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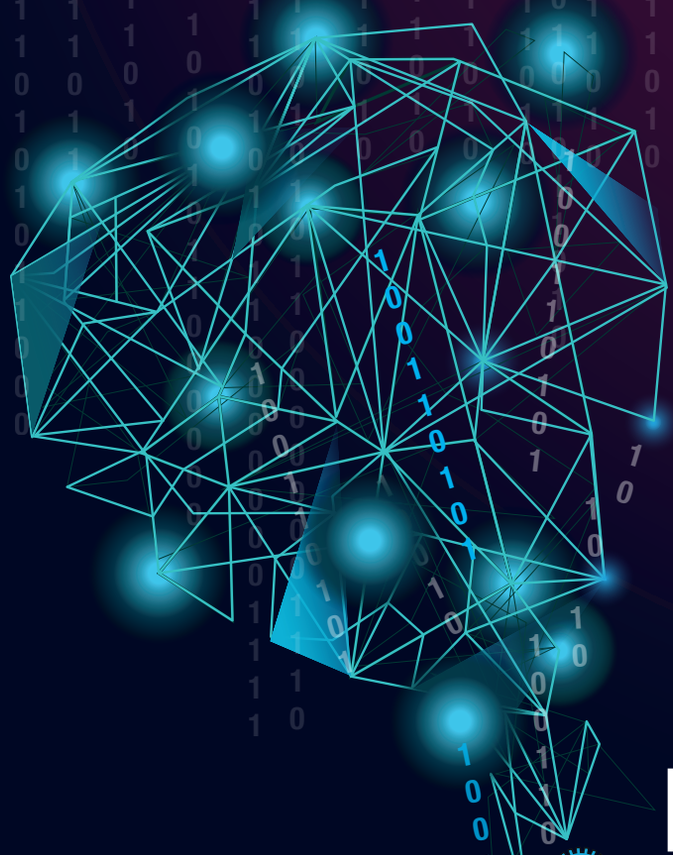
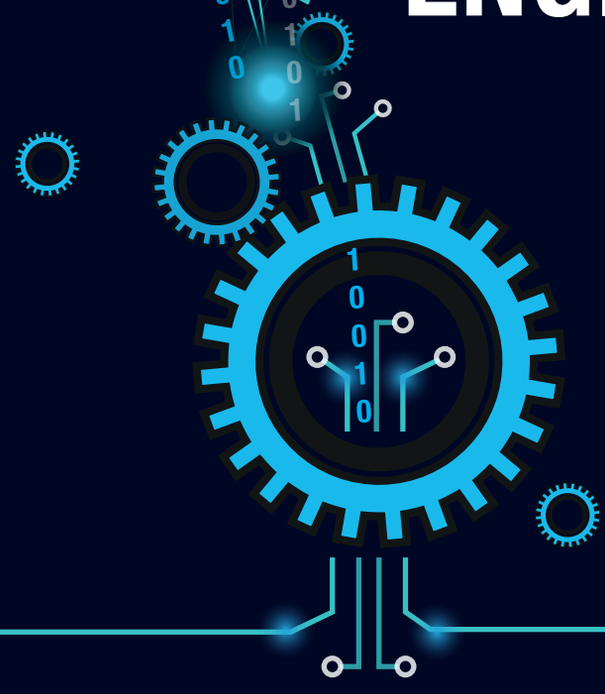


NEW AGE OF ENGINEERING



ISSUE 8, APRIL 2022

Letter from the Editor

Greetings to all readers of SYNC the SOE research newsletter! We are thrilled to present to you the eighth issue with the theme “New age of Engineering”. This issue encompasses innovative and futuristic technology and systems with new age and sustainable ideas conceived by our fabulous researchers.

We are honored to have the Head of School of Engineering to share his insights on the efforts taken by the school to expand and support its research community. Spotlights on the BEMS group, TranXenergy, our sharings on the circular economy as well as innovations in the new normalcy are not to be missed!

As we are moving slowly to the endemic phase, we dedicate a special feature to our fellow GRS community on mental health awareness. We are also featuring the story behind the award winning remote lab by A/Prof Ramakrishnan, and some of amazing research works on new age engineering by Dr Patrick Ho, Dr Tan Jully and Dr Susilawati. Do not forget to see amazing achievements by the GRS community and do look for our fun break zone section!

The editorial team of SYNC would like to thank all our contributors for their time and support. To all readers, we hope you find great insights from this issue and do send us your feedback for our continuous improvement. If you would like to collaborate with us or be part of the editorial team, do let us know via our emailbox.

Let us SYNC- Say Yes ‘N’ Collaborate

Thank you

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Scan the QR code to Join our team
or send us your feedback!

Contents

Insights from
the Head of School

It has been interesting to read the SYNC Newsletter produced by the GRS community in the School of Engineering, where I sense the insight and the dynamics of our young researchers, and I would like to take this opportunity to say well done to the editorial team. Monash University's latest strategic plan, Impact 2030, has identified three Global Challenges (the Challenges of the Age) that are significant for us all, and global in their scale and implications. They are Climate change, Geopolitical security, and Thriving communities. These challenges call us to focus on sustainable development that addresses the issues we are facing. For example, Climate change would fuel how we think of energy and energy transition. Thriving communities would call for innovative solutions and technology to deliver healthcare servicse to rural communities. Other issues include food, water, flood, carbon emissions, depleting resources, etc., which expect and challenge us in engineering to do better and more in solving relevant complex problems.

The School of Engineering has embraced the Industrial Revolution 4.0 and the new technologies such as the Internet of Things (IoT), AI & Machine Learning, Robotics, etc., which are going to shape the future. From this year, we are offering Master of Applied Engineering in three specializations (Energy and Sustainability, Industrial & Robotics Engineering, and Oil & Fats Processing) for our students to take on such opportunities. We have also seen increasing research activities in advanced materials and nanotechnology, smart manufacturing and industrial IoT, embedded sensors and wearable systems, etc., among our research focus. Over the years, we have strived to be a top research-intensive school by cultivating a high-performing and supportive environment, and we have been making steady progress. Currently, the School has more than 20 support schemes to support our researchers in building capacity, driving excellence, and fostering collaboration. To support the growing GRS community of 171 (143 PhD students and 28 Master students) in the School, we have introduced the Global Research Experience (GRE) program for mobility, T&R Scholar program to gain enhanced teaching experience for a university career, and SEPA (School of Engineering Publication Award) scheme that fosters a strong quality culture. Engineering right now is in an exciting era, and I would encourage you to take the opportunity to explore the "New age of engineering" theme in this issue, leaving your footprint in creating solutions to the challenges we all face.

Prof. Anthony Guo
Head of School
Engineering & Information Technology

BEMS

Saving lives, one data at a time

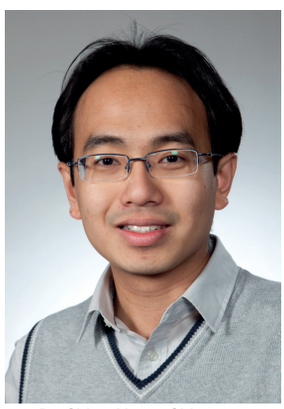
- Lim Yi An

Over the past several decades, the medical industry has been revolutionized and liberated by advancements in computational technology. Biomedical engineering is a multidisciplinary field that seamlessly fulfills the gaps between medicine and engineering, providing design and problem solving skills. The combination of medical sciences and engineering have contributed to countless breakthroughs and improvements in healthcare diagnostics and monitoring. With the implementation of computational modelling and data analytics, simulated results and data can gathered easily, mimicking the human biological system with high accuracy. Driven by their passions in the biomedical field, Dr Ooi Ean Hin and Dr Chiew Yeong Shiong have successfully launched the Biomedical Engineering Modelling and Simulation (BEMS) group under the School of Engineering.

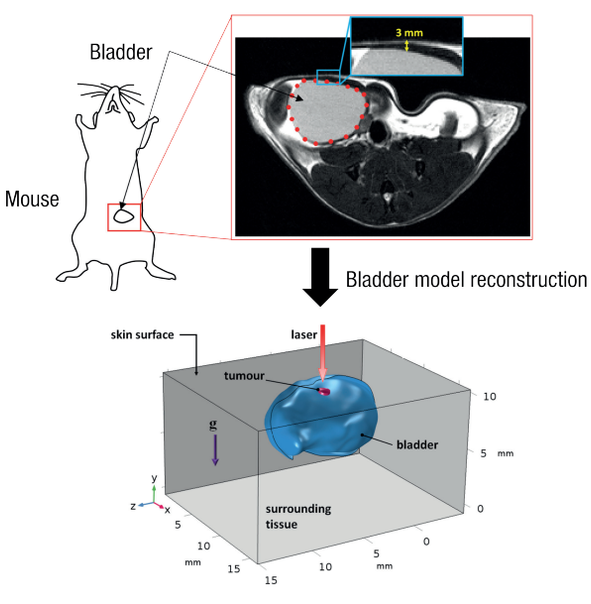
BEMS- Biomedical Engineering Modelling and Simulation

BEMS is a research group that is primarily made up of biomedical engineers. BEMS comprises, the Computational Modelling team and the Data Analytics team. The ultimate goal of this group was to contribute towards the advancement of healthcare systems, specializing in both experimental and computational methodology in solving medical and physiological problems. Joining hands in collaborations with some of the top medical centers, BEMS runs experiments, clinical trials, simulations, and modelling to help improve clinical practices. Sunway Medical Centre and the National Cancer Institute Malaysia are some of the collaborators, to name a few. In addition to that, BEMS has experience in collaborations with academia, e.g., Nanyang Technological University (NTU) and National University Hospital (NUH), Singapore, University of Canterbury, New Zealand, and University of Malaya (UM), and International Islamic University Malaysia.

Dr. Ooi Ean Hin



Dr. Chiew Yeong Shiong



A study on the feasibility of using gold nanorods to assist enhance heating during bladder cancer treatment using laser heating. This study is a research collaboration between Monash University Malaysia and research institutions from Italy and the United Kingdom.

For more details, check out their publication: https://doi.org/10.1016/j.compbiomed.2021.104881

Importance of computational modelling and data analytics in healthcare

In reality, there are numerous hiccups in human body analysis, especially parts that are sensitive and not easily accessible, for instance, the human eye. With the help of computational modelling and mathematical equations, the physical phenomena of the human body can be described with ease and put through various simulated treatment conditions. Taking radiofrequency ablation treatment as an example, the development of models that can predict the outcomes of the treatments could significantly reduce the amount of CT scans that patients need to go through.

What does BEMS do?

According to Dr. Ooi and Dr. Chiew, clinical trials are irreplaceable but are difficult to carry out and resource intensive. Thus, computational modelling and data analytics are carried out to help clinical practitioners better understand certain diseases or pathological conditions; and provide predictions and estimations of the real cases. Hence, BEMS provides the solution to the current problems or issues that clinical practitioners face during their practices. With the expertise available in BEMS, computational modelling can provide the fundamentals of the problems faced, while data analytics would impart application frameworks. The combination of these two will be able to greatly improve healthcare systems.

BEMS featured works

Computational Modelling - Bladder cancer is a common urinary tract cancer, where 9 out of 10 people diagnosed are typically over 55 years of age[1]. Due to the limited understanding and treatments available regarding the biology of the disease, this led to the ineffectiveness of bladder cancer eradication. Recent studies have reportedly mentioned that gold nanorods (GNR) - assisted photothermal therapy (PTT) is an effective treatment for bladder cancer.

.

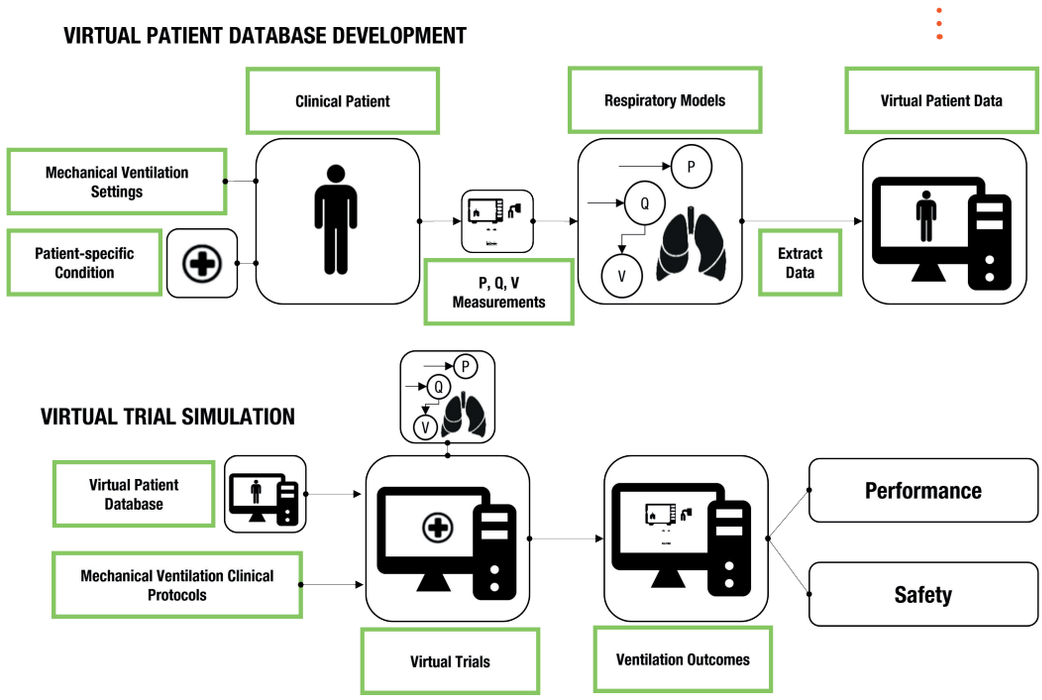
Here, computational models of the mouse bladder were developed to understand and investigate how different laser power, gold nanorods concentration, and duration of heating affect the treatment outcome. The bladder model was reconstructed based on MRI scans of the mouse which can be easily adapted to construct models of the human bladder.

Data analytics - Due to the complex and high variability in responses of intensive care unit (ICU) patients towards medical treatments, it is rather difficult to safely manage the intensive care of these patients, especially for those that require mechanical ventilation. With the help of computational methods and modeling, virtual patient databases are developed and designed to estimate patients' outcome and response to treatment.

Advice for GRS in computational modelling and data analytics applications

The first step is the most crucial step, where it is to identify the suitability and prospects of computational modelling and data analytics applications in one's research. In other words, 'Can the problem be modelled?'. The complexity of modelling biological systems will have an impact on the way the problem can be solved. In addition, insufficient data will largely hinder the accuracies in performing data analytics, as well as artificial intelligence implementations. To conclude, it is important to possess sufficient modelling equations and data sets before diving into computational modelling and data analytics. ■

[1] https://www.cancer.net/cancer-types/bladder-cancer/statistics



A study on the development of virtual patient model for mechanically ventilated respiratory failure patient by Dr. Chiew Yiong Shiong and team.

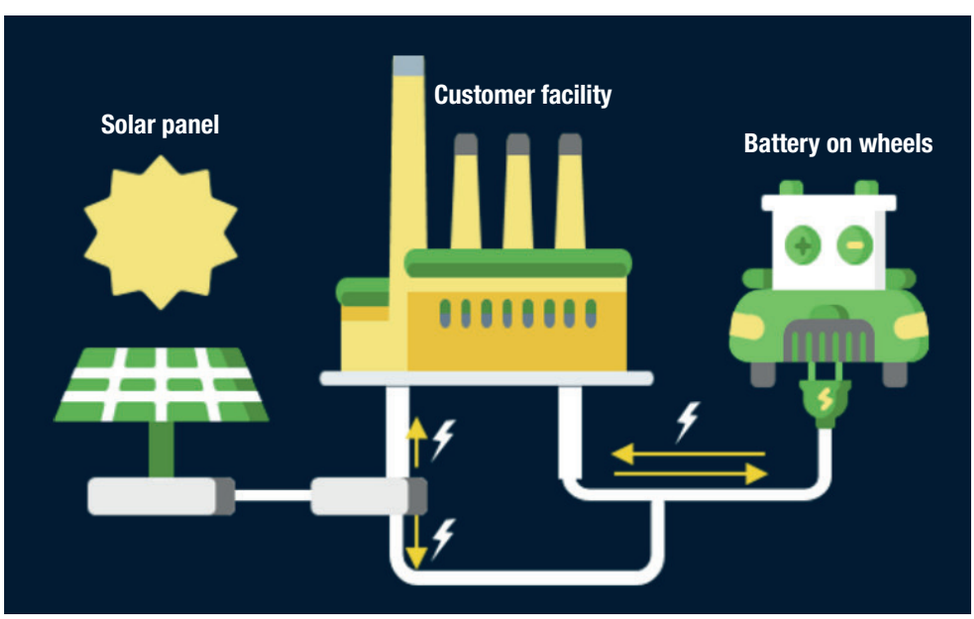
TranXenergy

Green Energy Sharing via Battery on Wheels

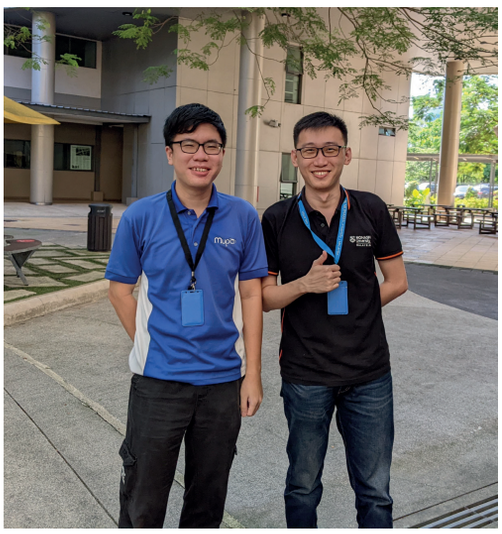
- Khanisya Palaniandy

Transportable energy storage systems have come a long way from powering electronic devices using electrochemical cells, which we call batteries, to power automobile vehicles on the road, the fuel cells. Today, transportable energy storage systems act as an electrical hub for the entire power grid, ameliorating renewable resources from solar, wind and non-renewable sources from nuclear, hydro and fossil fuels. Such advanced technologies add flexibility to the power distribution as secondary energy storage and are indispensable in the events of geographical and economic catastrophes that can lead to large area blackouts. On the consumer end, energy storage can be an efficient alternative energy carrier to transmission cables. The latter is more susceptible to congestion, especially during the peak load period. To this end, Dr. Tan Wen Shan from the Mechatronics Engineering discipline and his team collaborated with AmSolar, Sdn. Bhd. to curate an energy sharing network - the TranXenergy, consisting of solar powered energy shared among industries via transportable energy storage. Their work has garnered them first prize in Siemen's Tech for Sustainability competition in 2021. In an interview with Dr. Wen Shan, we learned more about TranXenergy and their next step after winning the global level competition.

Tell us about TranXenergy and how it came about.
TranXenergy is an idea that came up when we came across the call for entry in Siemen's global competition last year. The primary concept of the TranXenergy solution is to enable energy sharing among the consumers via transportable energy storage or, as we call them, battery on wheels. These portable batteries could be charged at one consumer facility and assigned to discharge to another consumer facility that needs electrical power, as illustrated in the diagram below. This trading virtually uses real-time data from all the facilities by consistently tracking their energy demand. It allows one facility to temporarily borrow electricity generated by the nearest participating facility, to achieve operational savings. Having portable energy storage in an energy distribution network allows a more flexible energy transfer when there is a demand from the consumer end. This also means that there is no need to pump this energy back to the main grid to be transferred to the consumer. TranXenergy does not rely on the grid. Instead, it could avoid congestion due to peak demands rising from the operating facilities.



An illustration of the TranXenergy system whereby solar power from the consumer facility is used to store excess energy in transportable battery.



Dr. Joseph Chan and Dr. Tan Wen Shan

AmSolar Director Skip Ng, Consultant Alan Koay

This system requires the installation of solar panels in the consumers' space. Though this technology is relatively new in Malaysia, transportable energy storage systems and energy trading are emerging in North America, Europe and China. Such advanced technology is arguably beneficial to the consumers as it reduces their reliance on grid power and optimizes their electricity bills. Our TranXenergy is currently at the beginning stage, where we have performed simulations using real-time data from Malaysian facilities. Based on the simulations, our business models suggest that this system could give about 70% savings to the client, and benefits on the sustainability side will be an added feather in our cap.

Tell us more about your team and their roles

The idea was initiated by me as I am always in touch with the current technologies and updates in this field. The team is led by Marian Yeow, my final year project student who worked with the renewable energy field. AmSolar is our long-time collaborator in our previous projects.They provide us with their business and industrial perspectives to improve the idea and proposal. They also propose practical solutions from the Malaysian industry perspective that helped us design and improve the overall idea. We also have postdoctoral researcher, Dr. Joseph Chan, and a few research assistants who worked on the technical side, contributing their design and software expertise to the project. The organizers of this competition also provided us with several training workshops on business models and pitching in this area which was beneficial. As it was only a 1-month long competition, time was a huge challenge, however with great management by Marian and contributions from all the members, we successfully won the competition.

What are your views on the prospects of TranXenergy and the future of energy storage systems?

Technologies like TranXenergy are extremely useful during disasters like flash floods and earthquakes as the conventional grid is easily damaged due to rising water levels. By deploying green energy storage to the affected areas, they could act as a temporary power supply for electricity, especially when there are power outages at night. Digitalization will help to give real-time data of the battery on wheels and efficiently manage the supply-demand situation before deploying the batteries on-site. We hope to get financial backing from Siemens' Digital Grid and Fluence Energy team to support our pilot testing in Malaysia in the near future.

If you would like to know more about TranXenergy, check out their webpage:

https://tranxenergy.wixsite.com/home/team-3

GRS Mental Health

A special feature dedicated to the GRS community

- Dora Lawrencia

Mental health is vital to every person in every community. This includes our engineering graduate research students (GRS) who often face challenges to be solved throughout their candidature period. The pandemic had impeded their research progress in many ways due to restrictions from entering the laboratory and communication barriers, which contributed to increased stress levels and anxiety. To this end, we interviewed two GRS, **Lim Chang Sheng** and **Howgen Pratama**, to share their thoughts and experience on this subject matter.

Lim Chang Sheng has just completed his PhD in Mechanical Engineering. He studied the potential of graphene materials for heat transfer and electronic cooling. With persistent hard work and perseverance, he was able to publish two articles in reputable journals. The 2020 pandemic has certainly impacted his experimental research progress. To a certain degree, the lack of peer-to-peer interactions also affected his experimental work as well as his mental health and well-being. Nonetheless, he says he made use of the time during the lockdown to sincerely work on his personal projects and achieve self-actualization within himself. His PhD journey was never short of challenges, however, with proper time management and strict discipline, the journey turned out to be very fruitful and extremely rewarding. Chang Sheng also says he is extremely grateful for the constant support from his peers and family.

Howgen Pratama, a final year PhD student in Electronic and Computer systems engineering, currently studying on making sensors using surface acoustic devices. As the Movement Control Order (MCO) kept dragging on, he faced difficulties coping as there were minimal changes that he could implement. For instance, he tried to set up a simple experiment at home. However, there were too many variables that he could not control which made the results not comparable or as reliable as doing it in the lab. He also felt pressured as he still needed to meet the deadlines and try his best to produce the expected results despite all the limitations. Furthermore, as an international student, his candidature period was fixed by the student visa. So, even though there was an option for him to extend his candidature period, he needed to rush against time.

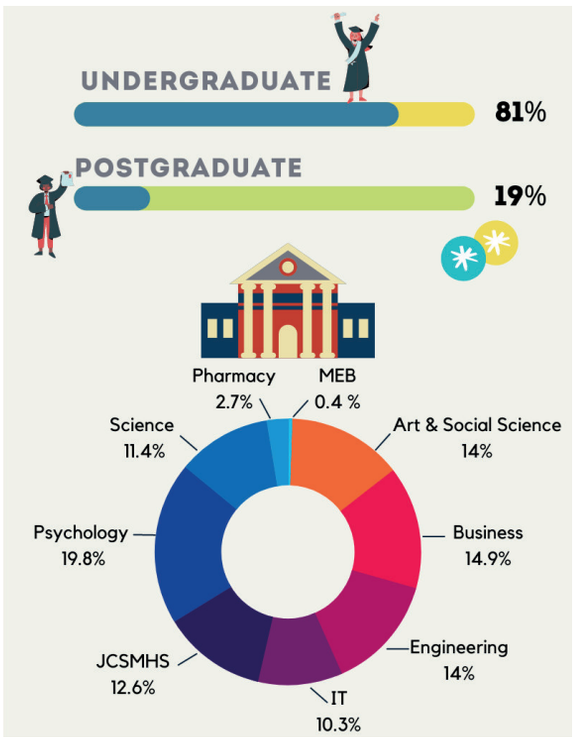
Their advice to GRS in similar situations is to talk to your peers to prevent feeling all alone and powerless knowing that someone else may be facing the same struggles. When facing struggles in publications or being lost in direction, it is important to be patient and confident in your research work. With a strong hypothesis and results, your work will eventually get recognized.

We truly believe that every research student has their own share of struggle and success in their research journey. Chang Sheng's and Howgen's PhD stories do not entirely represent the stories of GRS community in Monash University Malaysia. However, this article and sharings are especially for all the research students currently in different stages of your research journey. Seek help and advice, indulge in friendly conversations with your peers or anyone who you think would listen to you! Your journey will be more rewarding and enjoyable.

We have also interviewed Ms. Cheryl Kong, a student counselor from Monash University Malaysia, to advise on managing our mental health. According to her, most students sought professional counseling to discuss their personal, mental health, and academic related problems. Among these students are **19% postgraduate students** for the year 2021 (*picture on the right*).

She also mentioned that local students face a considerable challenge in working from home due to the lack of focus during the pandemic. In contrast, international students felt homesick because they could not go back to their home country due to border closure. Students may also face stress due to financial difficulties, lack of support, and challenges in their research work.

Ms. Cheryl said that stress happens daily and comes from things that seem too overwhelming. One way to overcome this is to understand the root of anxiety and develop a coping strategy. Everyone has different coping methods. It can be through music, exercising, or talking to other people. It is essential to break significant challenges into smaller chunks to make them manageable. They need to focus on the things at present that they can control instead of worrying about what they cannot control.



One useful technique to be present and mindful is the grounding technique, which uses all of our five senses (as illustrated in the picture below). Another technique includes breathing exercise to help the muscles and mind relax. So, the core is to step back, find the root problem, be present and mindful instead of thinking about uncertainties in the future that are out of our control.

However, amidst all the help present out there, it is really important to be brave enough to take that first step. Speaking with the counselors offers you a space that is not judgemental and helps you resolve the deeper issue instead of just general advice and encouragement. It is okay to take your time, but ask yourself, **"Do I want to get help?"**. There is a saying **"you are the master of your fate"** which is true because someone will always be there, ready to lend their ears and offer a helping hand, but it is all up to you to make that first leap. ■

You can make an appointment with the Monash counsellors through the form below or you can make an anonymous call through the mental health hotline 24/7 at **+603-29359013**.

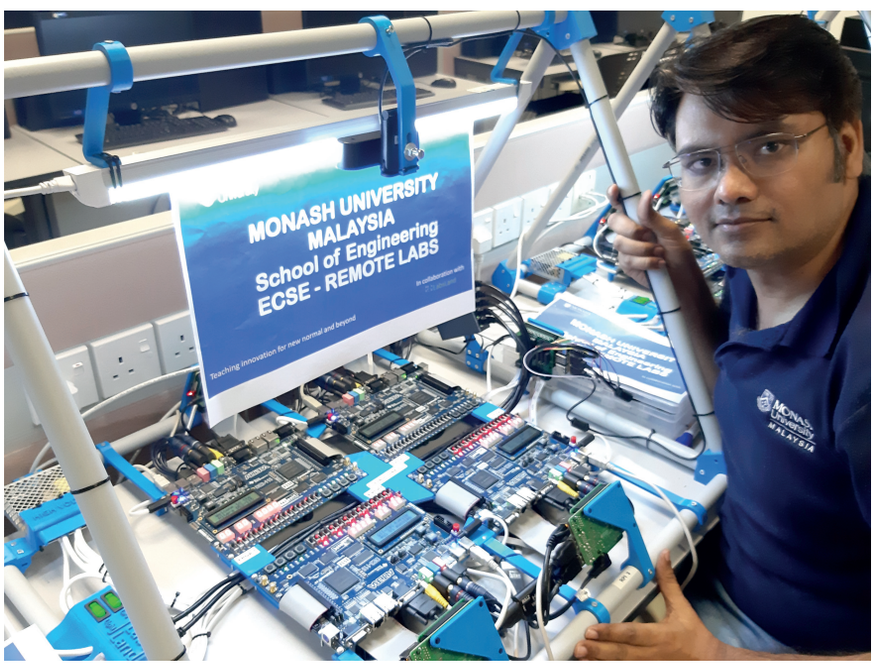
Scan here to book your appoinment with the Monash counsellors

GRS! This is for you!
Help us fill in a short form to help you and your peers!

The Remote Lab Initiative

Associate Professor Ramakrishnan Narayanan's breakthrough in bridging remote learning and engineering labs.

- Srivardhini Veeraragavan



Assoc. Prof. Rama teaches Computer Systems (ECE3073), a heavily lab-intensive unit that requires students to program a Field Programmable Gate Array (FPGA) called the Altera Nios II Processor. Students perform weekly labs with various exercises using the FPGA board, and the lectures and labs go hand in hand. However, once the pandemic struck, and the MCO came into effect, students and staff were not able to access the labs and A/Prof Rama was facing difficulties in conducting the unit. The students could not each take home a board either, as there was a shortage of supply. However, the unit had to carry on- so A/Prof. Rama came up with a unique solution to allows his students to remotely access the Altera boards from their homes.

He reached out to a company called LabsLand, which offered remote lab services worldwide to connect university students to lab hardware. LabsLand already offered a repository of FPGAs, so A/Prof. Rama decided to use their service to host his labs online, and students can run their programs remotely through the LabsLand server. However, the services offered were limited and did not suit the requirements of his lab exercises.

The next few weeks were tedious and A/Prof. Rama spent hours in meetings with the LabsLand CEO in Brazil, and he advised A/Prof. Rama to script the Nios Code to run on their board. In 2-3 weeks, A/Prof. Rama was able to recreate the labs for the FPGA to run on the LabsLand hardware without compromising any learning outcomes for the unit.

Now, students can access the required hardware for their labs remotely and focus on completing their labs on time. They also had 24/7 access and they were not limited to working only during lab hours. A/Prof. Rama said that his students had logged in a total of 20,000 times and had the freedom to work at their own pace, which was the reason the students did very well even though he posed challenging questions for the final lab test.

This remarkable success of A/Prof. Rama's remote labs will definitely pave the way for a seamless learning experience and any future challenges as well. For future offerings of the unit, the virtual offering of the lab will still be available for students to practice on, as A/Prof. Rama has set up the virtual lab server on our very own campus and is no longer relying on the LabsLand Server. For his contributions, A/Prof. Rama received the SoE Education Excellence Award for the Covid-19 Teaching Innovation category and also Best Video Presentation Award in TransformED 2020. Congratulations A/Prof for paving the way to a seamless virtual learning experience. Ancora Imparo! ■

Research Focus

Our academic staff and their research team undertake cutting-edge, high impact research that provides solutions to industry needs and addresses global problems. Here, we feature the works of a few of the researchers from different engineering backgrounds.

Gauging environmental impacts with life cycle assessments by Dr. Tan Jully (Chemical Engineering)

- Lim Yi An

Life cycle assessment (LCA) is a crucial tool heavily applied in sustainable developments. The main purpose of performing an LCA is to evaluate the environmental impacts at different stages of life of a specific product or process. With the help of pinch analysis and process integrations, the multi-decision making in LCA is especially useful for industrial players in priority-based optimizations and improvements. Data like process flow and product specifications are crucial to perform accurate LCA. Nonetheless, the limitation of data availability hinders the accuracy of LCA. Still, it can be overcome by applying a precise assumption basis and uncertainty analysis. Because of the COVID-19 pandemic, sustainable developments have been significantly boosted, largely due to encouragement from COP26 (2021 United Nations Climate Change Conference). This has prompted industrial players to divert their attention towards environmental issues and LCA implementations during the pandemic. Unfortunately, the applications of LCA in Malaysia are still considered to be in the infancy stages due to the resistance in data sharing, driven by industrial competitions and confidentiality issues. To generate reliable predictions with LCA, real-time data would still be needed.

The manufacturing and usages of single-use plastics are great examples to demonstrate the importance of LCA. Scrutinies on the pollution and negative environmental impacts of single-use plastics (e.g., plastic straws) have caused mixed opinions worldwide. In support of reducing single-use plastics, the Malaysian government has implemented a ban on plastic straws in Klang Valley since January 2019. Recent LCA studies by Dr. Tan Jully and her team on the sustainability assessments of drinking straws found that plastic straws potentially are more sustainable, having a lower carbon footprint than stainless steel straws in the scope of raw material acquisition to manufacturing stage. This clearly amplifies the importance of cradle-to-grave LCA implementations. Often, the focus on product disposal disfavors the significance of the environmental impacts from the manufacturing stages. Hence, spreading awareness is crucial and should be greatly incorporated in the education system, regardless from pre-school to higher education.■

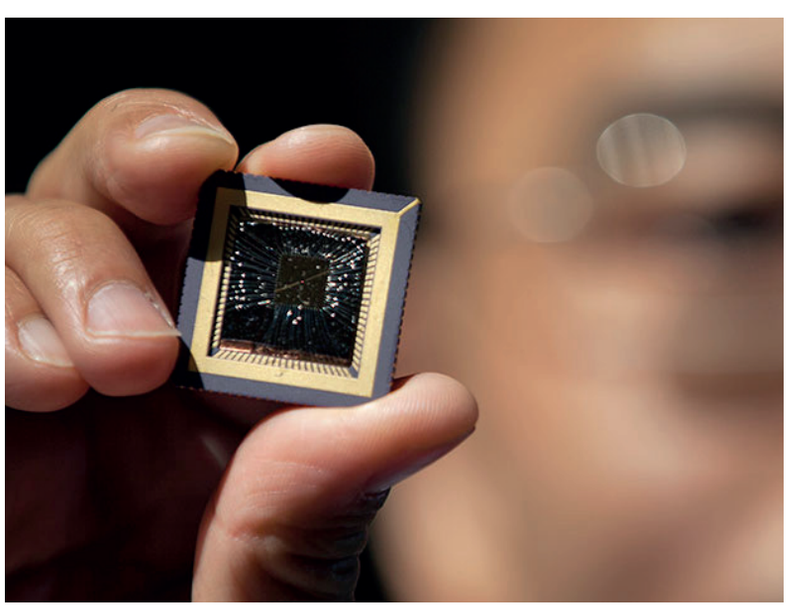
Fabrication and optimization of memristors: the new semiconductor device by Dr. Patrick W. C. Ho (Electrical and Computer Systems Engineering)

- Dora Lawrencia

Memristor is a new non-volatile electronic memory device that could potentially replace transistors in the near future. They are about six times smaller than transistors, which means they exhibit a potential increase in data storage, faster speed, and a more robust technology overall. Despite all the said advantages, till date, memristors are not yet mass manufactured in the industry. At most, they are only being produced at a small scale for research purposes. This is due to some areas where they face a considerable barrier for commercialization, including their endurance, retention, and switching speed. Our research area was initially focused on circuitry and end-user applications of memristors such as programmable devices, memory cells, logic arrays, etc. However, our current research focus has shifted to the optimization and fabrication of memristors to discover the root cause of the delay in commercialization.

Although memristors had been discovered since 2008, our research faced several challenges in the early phase back in 2013. As the technology was relatively new, we could not fabricate memristors even for research purposes and testing. As a result, most of our research involved modelling and simulation imitating the behaviour of memristors so that we could propose suitable circuitry and end-user applications. Nevertheless, as the research on this device is picking up pace in the past decade and people are becoming more aware of the potential of memristors, it opens up more collaboration opportunities with other researchers and industry partners that allows us to fabricate memristive devices and perform more research.

The next challenge after this phase is to work our way towards bringing memristors into the mass-market. What we can do right now to reach that goal is to look into the best material to be used in the fabrication process. The materials most commonly studied include titanium oxide, zinc, tungsten and tantalum oxide. To find the most suitable pioneer material for the memristors, it is important to study how the different metal oxides behave differently in memristors. Following this stage, we need to ensure we can fabricate memristors consistently. Although it will be a long journey, with the potential of memristors, we are optimistic that we will eventually get there. ■



An image of programmable memristor chips.

Shared Mobility as the Future of Smart Cities by Dr. Susilawati (Civil Engineering)

- Srivardhini Veeraragavan

Transportation is a major contributor to climate change. Dr. Susilawati from the Civil Engineering discipline is investigating emerging technologies for transport planning, including shared mobility to reduce CO2 emissions from urban transportation systems. Shared Mobility (SM) includes pooled ridesharing with strangers, peer-to-peer car sharing, e-hailing shared taxis and shared electric scooters among other mobility-as-a-service technologies. Dr. Susilawati believes that shared mobility will likely be a key transformative change since the emergence of the first automobile. Thus, she predicts that shared mobility will be a future of mobility, especially when combined with public transportation. Since 2019, she has been using the fundamental research grant scheme to develop new ideas including system design of coupling shared mobility with public transport that align with the social, economic and environmental pillars of sustainability.

It is expected that coupling shared mobility with public transport will solve first/last mile connectivity, increasing demand for affordable and safe public transit, making it more accessible for people of all walks of life. These lead to some significant changes in public transport ridership.

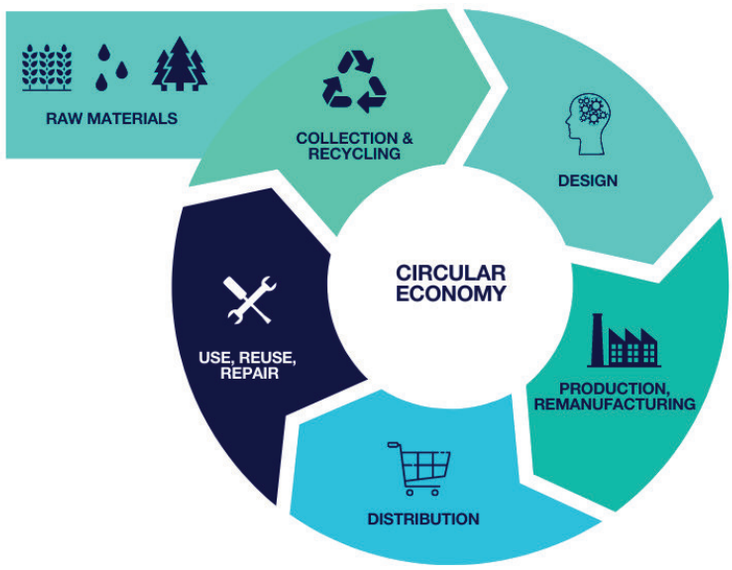
An illustration of shared mobility in a township.

Dr. Susilawati and her team also look into the social aspects of transportation planning, such as people's behaviour and outlook on transportation, which has greatly changed during the pandemic. The pandemic shifted in the way people travel. At the same time, the pandemic also greatly affected public transport. Due to safety concerns, more people prefer to use personal vehicles to limit their exposure to COVID-19, leading to a considerable drop in public transport ridership. To comply with social distancing SOPs, public transport operators reduce public transport capacity For example, prior to the pandemic, buses could carry around 60 people at full capacity, but with the SOPs in place, they may only operate at 50% capacity.

To counterbalance the safety concerns and accommodate the lost capacity of public transport, shared mobility can play a key role during pandemics through provision of an alternative transport mode.■

Circular economy
by Industrial Players

- Lim Yi An



Did you know that every **Nike** apparel or footwear unit produces **7.33kg of CO_2 emissions**? Recent studies reported that the **fashion industry** alone contributes approximately **8%** of the **global carbon emissions**. The United Nations Conference on Trade and Development (UNTAD) defined a circular economy as a market that focuses on reusing waste materials and returning themto the economy, instead of extracting from new resources. In terms of carbon footprint, implementing a circular economy is a significant decarbonization pathway.

Encouragement from governmental authorities and non-governmental organizations have led to the sustenance of circular economy implementations among industrial players in their businesses. The achievements of a circular economy in a company are basically working towards the triple bottom line (people, planet, profit). This is important as industrial players are drivers of economic growth and trailblazers of sustainable solutions. **Experts predict that this switch towards a circular economy could reduce emissions by 39%.**

To name a few, brands like **Adidas, IKEA, and H&M,** were the pioneers in declaring a circular economy in their business models. Working closely with Parley Ocean plastic, a recycled ocean plastics waste provider, Adidas successfully sold **5 million pairs of shoes made from ocean plastics** in 2018. Other examples include **Burger King's** collaboration with TerraCycle's Loop initiative in the use of reusable food packaging, **H&M's biodegradable clothing material derived from wood pulp and food waste**, and **IKEA's furniture buyback and resale programs.** Hence, tapping into a more sustainable material source to meet the demands of the public has proven to lead a global shift towards a greener supply chain, and this shift also helps mould consumers' mindsets. It is anticipated that more businesses will also adopt sustainable solutions in the future, fulfilling their parts in social responsibility. ■

Adidas shoes made from ocean plastics

Burger King's reuseable cups.

Sources:
https://purpose.nike.com/carbon-footprint
https://www.triplepundit.com/story/2020/brands-circular-economy-2020/709596

Innovations for the New Normal

- Srivardhini Veeraragavan

There is a less familiar story of COVID-19 that boosted innovation- one that drove existing technology to new applications, saved lives, businesses, and brought lasting change to the world in the post-pandemic era. Technology such as drone deliveries, medical robotics, customer service robots, and remote education tools have prevented what would have been a staggering halt to essential services, costing lives and livelihoods. **Drone deliveries**, which were not expected to take off until 10 years down the line, picked up rapidly within a year due to the pandemic. Drones deliveries are being used to deliver medical supplies like treatments, vaccines, and emergency supplies to extend hospital services during times of limited service capacity. Patients can also receive their medications directly at home after online consultations, which reduces trips to the hospital and limits patients' exposure to the virus. Beyond medical applications, retail and food delivery companies are also hopping on the technology wave of drone deliveries for a more safe, efficient, and low-risk delivery alternative.

With food deliveries on the rise, the concept of **"ghost kitchen"** naturally followed suit, which is a flexible kitchen space where many different cooks and restaurants hot-station under a single roof to produce their delivery orders. Many startups that offer flexible spaces, including ghost kitchens are popping up across Europe. While they started out as a startup, some companies grew exponentially during this time.

Another example of a small industry that exploded in growth during the pandemic is **remote working and online learning technology**. At the beginning of the pandemic, only 10 million people were using remote working technologies and online learning tools, but within a year this number grew to 300 million. Now, the remote working and online learning industry has become an inseparable part of educational institutions and corporate companies today due to its benefits.

Technology is here to stay and some of the best ideas need the right circumstances to demonstrate their value. But there is no need to look very far to see new technology being adopted- even our local mamak Shaaz has robots to deliver your order to your table. ■

Drone delivering packages.

Sources:
https://www.kinaxis.com/ja/node/2613

Introducing
New Academics

Name: Dr. Lim Lam Ghai
Position/Department: Lecturer, Robotics and Mechatronics Engineering Discipline, School of Engineering
Expertise: Near-infrared spectroscopy, neural signal processing, brain-computer interface, artificial intelligence, and health analytics

Ongoing/ Completed Projects:
• Real-time optimization of the hemodynamic block design with baseline state detection for mental workload assessment
• Assessing frontal and temporal lobes of schizophrenia patients with expressed emotion using functional near-infrared spectroscopy
• Development of cognitive training system as diagnostic and prevention tools for Alzheimer's disease

Contact: lim.lamghai@monash.edu
For more information, please visit https://bit.ly/3i6fpgz

Name: Dr. Ooi Jong Boon
Position/Department: Senior Lecturer, Mechanical Engineering Discipline, School of Engineering
Expertise: Combustion, Biofuels, Internal combustion engines, Fuel technology, Nanomaterials

Ongoing/ Completed Projects:
• Optimization of the performance and exhaust emissions of a diesel engine fuelled with ternary palm biodiesel blends using response surface methodology
• Carbon-based nanoparticles as diesel fuel additives for light-duty diesel engine applications
• Blending effects of diethyl ether and ethanol on the combustion and emission behaviours of Malaysian palm biodiesel droplet
• Effects of ethanol on the evaporation and burning characteristics of palm-oil based biodiesel droplet

Contact: Ooi.JongBoon@monash.edu
For more information, please visit https://bit.ly/3ia8naF

Name: Ir. Ts. Mithila Seva Bala Sundaram
Position/Department: Scholarly Teaching Fellow,Electrical and Computer System Engineering, School of Engineering
Expertise: Electrical

Ongoing/ Completed Projects:
• Research on Load Characterization for Conservation of Voltage Reduction (CVR) and Volt-VAR Optimization (VVO) Application
• Development of an Enhanced Distribution Network Master Plan (DNMP) Methodology
• Research and Development of Risk Based Planning Methodology for TNB Distribution System.

Contact: Mithila.Seva@monash.edu
For more information, please visit https://bit.ly/3weUJLA

Name: Ts. Dr. Ho Kok Hoe
Position/Department: Senior Lecturer, Robotics and Mechatronics Discipline, School of Engineering
Expertise: Industrial Engineering, Operations Research, Manufacturing, Process Engineering

Ongoing/ Completed Projects:
• Industrial Collaboration
• Manufacturing
• Industrial Engineering / Operations Research
• Modelling and Simulation
• Statistics and Mathematics
• Improving Teaching and Learning Pedagogy
• Automation and Robotics
• Industrial 4.0 Related Topics

Contact: Ho.KokHoe@monash.edu
For more information, please visit https://bit.ly/3CH7Fv7

Congratulations to the winners of XPRIZE carbon removal competition !

Monash Carbon Capture and Conversion (MC^3) (Australia and Malaysia Campus) is one of the 23 student teams that won **US$250,000** from the XPRIZE carbon removal student competition funded by The Musk Foundation. **Lim Yi An** (PhD in Chemical Engineering) and **Joshia Christa Pradana** (Master in Chemical Engineering) are graduate research students from Monash University Malaysia who took part in the competition.

Lim Yi An

What is your role and contribution?

Yi An: "I am a part of the biological carbon capture team. We were in charge of coming up with a method to capture 1000 tons of carbon using microalgae and forestry. This includes reactor design and calculation as a proof of concept."

Joshia: "I am a part of the carbon conversion team. We contributed in performing literature review and theoretical studies to convert the carbon captured by the biocapture team to produce timber and biochar."

Joshia Christa Pradana

Are there any major factors that helped the team in achieving the prize?

"Everyone has an important role that contributes to the team's success. We have great advisors in our team who provide us with a lot of new information as well as undergraduate team members who are very passionate in learning. As they brought up new ideas, the we helped in advising and combining the pieces together. This formed a great teamwork between the members."

What is the next step after winning the student award?

"The next step will be experimental work on a small scale to prove the concept by February 2022. Afterwards, we need to prove that it also works on a large scale. The end goal is to commercialize the technology."

How did you collaborate and divide the job scope with the team members in Monash University Australia campus?

"We usually have routine meetings to keep everyone on track and delegate the tasks. For the next phase, experiments will be done in Australia campus while overseas team members are in charge of simulations."

Congratulations to our
ITEX 2021 Winners !

The 32nd International Invention, Innovation and Technology Exhibition (ITEX) 2021 Malaysia was held on 13th – 14th December 2021 at KL Convention Centre, with the theme RESET. REINVENT. REIMAGINE. Like every year, researchers and graduate research students from Monash University Malaysia had presented their outstanding inventions and won six gold, one silver, and one bronze medal this time around. Our own School of Engineering researchers have won four gold medals as highlighted below.

Smart self-healing glove
Dr. Tang Siah Ying and Janarthanan A/L Supramaniam (GRS)

CARENET - A network monitoring system for intensive care mechanical ventilation treatment
Dr. Chiew Yeong Shiong, Ng Qing Arn (GRS), A/Prof Wang Xin, and Prof. Mohd Basri Mat Nor (IIUM)

CATCH - Comprehensive Aerial Transport via Compliant Handling
Dr. Surya Nurzaman and Lee Loong Yi (GRS)

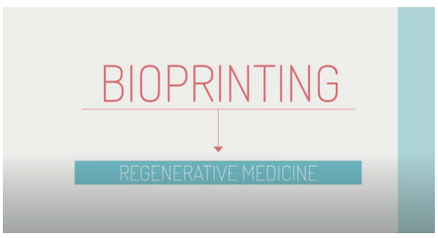
Tocoheal - All-in-one dressings with Vitamin E Tocotrienols
Dr. Alice Chuah Lay Hong (School of Pharmacy), A/Prof. Poh Phaik Eong, and Dr. Fu Ju Yen

MUM teams with their ITEX medals

TED Talks

Tiny robots with giant potential | Paul McEuen and Marc Miskin

https://rb.gy/exerk1



Why "biofabrication" is the next industrial revolution | Suzanne Lee

https://rb.gy/kxkl6q

A concrete idea to reduce CO_2 emissions | Karen Scrivener

http://y2u.be/f9618uQlZmc

How to 3D print human tissue | Taneka Jones

http://y2u.be/f9618uQlZmc

Global Engineering News

New discoveries around the globe

- **Rare earth elements await in waste**
- **Scientists build bioreactors and engineer bacteria to advance biofuel research**
- **On the spot drug delivery with light-controlled organic microswimmers**
- **Circular economy: Researchers show how synthetic rubber raw material can be degraded**
- **It's in the air – battery discovery takes up the charge**
- **Scientists give new lease of life to e-waste plastics**
- **Creating sustainable material from waste**

Scan this QR code to learn these interesting discoveries in greater detail!