included the engineering of an antiviral peptide that targets the membrane of viruses, utilisation of nano-cellulose fibres to reduce fat absorption by the body, and the use of nano-particles to quickly and accurately predict the likelihood of excessive scarring in wounds.
A research team from NTU’s School of Electrical and Electronic Engineering (EEE) has developed a smart handheld medical device that could enable early intervention for patients with congestive heart failure. Heart failure of this nature occurs when one’s heart muscle does not pump blood as well as it should and has no cure.

The portable innovation is made up of an acoustic sensor connected to a smartphone. It enables early intervention by allowing patients to check for water accumulation in the lungs – an important symptom of congestive heart failure – at home.

Currently, patients can only check for water accumulation in the lungs through a clinical examination, or through imaging modalities and serum biomarker tests, which are invasive and cannot be performed regularly and hence, do not allow early intervention.

The non-invasive device built by the team led by EEE’s Associate Professor Ser Wee from NTU EEE.

Front row, from left: Medical collaborator, Associate Professor David Foo from Tan Tock Seng Hospital and inventor, Associate Professor Ser Wee from NTU EEE. Back row, from left: Research Associate Edwina Alias Thelappilly and Research Engineer Peh Qian Hui, who are part of the NTU’s EEE team that developed the non-invasive medical device.

Our researchers are driven by the passion to address global pressing issues and create a better quality of life for the world. From world-renowned professors to young academics, these experts are constantly intensifying their efforts to meet the new demands of the Fourth Industrial Revolution.
A new imaging system for self-driving vehicles, called LiDAR (Light Detection and Ranging), may soon be about 200 times cheaper and the size of a fingertip, thanks to a laser invented at NTU’s School of Electrical and Electronic Engineering (EEE).

LiDAR systems are used to help driverless vehicles avoid collisions – they build three-dimensional maps of objects around it and then emit light beams to detect and measure the locations of obstacles.

The sizes of present LiDAR systems are inevitably huge and their prices are high as they comprise discrete, bulky, and expensive optical components such as lasers and photodetectors.

NTU researchers, led by Assistant Professor Nam Donguk and Associate Professor Tan Chuan Seng, have invented a novel laser structure that can stretch germanium – a widely used material in silicon-based CPU chips. They demonstrated that the light-emitting efficiency of germanium could be dramatically improved upon stretching, thereby allowing it to emit coherent laser light under optical pumping. This breakthrough may lead to the ultimate miniaturisation of various disruptive technologies such as a tiny LiDAR chip, ultracompact biosensors, and optical computers that can fit into the palm of a person’s hand.

A prototype of the device was found to have over 92 percent accuracy in identifying patients with the condition – comparable to the existing ‘gold standard’ diagnosis method, X-rays. The prototype has garnered positive response from multiple parties. A major pharmaceutical company, a healthcare multinational corporation and a local healthcare company have approached the research team to explore possible collaborations.

The team has also filed a patent for the invention, and is now refining the product. A MedTech start-up from NTU to commercialise the device is in the pipeline. The team will also seek clinical and regulatory validation for the product’s mass production.

In a pilot study, the device was found to have over 92 percent accuracy in identifying patients with the condition – comparable to the existing ‘gold standard’ diagnosis method, X-rays.

DID YOU KNOW?

In a pilot study, the device was found to have over 92 percent accuracy in identifying patients with the condition – comparable to the existing ‘gold standard’ diagnosis method, X-rays.

BRIGHTER PROMISE FOR DRIVERLESS CAR SAFETY

In a pilot study, the device was found to have over 92 percent accuracy in identifying patients with the condition – comparable to the existing ‘gold standard’ diagnosis method, X-rays.

DID YOU KNOW?

This breakthrough may lead to the ultimate miniaturisation of various disruptive technologies such as a tiny LiDAR chip, ultracompact biosensors, and optical computers that can fit into the palm of a person’s hand.
For materials to emit coherent laser beams, the light should be amplified in intensity while travelling inside the material by bouncing between two optical mirrors. In un-engineered germanium, however, light intensity decreases while travelling because of larger absorption (optical loss) than amplification (optical gain).

Assistant Professor Nam’s team first theoretically envisaged a way to obtain larger amplification than absorption to realise a germanium laser; optical gain is boosted via stretching germanium while optical loss is suppressed by lowering operation temperature.

The team then worked with Associate Professor Tan Chuan Seng, a co-leader of this research, to experimentally realise a laser structure wherein a stretched germanium nanowire is surrounded by two high-quality optical mirrors.

The team is currently investigating the further development of this laser. This research project was published in *Nature Communications*, a peer-reviewed scientific journal under the Nature Publishing Group.
Glaucoma, a leading cause of blindness in the world, can potentially be diagnosed and managed earlier – thanks to an invention by NTU scientists and clinicians from the Singapore Eye Research Institute (SERI).

In glaucoma, high pressure within the eye is caused by an imbalance between fluid production and its drainage out of the eye. Typically, an eye specialist determines the type of glaucoma through a gonioscope, a handheld lens put in direct contact with the eye. The specialist then peers through a microscope paired with the lens to make a visual diagnosis. Each type of glaucoma requires a different form of treatment.

The team’s ‘pen camera’, called the GonioPEN, could help tackle the eye disease with its ability to detect the type of glaucoma in a faster and less costly manner. It allows medical professionals to capture more detailed images of the eye drainage canal with minimal contact at the side of the cornea, causing negligible discomfort, unlike the current gonioscope. A software then analyses the images to aid in diagnosis.

The GonioPEN is built by a team led by Associate Professor Murukeshan Vadakke Matham, Director of NTU’s Centre for Optical and Laser Engineering and professor at NTU’s School of Mechanical and Aerospace Engineering (MAE), in collaboration with Professor Aung Tin, the Executive Director of SERI.

In a recent pilot study by Assistant Professor Baskaran Mani from SERI, all 20 patients found the GonioPEN more comfortable than the conventional handheld lens used with a microscope – a gold standard used in clinics now. As the current gonioscopy method takes up to 15 minutes to perform and requires a skilled specialist’s expertise to diagnose the problem on the spot, it is not done in clinics as a routine. As a result, half the patients here do not go through the test in clinics, leaving glaucoma largely undiagnosed here.

The GonioPEN circumvents these problems with its ability to quickly capture in just three minutes, high-resolution digital images of the eye from the side of the cornea. These digital images can then be stored for future reference and retrieved easily. A technician could perform the gonioscopy before a specialist reviews the images to give an in-depth diagnosis or a second opinion. Doctors can better track the changes in their patients’ condition over time. Costs are also kept low because a microscope is no longer required.

With GonioPEN, the diagnosis can be generated with an automated software, instead of only relying on a doctor’s expertise. This saves time for both doctors and patients involved in eye care, allowing more patients to be examined in clinics.

Patents have been filed for the GonioPEN by NTU’s innovation and enterprise arm, NTUitive, and the research is supported by grants from the National Medical Research Council and the National Research Foundation (NRF).
A robot has mastered the task of assembling an IKEA chair on its own – paving the way for potential larger-scale industrial breakthroughs.

The robot, designed by Associate Professor Pham Quang Cuong and his team from NTU’s School of Mechanical and Aerospace Engineering (MAE), assembled IKEA’s Stefan chair in 8 minutes and 55 seconds. Prior to the assembly, the robot took 11 minutes and 21 seconds to plan the motion pathways and 3 seconds to locate the parts.

These findings have been published in the journal Science Robotics.

The robot is being used to explore dexterous manipulation, an area of robotics that requires precise control of forces and motions with fingers or specialised robotic hands. As a result, it is more human-like in its manipulation of objects.

The NTU team comprising Associate Professor Pham, research fellow Dr Francisco Suárez-Ruiz and alumnus Mr Zhou Xian believes that their robot could be of greatest value in performing specific tasks with precision in industries where tasks are varied and do not merit specialised machines or assembly lines.

Next, using algorithms developed by the team, the robot plans a two-handed motion that is fast and collision-free.

The force sensors on the wrists help to determine the amount of force required, allowing the robot to precisely and consistently detect holes by sliding the wooden plug on the surfaces of the work pieces, and perform tight insertions.

Now that the team has achieved its goal of demonstrating the assembly of an IKEA chair, it is partnering companies to apply this form of robotic manipulation to a range of industries. It is also working to deploy the robot to do glass bonding that could be useful in the automotive industry, and drilling holes in metal components for the aircraft manufacturing industry.
**STRIKING THE ZIKA VIRUS AT ITS MOST VULNERABLE**

A research team led by Associate Professor Cho Nam-Joon from NTU’s School of Materials Science and Engineering (MSE) has engineered an antiviral peptide that exploits the Zika virus at its Achilles’ heel – the viral membrane – hence stopping the virus from causing severe infections.

The Zika virus is transmitted by Aedes mosquitoes, and infections during pregnancy are linked to birth defects such as microcephaly, a condition in which a baby is born with an abnormally small head and brain. Declared an international emergency in 2016, it remains a large threat globally today.

This new method of attacking the viral membrane focuses on directly stopping Zika virus particles instead of preventing the replication of new virus particles.

When administered in Zika-infected mice in the lab, the engineered peptide drug (a compound consisting of amino acids) reduced disease symptoms and the number of deaths. Importantly, the peptide was able to cross the nearly impenetrable blood-brain barrier to tackle viral infection in mouse brains and protect against Zika injury – a critical feature since Zika targets the brain and central nervous system.

There are currently no vaccines for the Zika virus, while available medicines only alleviate symptoms such as fever and pain. This newly created peptide holds great promise in becoming a future antiviral drug that can act directly on viral infections in the brain.

Lab tests showed that when the peptide was administered, 10 out of 12 infected mice survived. In comparison, all the mice in the control group died within a week post-infection.

In general, most antiviral drugs target the replication process of viruses. However, viruses often mutate quickly and antiviral drugs that target viral replication can become obsolete. Attacking the physical structure of enveloped viruses is a new approach to developing antiviral drugs. It offers promise for the peptide to be effective even if the Zika virus attempts to mutate.

There are instances where a virus mutation can lead to an epidemic in a short time, leaving communities unprepared. By targeting the lipid membrane of virus particles, scientists may devise more robust and effective ways to stop viruses.

The study, done in collaboration with the Federal University of Minas Gerais (UFMG) in Brazil and Ghent University in Belgium, spanned over six years and combined materials engineering, antiviral drug development, and pharmacology. Findings were published in the peer-reviewed journal *Nature Materials*.

Moving forward, the research team intends to study the effects of the peptide on diseases caused by other viruses in greater detail. The team will also conduct trials in larger animals, and subsequently plans to initiate human clinical trials once relevant preclinical studies are completed and regulatory approvals obtained.

Related antiviral technologies have been licensed from NTU to a local spin-off company, TSG Therapeutics Pte. Ltd., as part of plans to spur clinical translation. Associate Professor Cho is co-founder of TSG Therapeutics.
The world could be taking a big step forward in its fight against obesity, thanks to a miniscule fibre 100 times thinner than a strand of human hair.

Experiments done in a simulated gastrointestinal tract by scientists from NTU's School of Materials Science and Engineering (MSE) and Harvard University showed that the nanocellulose fibres could cut fat absorption by up to half (48 percent).

In animal experiments, rats fed with heavy cream containing nanocellulose absorbed 36 percent less fats than rats fed with heavy cream alone.

Associate Professor Joachim Loo and Associate Professor Ng Kee Woei from MSE, together with senior author of the study, Associate Professor Philip Demokritou, from the Harvard T.H. Chan School of Public Health, have discovered how nanocellulose can bind and trap fat molecules in the gut.

Typically, digestive enzymes in the gut break down fats into fatty acids, which are absorbed by the small intestines and converted into fat by the human body. However, when fat molecules are trapped in nanocellulose fibres, enzymes involved in breaking down fats for absorption are less effective, reducing the amount of fatty acids that can be absorbed by the body.

In the scientific journal ACS Nano, this new method of using nanocellulose fibres as fat blockers has been granted a US provisional patent, jointly filed by Harvard and NTU.

Published in the scientific journal ACS Nano, this new method of using nanocellulose fibres as fat blockers has been granted a US provisional patent, jointly filed by Harvard and NTU.

Through these animal experiments, the team has shown that fibres at the nanoscale are much more effective at reducing fat absorption than in its bulk form.

To Professor Philip Demokritou, the most exciting aspect is that fat absorption can be curbed simply through the use of a nanoscale material made of naturally-obtained fibres derived from plants, engineered using mechanical means without any chemicals.

Moving forward, the NTU and Harvard scientists will continue to probe the toxicological profile of nanocellulose to examine its safety for consumption in large amounts in further animal trials.
MICRO-NEEDLES, BIG IMPACT: THE FUTURE OF EYE DISEASE TREATMENT

NTU scientists have developed a ‘contact lens’ patch that could provide a painless and efficient alternative to current methods of treating common eye diseases such as glaucoma and macular degeneration.

Today, treatment methods such as eye drops and ointments are hindered by the eye’s natural defences, blinking and tears. Also, eye injections can be painful and potentially cause eye infection and damage. As a result, some patients – many of whom require long-term treatment for their eye ailment – do not keep up with the prescribed regime.

To tackle these problems, the NTU research team developed a 2mm by 2mm patch with nine micro-needles that can be loaded with drugs for lab tests.

The proof-of-concept patch is covered with biodegradable microneedles that deliver drugs into the eye in a controlled release. After a user presses it onto the eye surface – much like putting on contact lenses – the drug-containing microneedles detach by themselves and stay in the cornea, releasing the drug over time as they dissolve.

When tested on mice with corneal vascularisation (a sight-threatening condition where new blood vessels grow into the corneal tissue due to oxygen deprivation), a single application of the patch was 90 percent more effective in alleviating the condition, compared to applying a single eye drop with 10 times more drug content. There was also no puncture found on the cornea after a week, suggesting that the microneedles are strong enough to penetrate the cornea, but not too stiff to spear through the whole cornea.

This novel approach, developed by a team led by Professor Chen Peng from NTU’s School of Chemical and Biomedical Engineering (SCBE), with clinical insights from Singapore National Eye Centre’s Associate Professor Gemmy Cheung, was published in *Nature Communications*. The team includes Assistant Professor Wang Xiaomeng from NTU’s Lee Kong Chian School of Medicine (LKCMedicine), and Assistant Professor Xu Chenjie and research fellow Dr Aung Than from SCBE.

Professor Chen said this approach could realise the unmet medical need for a localised, long-lasting and efficient eye drug delivery with good patient compliance.

The team has filed a patent, and is currently working on further improving the eye patch technology. They are also looking to partner with clinician scientists to study the feasibility of conducting medical trials.

**DID YOU KNOW?**
When tested on mice with corneal vascularisation, a single application of the patch was 90 percent more effective in alleviating the condition, compared to applying a single eye drop with 10 times more drug content.
NATURAL ALTERNATIVES TO ARTIFICIAL FOOD PRESERVATIVES

NTU scientists have discovered a plant-based food preservative that is more effective than artificial preservatives.

The organic preservative comprises a naturally-occurring substance known as flavonoids. The flavonoids created by NTU scientists have strong anti-microbial and anti-oxidant properties – two key traits of preservatives that inhibit bacterial growth and keep food fresher for longer.

In tests carried out on meat and fruit juice samples at room temperature (about 23 degrees Celsius), the organic preservative kept its samples fresh for two days without refrigeration, compared to commercial-grade artificial food preservatives which succumbed to bacterial contamination within six hours. This breakthrough may open new doors in food preservation technologies, providing a low-cost solution for industries, which could in turn encourage a sustainable food production system that produces healthier food that stays fresh longer.

The research team was led by Professor William Chen from NTU’s School of Chemical and Biomedical Engineering (SCBE), who is also the Director of NTU’s Food Science and Technology programme.

Though flavonoids’ anti-microbial potential have been reported, they have not been used as a food preservative because they require further processing before they can mitigate the effects of bacteria. The process is not cost-effective or sustainable.

NTU researchers have not only found a way to grow flavonoids with high anti-microbial and anti-oxidant properties but also in a natural and sustainable manner. They achieved this by implanting the flavonoid-producing mechanism from plants into baker’s yeast (a species known as Saccharomyces cerevisiae).

Similar to how vaccines are manufactured using yeast, the researchers found that the yeast produced flavonoids with high anti-microbial properties, which are not even present in pure flavonoid samples extracted directly from plants.

This research comes at a time when there is a growing body of scientific evidence on how artificial preservatives affect the body’s long-term growth and development.

The team’s findings were published in the scientific journal *Food Chemistry* – one of the top three research-based food science publications. The team is also in talks with multinational companies to further develop the new food preservative. Moving forward, it aims to further develop their findings with the food industry and enhance its efficacy and safety so that it can be used in all packaged food products.
THREE CHEERS FOR
NTU’S 3D PRINTING BREAKTHROUGHS

The year also saw successful developments in the 3D printing arena – one, an ultra-delicate form of printing for membranes, and the other, heavy-duty concrete printing.

PRINTING NANOFIBRES ONTO MEMBRANES

Nano Sun, a water technology start-up founded by a scientist from NTU, has launched a 3D printing facility to manufacture a new type of water treatment membrane.

Unlike conventional membrane-manufacturing processes that use acids to make polymers porous that function as filters, Nano Sun 3D prints millions of nanofibres layered on top of each other, compressed into a thin membrane.

This results in a new membrane that has a faster water flow rate than conventional membranes despite having a similar pollutant rejection rate. It allows for the construction of smaller wastewater treatment plants, lowering the costs for land, infrastructure and labour.

The new membrane is also more resistant to breakage and biofouling, requires less maintenance and brings about greater cost efficiencies.

This new 3D printing manufacturing plant is the result of a two-decade effort by its co-founder and Associate Professor Darren Sun from NTU’s School of Civil and Environmental Engineering (CEE) to develop and deploy his research innovations in the fields of materials science, water chemistry and advanced manufacturing. It is supported by the Singapore Economic Development Board (EDB).

Since 2015, the NTU spin-off company has designed, commissioned and delivered over 15 water treatment systems and plants to various governments and companies in Singapore, China, Philippines and Indonesia.

With three new wastewater treatment contracts under its belt, Nano Sun’s annual revenue is expected to reach S$10 million this year, making it one of NTU’s most successful spin-off companies to date.

Over the next three years, Nano Sun will expand its manpower from a Singaporean team of 18 engineers and staff to about 80, with membrane applications to be deployed in China, Indonesia and Philippines.

Further studies are now underway to develop even better anti-fouling additives which can be combined with other materials during the 3D printing process.

DID YOU KNOW?

Nano Sun’s 3D printed membrane is more resistant to breakage and biofouling, requires less maintenance and brings about greater cost efficiencies.
Scientists from NTU have developed a technology where two robots can work in unison to 3D print a concrete structure.

This method of concurrent 3D printing, known as swarm printing, paves the way for a team of mobile robots to print even bigger structures in future.

Developed by Associate Professor Pham Quang Cuong from NTU’s School of Mechanical and Aerospace Engineering (MAE) and his team at NTU’s Singapore Centre for 3D Printing (SC3DP), this new multi-robot technology was published in Automation in Construction, a top-tier journal for civil engineering.

Using a specially formulated cement mix suitable for 3D printing, this new development will allow for unique concrete designs currently not possible with conventional casting. Structures can also be produced on demand and in a much shorter period.

Currently, 3D printing of large concrete structures requires huge printers that are larger than the printed objects, which is not feasible since most construction sites have space constraints.

Having multiple mobile robots that can 3D print in sync means large structures like architectural features and specially-designed facades can be printed anywhere as long as there is enough space for the robots to move around the work site.

This multi-step process starts by having the computer map out the design to be printed and assign a specific part of the printing to a robot. It then uses a special algorithm to ensure that each robot arm will not collide with another during the concurrent printing.

Using precise location positioning, the robots then move into place and print the parts in good alignment, ensuring that the joints between the separate parts are overlapped. Finally, the mixing and pumping of the specialised liquid concrete mix have to be blended evenly and synchronised to ensure consistency.

This research project was supported by the National Research Foundation (NRF) and Sembcorp Design and Construction, one of the key industry research partners of SC3DP.

Moving forward, the research team will look at integrating even more robots to print larger-scale structures, optimising printing algorithm for consistent performance and to improve the concrete material for faster curing.
From left: Ms Liu Xiangwen, Director, Technology Strategy Department of Alibaba Group; Mr Jeff Zhang, CTO of Alibaba Group; Dr Amy Khor, Senior Minister of State for the Ministry of the Environment and Water Resources and Ministry of Health, Singapore; Professor Subra Suresh, NTU’s President and Professor Lam Khin Yong, NTU’s Vice-President (Research) launching the new Joint Research Institute.

FUELLING NEW RESEARCH ON ARTIFICIAL INTELLIGENCE (AI) TECHNOLOGIES

NTU and Alibaba Group have launched the Alibaba-NTU Singapore Joint Research Institute to advance discoveries in AI.

This is the e-commerce giant’s first joint research institute outside China. This multimillion dollar per year partnership will start with a five-year period, with a pool of 50 researchers from both organisations.

This institute seeks to combine NTU’s human-centred AI technology which has been applied to areas such as health, ageing, homes and communities, with Alibaba’s leading technologies including Natural Language Processing (NLP), computer vision, machine learning and cloud computing to explore further technology breakthroughs and real-life AI solutions. Professor Miao Chunyan from NTU and Ms Liu Xiangwen from Alibaba are the co-directors of the Joint Research Institute.

Over the next five years, NTU and Alibaba will further push the frontiers of AI and deploy AI solutions in scenarios ranging from home, retail, community and urban transportation to hospitals and nursing homes, with the aim of enhancing the city’s efficiency and helping people to achieve healthier, smarter and happier lives.

NTU students, staff and faculty will have opportunities to go on exchange to Alibaba’s facilities and vice versa, while working on cutting-edge AI research. In addition, both parties will work towards building a crowdsourcing platform to connect researchers and industry practitioners around the world within an AI-focused R&D ecosystem, encouraging global AI experts, research institutions and universities to join and contribute to the AI research community.
ENGINEERING A DIGITAL MANUFACTURING FUTURE

The HP-NTU Digital Manufacturing Corporate Lab has been established to support Singapore’s push towards industry transformation – in the areas of digital manufacturing and 3D printing technologies.

Supported by the National Research Foundation (NRF), the new corporate lab is HP’s first university laboratory collaboration in Asia. It will be a key pillar of NTU’s Smart Campus initiative and will build on HP's strong research and manufacturing capabilities.

The lab’s main research themes will focus on advancing 3D printing, specifically around AI, machine learning, new materials and applications, cybersecurity and customisation. Led by Associate Professor Tan Ming Jen from NTU’s School of Mechanical and Aerospace Engineering (MAE) and Dr Mike Regan from HP Inc., the directors of the HP-NTU Digital Manufacturing Corporate Lab, it will house three major programmes:

- **3D printing programme**
  Research projects will delve into areas such as droplet-powder interaction fundamentals, alignment of reinforcement fibres in a powder bed, designing materials with site-specific properties, developing educational modules on design for digital manufacturing, developing biocompatible materials for medical devices, predicting structural and mechanical characteristics in the MultiJet Fusion (MJF) process, 4D printed smart systems and bioprinting of tissue models.

- **AI / Machine Learning programme**
  Projects will look into developing predictive diagnostics for MJF and industrial digital printers, part design aids that will pave the way to engineering parts at the voxel (a volume element or 3D pixel) level, robotic manipulation for unloading of parts from MJF printers, and edge processor design for 3D printer cloud.

- **Cybersecurity programme**
  Research will focus on hardware-enhanced security management of MJF printers, secure machine learning, and malware detection via hardware and software co-analysis.

The lab also aims to support innovation and research through creating technical disclosures, patents, papers and new products. Plans to develop educational curriculum on designing for Additive Manufacturing – covering areas such as data management, security, user experience and business models – are in the pipeline as well.

More than 20 NTU principal investigators across different schools and colleges, as well as from HP are involved in this project. Moving forward, the lab aims to recruit up to 100 researchers and staff.
BUILDING NEW SUSTAINABLE URBAN AND INDUSTRIAL SOLUTIONS

TU, Surbana Jurong and the National Research Foundation (NRF) have set up a joint corporate laboratory – the SJ-NTU Corporate Lab – to develop next-generation sustainable solutions to tackle industrial and complex urban challenges.

This $61 million five-year partnership aims to translate research outcomes into practical and viable solutions that are focused around three core themes: digitalisation, green and sustainable urban solutions, and future of the industry and productivity. Led by Professor Tan Kang Hai from NTU’s School of Civil and Environmental Engineering (CEE), who is the co-director of the SJ-NTU Corporate Lab, the collaboration taps NTU’s strengths in engineering and sustainability research, and Surbana Jurong’s track record in providing urban, infrastructure and industrial solutions to its global customers.

For a start, a research team comprising Assistant Professor Alessandro Romagnoli from NTU’s School of Mechanical and Aerospace Engineering (MAE), Associate Professor Zhao Zhiye and Assistant Professors Qian Shunzhi, Wu Wei and Yi Yaolin from NTU’s School of Civil and Environmental Engineering, will explore underground storage spaces for storing liquefied natural gas (LNG) in industrial and urban areas so that space aboveground can be freed up for other uses.

In another project, researchers will develop a thermal management system and an indoor air quality system that is not only energy efficient, but also uses a botanical solution to purify the air. Integrating selected plants with architectural and interior design, indoor air pollutants would be reduced while creating a natural and lush indoor environment.

A team is also working on a chilled ceiling technology that uses special composite materials for ceiling panels which are linked to a central monitoring system. The composite panels transfer heat more effectively than conventional aluminium panels, reducing the need for air-conditioning and improving energy efficiency.

On the digital front, researchers will look into creating technologies to scan and map the external and internal parts of building structures such as piping networks, to create Building Information Models. The solution aims to improve the efficiency of facility managers and change the way buildings are managed and maintained by visualising structures before the commencement of construction, hence minimising costly and time-consuming reworks.

Upcoming projects include research to explore underground storage systems, sustainable indoor solutions for buildings, and digital technologies to scale up productivity in the built environment.

The lab will include NTU scientists from various fields and Surbana Jurong professionals. When fully operational, it will be supported by 70 researchers, including NTU undergraduates and Ph.D. students.

DID YOU KNOW?

SJ-NTU Corporate Lab:

• $61 million five-year partnership
• Focused on 3 core themes: Digitalisation, Green and sustainable urban solutions, Future of the industry and productivity
PUTTING E-WASTE TO BETTER USE

NTU has partnered the French Alternative Energies and Atomic Energy Commission (CEA, France) to set up the NTU-CEA Joint Lab known as NTU Singapore-CEA Alliance for Research in Circular Economy (SCARCE) to develop innovative and energy-efficient solutions in the recycling and recovery of resources from electrical and electronic waste (e-waste). SCARCE is established in collaboration with National Environment Agency (NEA, Singapore) with the three organisations committing S$20 million to this lab. This is one of NEA’s closing the waste loop research and development (R&D) initiative.

The lab’s four research thrusts include recycling, recovering and reuse of materials from e-waste such as:
- discarded lithium-ion batteries;
- silicon-based solar panels;
- printed circuit boards (PCBs) from discarded consumer electronics; and
- toxic plastics in e-waste.

NTU and the CEA researchers will also address issues faced by current extraction methods of precious metals from lithium-ion batteries, solar panels and PCBs, which consume large amounts of energy and use strong acids. They will be led by the Joint Lab’s co-directors, Professor Madhavi Srinivasan from NTU’s School of Materials Science and Engineering (MSE) and Dr Jean-Christophe P. Gabriel of CEA.

The project will look into developing innovative recycling technologies that can sort, dismantle, and recover materials that can be re-used in an energy-efficient and environmentally benign way. One of the projects that the centre will run is a study led by Professor Srinivasan. She and her team will look into developing eco-friendly methods to recycle used lithium ion batteries and extract up to 75 percent of metals and reuse them to produce new lithium ion batteries.

The partnership will also explore using activation means and chemical reactions to dissolve materials and develop a systematic approach to safely sort, detoxify and recycle hazardous plastic materials from e-waste.

Printed circuit boards usually consist of metals such as copper, aluminium, gold and silver, as well as valuable organics and ceramics which are often lost during incineration. This lab will focus on hydrometallurgical approaches to extract these metals.

With the CEA’s world-renowned expertise in metal extraction and materials recycling with extensive industrial deployment, and NTU’s excellence in R&D translation and innovation in environmental sustainability, this collaboration stands to boost local R&D capabilities in e-waste management and recycling.
RESEARCH

NEW SINGAPORE ENERGY CENTRE TO ADDRESS FUTURE ENERGY CHALLENGES

The Singapore Energy Centre (SgEC) is a consortium founded by the Nanyang Technological University (NTU), the National University of Singapore (NUS), and founding members such as ExxonMobil USA. It taps the combined expertise and capabilities of the two universities to co-develop early-stage and near-term energy solutions for world-scale petrochemical industries in particular. The centre aims to tackle technological and socioeconomic issues in sustainable energy development while grooming talents in related fields simultaneously.

ExxonMobil, SgEC’s first founding industry partner, has committed US$10 million over a five-year period to support the centre’s wide range of innovative research projects and activities.

Topics explored for funding by ExxonMobil include:

- **Bioscience**
  Looking to nature’s biodiversity to discover novel materials and process designs that could result in low carbon dioxide-emitting approaches for making fuels and chemicals, thus potentially lowering overall carbon dioxide emissions.

- **Carbon capture, utilisation and storage**
  Exploring a broad range of technologies to capture existing carbon dioxide from industrial applications and sequester it or convert it to useful products in a cost-effective manner.

- **Energy and water efficiency**
  Exploring technologies that reduce plastic waste, water and energy consumption during manufacturing, while providing for the needs of a growing population and economy.

SgEC is co-led by both universities, with Professor Xu Rong from NTU’s School of Chemical and Biomedical Engineering (SCBE) as the director and Professor Lee Jim Yang from NUS as the co-director of the centre. Centre directorship is rotated every 2 years with NTU at the helm starting 2019.

DID YOU KNOW?

The Singapore Energy Centre (SgEC) is ExxonMobil’s first energy centre outside of the United States and will build on the company’s existing partnerships with US academic and research institutions.
ACHIEVING AS WE ACCOMPLISH:
Grooming Changemakers of Tomorrow

Talent. Passion. Creativity. These are just a few of the many traits that spur our students, alumni and faculty on as they work to shape a better tomorrow. As the embodiment of these exceptional forward thinkers, we are constantly seeking new ways to gain new knowledge, push boundaries and achieve even more in the name of excellence.
Our alumni have shown that success is a result of not just technical skills and knowledge, but also passion and perseverance to build a better tomorrow for themselves and those around them, amongst many other qualities. May the stories of some of our alumni – two stories amongst many – inspire more to push boundaries and realise their full potential.

CoE strives to ensure that our students receive a holistic education that will enable them to conquer challenges in the workforce. Our programmes have moulded changemakers across many fields, all with the passion and aptitude to better the world as we enter the Industry 4.0. These individuals have gone on to prove their mettle in the real world, and they have done us proud.
ABILASH SUBBARAMAN
HEETESH ALWANI
RAHUL IMMANDIRA

An Unexpected Brew
The beer brewery that started in an NTU residential hall is now available in Singapore's mass market and perhaps one day, the world. This is a success story of three friends, curiosity, entrepreneurship and a fortunate stroke of serendipity.

Abilash Subbaraman, Heetesh Alwani and Rahul Immandira were part of NTU's Renaissance Engineering Programme (REP). There, they honed their business skills through entrepreneurship modules and rubbed shoulders with entrepreneurs, which fuelled the “leap of faith” they would later take to launch their brand.

“As part of REP, we spent our third year of studies at UC Berkeley, California. There, Rahul did an internship at a local craft microbrewery, where he picked up some brewing skills,” explained Abilash.

“Heetesh and I casually asked him how difficult it was to brew beer, and he replied that it was not too difficult,” he recounted.

That one question led to the trio’s journey of experimenting with beer brewing, with constant improvisation and tweaking along the way – never with the intention to sell. Five months after they started, the three friends had brewed about 10 batches of beer on campus – each batch ranging from 10 to 20 litres – which were a hit with their peers.

But it wasn’t a smooth journey. One day, they were asked to stop their brewing activities on campus as it flouted local regulations on the home-brewing of fermented liquors.

Just when they thought their brewery adventure was coming to an end, local media picked up their story that was published on an NTU newsletter, and encouragement from the public as well as partnerships from local breweries started to stream in. The trio eventually took on a contract brewing arrangement, where they engaged a licensed brewer to make brew based on their recipes.

Binjai Brew – named after NTU’s Binjai Hall where the brewing journey started – was officially launched in end-December 2018.

In the short term, the trio wants to enable more people to try Binjai Beer by expanding its distribution reach. It is currently discussing collaborations with other brands, as well as participating in events to reach out to a larger community.

Long-term plans are brewing.

“We would like to become an approachable brand that people can identify with. We look forward to opening up our own brewery and selling Binjai Brew wherever life may take us,” said Abilash.
VEERAPPA RAJAN

Grit Brings Opportunities

Veerappa Rajan is testament that infinite opportunities are all around for those who look.

He graduated from NTU’s School of Mechanical and Aerospace Engineering (MAE) with a Minor in Entrepreneurship in 2012. He then joined Procter & Gamble (P&G) as a Purchasing Manager, where his entrepreneur senses blossomed.

During his five years in the organisation, his responsibilities included helping the company sell off surplus consumer goods to recover cash and avoid unnecessary costs across Asia Pacific region.

“I saw a huge white space opportunity and I felt I could do it better if I became a third-party business partner for all consumer goods companies, sellers and buyers,” he said.

In 2017, he founded a start-up which launched JobberDeals, a business-to-business (B2B) platform for trading surplus consumer goods. A “Jobber” is a middleman who deals in small lots of goods (or “jobs”) and does not deal directly with the principal.

“JobberDeals aims to help brand manufacturers and product distributors to sell directly to businesses and retailers who do not carry them so that no surplus consumer goods go to waste,” he said.

Veerappa’s entrepreneurship journey was not without its obstacles. Firstly, there were multiple issues with the platform development. Then, there were problems with capital and credible buyers, as well as a short-lived success before the business had to pivot. Finally, his co-founder and one of his investors decided to leave to start another business on their own. Today, he and his team are working to scale up his pivoted business, an office supplies and concierge business called Office Lounge, where he is still working to integrate his earlier concept of having no product going to waste.

When asked about his recipe for success, he says, “One has to have grit – a combination of passion and perseverance – if one wants to succeed in life.”

He also credits his success to his education at MAE.

“The coursework at MAE teaches us to analyse problems and look into practical solutions which we need to implement and improve via feedback. The skills we learnt can be applied not only in engineering, but also in business.”

NTU’s multidisciplinary curriculum enabled Veerappa to take a Minor in Entrepreneurship. “Thanks to the Minor Programme, I received a first-hand entrepreneurship experience by running a successful social enterprise for a year,” he said.

“MAE was also where I picked up both technical and commercial skills needed for procurement which helped me to get into the P&G Purchases team, and eventually, start Office Lounge,” he added.
At NTU CoE, our professors, mentors and advisors share the vision of grooming future-ready engineers who will go on to build a better tomorrow. Leaders in their fields, they are distinguished award-winners, scholars, accomplished researchers and sought-after consultants to the government and industry.

**Dr Mukta Bansal**
Lecturer, researcher and most recently, a role model for aspiring female engineers.

Women are often the most under-represented demographic in engineering, and Dr Mukta Bansal wants to do her part to change this.

The lecturer from the School of Chemical and Biomedical Engineering (SCBE) was named an Outstanding Woman in Engineering at the Venus International Women Awards 2018. She was lauded for her contributions, research excellence and accomplishments in Chemical Engineering.

“I was glad at the recognition because I have always wanted to inspire females who may believe that engineering is not for them,” says the lecturer.

This female role model in engineering is optimistic about increasing the female demographic in the field, and believes that increased female involvement is a key to encourage young women to join the engineering industry.

“We need to have more female faculty members reaching out to secondary schools and junior colleges to raise awareness about careers in engineering. Women-centric campaigns, special scholarships, as well as networking groups that showcase successful women in engineering are some other platforms we can tap,” she says.

Dr Bansal has also been recognised for her passion to groom and inspire the next generation of changemakers in engineering. She won the Nanyang Education Award (School) in 2017, the highest honour conferred by the University to faculty members in the teaching field. The Award recognises the passion, dedication and achievements of faculty members who have displayed excellent teaching practices and enriched the learning experiences of NTU undergraduates and National Institution of Education, Singapore (NIE) trainee teachers.

When asked about her opinion on the qualities of a good educator, she cites the ability to put oneself into students’ shoes and explaining concepts in ways they would want to learn as a key virtue. Of course, she adds, it’s not all about having excellent technical and communication skills. “A good educator must be able to convey enthusiasm for the subject, connect to students and be approachable,” says Dr Bansal.

Dr Bansal is also actively involved in research at NTU. She is currently part of the team working on Weblabs – a user interface project to enable users to access labs virtually. Another project she is involved in is Modelling, Simulation and Optimisation of Chemical Process.

And what is it that fuels her to do what she does?

She shares a motto she lives by: “In every situation, do your best and make sure that it is beneficial to society”. 
Three young NTU faculty members were lauded for their outstanding achievements in Artificial Intelligence (AI).

It was a proud moment for CoE when three faculty members from the School of Computer Science and Engineering (SCSE) were featured in the 2018 “AI’s 10 to Watch” list by IEEE Intelligent Systems.

IEEE Intelligent Systems has long helped to promote young and aspiring AI scientists via its biennial “AI’s 10 to Watch” section. 10 young individuals who have demonstrated outstanding AI achievements make it to the list. These talents are handpicked from a pool of worldwide nominations by a selection committee formed by IEEE Intelligent Systems editorial and advisory board members. Nominees, who must have received their Ph.Ds in the past five years, are selected based on their reputation, impact, expert endorsement and diversity.

A Genuine Curiosity for Artificial Intelligence
Driven by a profound sense of intellectual curiosity and the passion to help solve societal challenges, Associate Professor Bo An loves delving into the areas of artificial intelligence, multi-agent systems, computational game theory, reinforcement learning, and optimisation.

Associate Professor An was recognised by IEEE Intelligent Systems for his contributions to the multi-agent systems field, particularly in game-based algorithms for physical security, cybersecurity and sustainability.

Today, he is working on research projects that aim to improve the efficiency and robustness of large-scale and complex AI systems. “I study areas such as adversarial machine learning, solving large-scale games and multi-agent reinforcement learning,” he elaborates.

When asked about his greatest accomplishments at NTU, Associate Professor An cites some of the University’s recent industry collaborations where he played a part in solving complex real-world problems.

His wealth of practical experience has proved useful in his work as a lecturer. “I like to apply real-world examples to course materials as much as possible. This makes it easier for students to understand complex problems and stay engaged in class,” he explains.

Apart from his responsibilities in research and education, the Associate Professor is also Assistant Chair (Innovation) at SCSE, where he...
is actively involved in broadening students’ flair for innovation through initiatives such as entrepreneurship programme and competitions.

Seeing AI from the Very Beginning
Associate Professor Erik Cambria is what one may call a visionary in AI. He looks back at the AI landscape when he started a decade ago.

“AI was not popular at all then. I remember meeting a professor who suggested that I give up on my research because many before me had tried – and failed," he recalls.

“Luckily, I didn’t listen to her,” he muses.

Fast forward to today, Associate Professor Cambria’s enthusiasm for his work in AI remains strong. The 2018 “AI’s 10 to Watch” list highlighted his achievements in championing a multidisciplinary approach to bridge the gap between statistical natural language processing and other disciplines (e.g. linguistics, commonsense reasoning, and affective computing) necessary for understanding human language.

“I believe AI research can change the world for the better. I am also happy to see that it is helping my students, collaborators and business partners grow both professionally and personally,” says Associate Professor Cambria, who is also the founder of a sentiment analysis services company.

He and his research team are currently working on integrating natural language processing tasks such as sentiment analysis, personality recognition, sarcasm detection, and commonsense reasoning.

As much as Associate Professor Cambria “is enthralled by the idea of mimicking intelligence into a machine”, he firmly believes in the “human factor” in interactions – specifically amongst researchers. This, he says, is something researchers tend to forget, partly due to stringent key performance indicators and peer pressure. He also makes it a point to be a caring, patient, and understanding professor to his students.

“We all have been students before. Treat your students as you would have liked to be treated when you were one and you’ll be surprised by the things they can do for you.”

Nurturing Both Artificial and Human Intelligence
Associate Professor Sinno Jialin Pan has a dream – to make machines possess the intelligence of human beings.

While promising results have been achieved in the field of AI, Associate Professor Sinno Jialin Pan acknowledges that a future with machines having their intelligence is “still far”. And he is committed to accelerating this future through the research of transfer learning in machines – that is, to teach machines to use knowledge learnt from prior tasks to accomplish future tasks.

Associate Professor Sinno Jialin Pan is one of the pioneers to have helped to lay the early theoretical foundations and develop practical algorithms for transfer-learning techniques with diverse real-world applications. His contributions have not gone unnoticed, most recently evident from his listing on the “AI’s 10 to Watch”.

On the education front, Associate Professor Sinno Jialin Pan has big dreams as well – to help his Ph.D. students gain recognition in the world of research.

“I want my students to graduate having built up a ‘research keyword’ for themselves. A researcher’s ‘research keyword’ means that when other researchers talk about him/her, they know what specific research topic he/she is working on. And when they talk about a specific area, they will know some of his/her work.”

He brings up the success of his first Ph.D. student, who graduated in 2018, in being known and praised for her ‘research keyword’ by researchers he met at a conference.

“As a professor, the greatest accomplishment is to successfully train a student who has become an independent and known researcher in the field he/she is working on,” he says.
TWO NEW IEEE FELLOWS

The IEEE Fellowship recognises individuals with extraordinary records of accomplishments in any IEEE field of interest. It is the highest grade of IEEE membership and is regarded by the international engineering community as a prestigious honour. The following two faculty members from NTU's College of Engineering were recently elected as IEEE Fellows:

**Professor Tan Yap Peng**
School of Electrical and Electronic Engineering

*for his contributions to visual data analysis and processing*

**Professor Er Meng Hwa**
School of Electrical and Electronic Engineering

*for his contributions to electronic engineering education*

NEW NATIONAL RESEARCH FOUNDATION (NRF) FELLOW

Assistant Professor Yu Jing from the School of Materials Science and Engineering has been conferred NRF Fellow in the NRF Fellowship Scheme.

The competitive programme seeks to attract, recruit and root outstanding young scientists from around the world to conduct independent research in all areas of science and technology in Singapore over a five-year period. The programme provides a research grant to support projects that have a high likelihood of making a breakthrough.

NATIONAL RESEARCH FOUNDATION (NRF) INVESTIGATORSHIP AWARD

Professor Miao Chunyan from the School of Computer Science and Engineering has won the NRF Investigatorship award.

The NRF Investigatorship provides opportunities for established, innovative and active researchers in their mid-career to pursue groundbreaking and high-risk research. It is intended to support a small number of Principal Investigators who have an excellent track record of research achievements and are recognised as leaders in their respective fields of research. Each recipient will receive up to S$3 million over five years to pursue groundbreaking research.
NTU's College of Engineering congratulates the following colleagues who were promoted to full professors in 2018.

- **Professor Cai Jianfei**
  School of Computer Science and Engineering

- **Professor Cong Gao**
  School of Computer Science and Engineering

- **Professor K Jimmy Hsia**
  School of Mechanical and Aerospace Engineering

- **Professor Ng Geok Ing**
  School of Electrical and Electronic Engineering

- **Professor Upadrasta Ramamurty**
  School of Mechanical and Aerospace Engineering

- **Professor Shane Allen Snyder**
  School of Civil and Environmental Engineering

- **Professor Wang Qijie**
  School of Electrical and Electronic Engineering

- **Professor Alex Yan Qingyu**
  School of Materials Science and Engineering

- **Professor Yang Chun, Charles**
  School of Mechanical and Aerospace Engineering

- **Professor Yang Yaowen**
  School of Civil and Environmental Engineering
NEWLY HIRED FACULTY IN 2018

NTU CoE welcomes the following faculty members who have joined us in 2018.

Legend:
CEE: School of Civil and Environmental Engineering
EEE: School of Electrical and Electronic Engineering
MAE: School of Mechanical and Aerospace Engineering
MSE: School of Materials Science and Engineering
SCBE: School of Chemical and Biomedical Engineering
SCSE: School of Computer Science and Engineering

Dino Accoto, MAE
Associate Professor
Ph.D., Sant’Anna School of Advanced Studies, Italy, 2002
Associate Professor, Universita Campus Bio-Medico, Italy, 2015 - 2018

Chen Change Loy, SCSE
Associate Professor
Ph.D., Queen Mary University of London, United Kingdom, 2010
Research Assistant Professor, The Chinese University of Hong Kong, Hong Kong, 2013 - 2018

Chen Yu-Cheng, EEE
Nanyang Assistant Professor
Ph.D., University of Michigan, USA, 2017
Postdoc Research Fellow, The University of Michigan, USA, 2017 - 2018

Czarny Bertrand Marcel Stanislas, MSE
Assistant Professor
Ph.D., Paris Descartes University, France, 2012
Principal Research Fellow, Nanyang Technological University, Singapore, 2017 - 2018

Deng Ruilong, SCSE
Assistant Professor
Ph.D., Zhejiang University, China, 2014
AITF Postdoctoral Fellow, University of Alberta, Canada, 2015 - 2018

Fei Xunchang, CEE
Assistant Professor
Ph.D., University of Michigan, USA, 2016
Postdoctoral Fellow, King Abdullah University of Science and Technology, Saudi Arabia, 2016 - 2018
Amer Mohammad Yusuf Mohammad Ghias, EEE Assistant Professor
Ph.D., The University of New South Wales, Australia, 2014
Assistant Professor, University of Sharjah, United Arab Emirates, 2015 - 2018

Poernomo Gunawan, SCBE Lecturer
Ph.D., Nanyang Technological University, Singapore, 2009
Research Fellow, Nanyang Technological University, Singapore, 2017 - 2018

Sourav Sen Gupta, SCSE Lecturer
Ph.D., Indian Statistical Institute, India, 2014
Visiting Lecturer, Indian Statistical Institute, India, 2017

K Jimmy Hsia, MAE Professor
Ph.D., Massachusetts Institute of Technology, USA, 1990
Professor, Carnegie Mellon University, USA, 2015 - 2018

Huang Changjin, MAE Assistant Professor
Ph.D., Pennsylvania State University, USA, 2014
Postdoctoral Research Associate, Carnegie Mellon University, USA, 2016 - 2018

Abid Hussain, CEE Assistant Professor
Ph.D., McGill University, Canada, 2013
NSERC Fellow, University of Waterloo, Canada, 2016 - 2018

Hou Han Wei, MAE Assistant Professor
Ph.D., National University of Singapore, Singapore, 2012
Senior Research Fellow, Nanyang Technological University, Singapore, 2014 - 2017

Kim Munho, EEE Assistant Professor
Ph.D., University of Wisconsin-Madison, USA, 2016
Postdoctoral Research Associate, University of Illinois at Urbana Champaign, USA, 2016 - 2018
Hung Dinh Nguyen, EEE
Assistant Professor
Ph.D., Massachusetts Institute of Technology, USA, 2017
Instrument designer, System Engineer, Daelim Industrial Corp., South Korea, 2013

Sellakkutti Rajendran, MAE
Senior Lecturer
Ph.D., Indian Institute of Science, India, 1994
Research Fellow, Institute of High Performance Computing, Singapore, 1999 - 2001

Upadrasta Ramamurty, MAE
Professor
Ph.D., Brown University, USA, 1995.
Professor, Indian Institute of Science, India, 2010 - 2018

Shane Allen Snyder, CEE
Professor
Ph.D., Michigan State University, USA, 2000
Visiting Professor, National University of Singapore, Singapore, 2011 - 2017

Abdulkadir C. Yucel, EEE
Assistant Professor
Ph.D., University of Michigan, USA, 2013
Postdoctoral Research Associate, Massachusetts Institute of Technology, USA, 2016 - 2017

Yu Han, SCSE
Nanyang Assistant Professor
Ph.D., Nanyang Technological University, Singapore, 2014
Lee Kuan Yew Post-Doctoral Fellow, Nanyang Technological University, Singapore, 2015 - 2018

Zhang Hanwang, SCSE
Assistant Professor
Ph.D., National University of Singapore, Singapore, 2014
Research Scientist, Columbia University, USA, 2017

Zhao Jun, SCSE
Assistant Professor
Ph.D., Carnegie Mellon University, USA, 2015
Research Fellow, Nanyang Technological University, Singapore, 2017 - 2018
EEE Students clinch top two places in Singapore-India Hackathon.

The Singapore-India Hackathon is a fast-paced 36-hour competition that challenges participants to develop creative and innovative solutions. This inaugural competition, themed “Smart Campus”, took place from 12 to 14 November 2018, where 20 teams from universities in India and Singapore competed to build the most innovative tech solutions. Teams presented original ideas on navigating a campus efficiently outdoors and indoors, enhancing learning using technology, managing one’s digital identity and more. They also proposed campus-skewed solutions that focussed on parking, effective learning, event management, and personal security.

Team Vandhe clinched the top spot with their community-based learning platform that encourages student collaboration and mutual learning as well as offers professor-approved answers to solution sets for past-year papers.
CoE’s Team Vandhe, comprising Lim Sheng Rui Varick, Dhea Mariesta and Mandy Wong Suping from the School of Electrical and Electronic Engineering (EEE), came out tops in the competition, going home with a cash prize of $10,000. It had proposed a community-based learning platform that encourages student collaboration and mutual learning as well as offers professor-approved answers to solution sets for past-year papers.

In second place was Team ZPJ, formed by Liew Yi An Jordan, Tan Zhi Wei and Tan Pin Da – also from EEE – who walked away with a $6,000 cash prize. The team had presented its idea for an app that could help users navigate campus grounds by using landmark-based location recognition and offering optimised walking routes.

The cash prizes were presented by Indian Prime Minister Narendra Modi and Singapore’s Education Minister Ong Ye Kung at the prize ceremony at the Fullerton Hotel, which was also attended by NTU President Subra Suresh.

Proposed by PM Modi during his official State visit to Singapore earlier in 2018, the Hackathon was facilitated by the High Commission of India in Singapore in partnership with Singapore’s Ministry of Education (MOE) and Ministry of Foreign Affairs (MFA). It was jointly organised by NTUitive Pte Ltd and All India Council for Technical Education (AICTE).
Three cheers for NTU students for their triumphs at the RoboMaster Robotics Competition 2018!

The annual RoboMaster Robotics Competition is one of the world’s key robotic competitions, where engineering students across the globe convene to build the best next-generation robots. This year, aspiring engineers once again engaged in a battle of skills and wit to design and build robots that could complete complicated tasks and engage in hand-to-hand combat.

Held in Shenzhen, China in July, the competition welcomed close to 200 teams formed by about 10,000 students, with 32 strongest contenders going on to the final round.

NTU’s Team M.E.C.A.tron won the first prize and third place at the RoboMaster International Regional Competition from 21 to 22 July 2018, walking home with a cash award of 30,000 RMB (approximately S$6,000). The team went on to compete at the RoboMaster Final Tournament from 25 to 29 July 2018, where they clinched second prize.

Team M.E.C.A.tron is a robotics competition team formed by students from various disciplines in NTU. The team, mentored by Ph.D. students and research fellows, currently comprises 63 students from the School of Mechanical and Aerospace Engineering (MAE); School of Electrical and Electronic Engineering (EEE); School of Computer Science and Engineering (SCSE); School of Materials Science and Engineering (MSE); and School of Physical and Mathematical Sciences (SPMS).
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Eileen Yap

SPECIAL THANKS
GO TO:

All featured faculty, staff, alumni and students from the six engineering schools for their contributions, patience, time and efforts, without which this annual report would not be possible. Also, thanks to all other faculty and staff from Dean’s Office and the six engineering schools, who at one point or another, have contributed to this annual report.

NTU College of Engineering Annual Report 2018 ‘THE SMART WAY FORWARD’ is a publication of the College of Engineering, Nanyang Technological University, Singapore.

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