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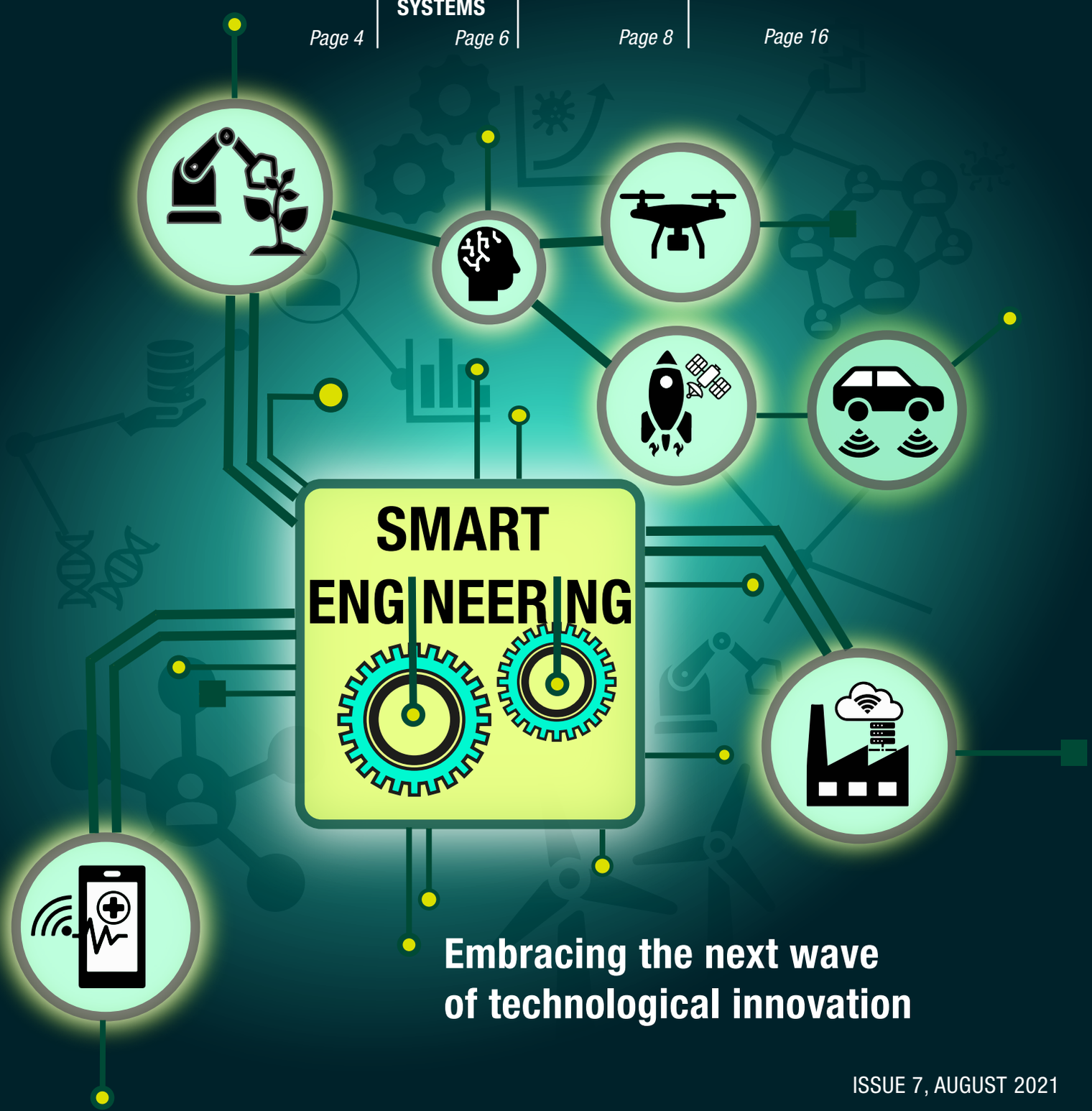
SYNC



Embracing the next wave of technological innovation

ISSUE 7, AUGUST 2021

Letter from the Editor

A warm welcome to all readers to the seventh issue of SYNC, the Monash University Malaysia's School of Engineering (SOE) biannual research newsletter. We hope you enjoyed reading our previous issues. In line with the global wave of technological innovations, we present to you the latest SYNC issue with the theme "Smart Engineering".

This time, we are proud to have Ir. Dr. Zulhilmi, the SYNC advisor to share his insights for this issue. In the Spotlight section, we are featuring "DroGatlight" by Ir. Dr. Joanne Lim Mun Yee and "Cyber Physical Systems in the agricultural context" by Dr. S. Veera Ragavan. We are also proud to feature our multi-disciplinary academics, who are currently working on smart and green engineering related projects. We are fortunate to present the industrial insights on smart manufacturing by two industry experts, Ir. Zai'm Azyze and our very own Ph.D. alumnus, Dr. Chua Wen Shyan.

As usual, we celebrate the achievements of our fellow graduate research students (GRS). Hence, you are welcomed at anytime to let us know about your achievements, so that we can feature them in our upcoming issues. Do not miss our informative and fun-filled feature on smart agriculture and green buildings. There are also some amazing rewards to be won in our Break Zone section, do check it out.

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 e-mailbox.

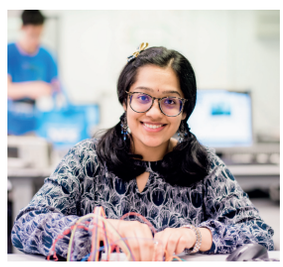
Let us SYNC- **Say Yes 'N' Collaborate**

Thank you

Khanisya Palaniandy
Editor

The editorial team

Khanisya Palaniandy
Editor and Designer
GRS



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Journalist
GRS

Lim Yi An
Journalist
GRS

Dora Lawrencia
Reporter
GRS

GRS from SOE Monash Malaysia? Join our team now or send us your feedback! Simply scan the QR code below or send us an email.

Feedback and suggestions

or
mum.soe.sync@monash.edu

Content

Insights from the Advisor

It has been 3 years since the inception of SYNC SOE newsletter. Looking back at the past few years, we have covered quite a range of topics such as sustainability, AI, healthcare and many more. Thanks to the relentless effort by our dedicated, past and present editorial team members, the newsletter has become a platform where we promote collaborations and celebrate research excellence in the School of Engineering.

With the lockdown enforced in the country to curb the spread of Covid-19 virus and more companies practicing work-from-home policy, there is a growing demand for smart engineering systems to revolutionise industrial and economic sectors. In this 7th issue of SYNC magazine, I am honoured to have our academics to share more on their recent smart engineering innovations and achievements. On top of having details from an academic perspective, we also feature industrial and practical insights by Ir. Za'im Azyze and Dr. Chua Wen-Shyan on smart factories and IR4.0. On behalf of the editorial team, I hope the readers will make use of the information in this issue to explore new ideas and technologies in your next collaboration.

Ir. Dr. Mohd Zulhilmi Paiz
Advisor of SYNC Newsletter
Mechanical Engineering
Monash University Malaysia

Eyes in the sky?

- Lim Yi An

Drones are unmanned aerial vehicles (UAV), often described as remotely controllable flying robots. The applications of drones have been proven effective and practical for various industries in recent years. One of the recent highlighted applications was to combat the COVID-19 pandemic, where drones were appointed for public space surveillance and even performed delivery of medical supplies. With their minute size, high speed and high-quality imaging capabilities, drones are without a doubt the next big trend in Smart Engineering. However, drone applications come with a dangerous downside of security breach. Even with drone regulations, it is difficult to prevent unauthorized or unlicensed drones from invading one's privacy at housing areas or private spaces. To address this issue, Ir. Dr Joanne Lim Mun Yee, along with her team, Kok Yuan Ting, Tay Liang Yu, Soh Owen and Lim Teik Aun came up with a brilliant invention, DroGatLight – DGL.

DroGatLight-drone tracking

DroGatLight is a drone tracking system, comprising 2 major technologies, object detection and radio frequency tracking system. With DroGatLight set on top of street lights, the front facing camera on DroGatLight provides visual and frequency detection by displaying the exact location of any passing drones on mobile applications. This unique technology is called power gating and is a crucial part of DroGatLight. Power gating allows IoT systems to utilize the power supply from existing street lights, consuming a considerably lower amount of power. This was also how the name came about, through the combination of drone, power gating and street lights. Because of this ground-breaking invention, Ir. Dr Joanne and her team won a gold medal for their invention DroGatLight at the 31st International Invention, Innovation & Technology Exhibition 2020 (ITEX 2020). In addition, DroGatLight currently has a patent pending with 3 copyrights. DroGatLight is useful for UAV traffic monitoring and controlling, and even as a security system for homes.

Team DroGatLight's ITEX 2020 Monash poster.

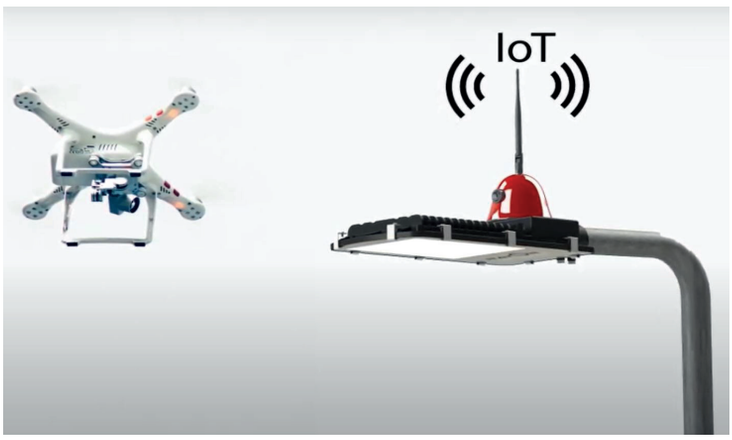


Illustration of the DroGatLight drone detection system by street lights.

Future Plans for Commercialization and Implementation of DroGatLight in Malaysia.

Currently, DroGatLight is applicable for detecting drones that fly within/beyond the line of sight, remote monitoring, surveillance and curbing privacy invasion. However, DroGatLight has a myriad of future opportunities for application in various fields. Dr. Joanne and her team are also working closely with the local authorities on research and developments of technologies to improve aspects like road traffic, car parking and drone technology. The main goal is to march towards smart transportation, creating a more advanced society and better transportation systems in Malaysia.

Ir. Dr. Joanne's thoughts on Smart Engineering Innovations in improving Industry 4.0 technology.

"The pandemic has pushed a lot of industries towards Industry 4.0, in the sense that we are all forced in some way to perform tasks remotely. With the implementation of automated systems and built-in IoT in factories or manufacturing lines, this would be a giant step towards smart engineering, where processes and productions can be monitored in the comforts of your home with a click of a button. This would be exceptionally practical, especially in this current pandemic season. Looking at a consumer's point of view, smart home systems that can monitor our health, movements, sleeping patterns or even occurrence of home invasions, and alert us via our phones. This is something that all of us could envision in the coming years. Nonetheless, security would still be the biggest drawback for such advanced technologies. Hence, more research and developments are performed in order to improve this particular aspect".

- Ir. Dr. Joanne Lim Mun Yee

For more information, click on the following links:

ITEX 2020 - DRONE TRACKING SYSTEM USING IOT STREETLIGHT WITH COMPUTER VISION (DROGATLIGHT-DGL)
https://bit.ly/3xYtvGA

DroGatLight on the Star newspaper (page 9)
https://bit.ly/3mgBUmw

Cyber Physical Systems

- Dora Lawrencia

Cyber Physical Systems (CPS) forms the basis of Industry 4.0. They are autonomous systems that can judge, decide and act in an uncertain environments. They are characterized by real-time interaction and tight integration between different domains like computation, communication and physical systems. From an engineering perspective, CPS is a design philosophy, but from an innovation perspective, CPS enhances existing systems through the use of modern technology. It is often associated with manufacturing just because industry 4.0 starts from the manufacturing sector. However, CPS can be implemented across many domains, including medicine, agriculture, energy management, transportation and logistics. Data collected in these systems can be used to simulate, synthesize and visualize processes. Based on this information, many features such as agility, resilience and adaptability can be built. In an interview with Dr. Veera Ragavan from the Robotics and Mechatronics Engineering discipline, we learn more about CPS and its application in the agriculture field.

Cyber Physical Systems in the Context of agriculture

The United Nations (UN) has flagged agriculture as one of the sectors to be improved to provide food security as many crops are wasted along the way from farm to table. This encourages the development of urban farms like hydroponics, aeroponics, and vertical farming. Dr. Veera and his students are building agricultural CPS with smart farms to automate urban farms as the crops grown in a controlled environment require precise control and monitoring. Using the principles of CPS, the system is used to collect data, monitor, diagnose and predict plant health to take further action like schedule fertilizer supplements, adjust pH, lighting, and other parameters. CPS in agriculture helps detect and even prevent unfavorable situations before it is detected by the human eye which will be too late. Using available data, urban farmers can also plan the production based on the market demand. In this way, farmers can produce just in time and avoid wastage.

Dr. Veera Ragavan
Robotics and Mechatronics Engineering

There are some upsides and downsides to the implementation of urban farming. As crops are grown in a controlled environment, it is now possible to locally grow imported fruits like New Zealand strawberries. Urban farms also have less environmental footprint and use about 80% less water, as water is normally recycled through the closed-loop system. Moreover, excess produce can be sold to the market just as excess electricity from our solar panel is sold to the grid. Currently, however, only limited types of crops like leafy vegetables, legumes and pods can be produced in urban vertical farms, and staples like rice and wheat are not included. As these crops are grown in a controlled sterilized environment, issues such as residues of agrochemicals in the crop and its impact on health arise. Therefore, some safety standards, ethical and regulatory principles need to be implemented by the government to regulate these processes.

The Status of Malaysia in Smart Agriculture

While the Agriculture sector is the third highest GDP contributor in Malaysia, the trade balance is also increasing steadily, and the government is continuously promoting process improvements and implementation of smart agricultural systems. Even the private enterprises are venturing into vertical farms and other types of urban farming, as shown by increasing vertical farming companies in and around urban Kuala Lumpur. The progress will pick up at an even faster pace as the younger generations want to be involved in smart agriculture lured by modern technology, process automation and outsourcing. Our neighboring country, Singapore, is already working on sustainable food sources which received great responses from their people. Today, they produce a significant percentage of their food, thus reducing reliance on imports. Singapore is a good role model to follow, and Malaysia will achieve rapid progress in the near future.

Thoughts on the Implementation of Smart Engineering Innovation

Although adopting new technology is an excellent thing, overuse is bound to have adverse implications. Dr. Veera expresses his concern about the hype which Industry 4.0 consultants create. Consulting firms conducted surveys and reported that close to 70% of the manufacturers have implementation of IR 4.0 technology as their top priority. This hype creates tremendous pressures on the small and medium-sized enterprises (SMEs) who are not equipped for a full-scale transformation. It is essential to understand that IR 4.0 can be done step by step (refer to the image below), and it is not a one-shoe-fit-all solution. These SMEs need to ascertain what they want first so that experts can help with customizing their requirements and progress step by step into digitization of other cyber physical systems to reach higher industry 4.0 maturity levels. Unless the company is initiating a new business, there is no need to replace the entire system as the existing equipment may still be performing well and adding sensors and internet connectivity can complete the digitization step.

Another important note is the need to set up a management committee with a clear direction and walk its talk. Because most projects fail due to a lack of commitment, and demotivate companies planning to adopt these new technologies.

Illustration of the stepwise road to maturity for implementation of Indsutry 4.0 technology.

For more information, do check out Dr.Veera's and his team's publications and related articles!

Ragavan, S. K. V., & Shanmugavel, M. (2016, December). Engineering cyber-physical systems—Mechatronics wine in new bottles?. In 2016 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC) (pp. 1-5). IEEE. https://bit.ly/2W6wLmh

Veeraragavan, S., Jiann, E. T., Leong, R., & Kumar, V. R. S. (2021). Cyber-Physical Systems: A Pilot Adoption in Manufacturing. In Futuristic Trends in Intelligent Manufacturing (pp. 205-223). Springer, Cham. https://bit.ly/3ggeoCf

Malaysian Agriculture 4.0 in the news: https://bit.ly/3D3rZq6, https://ap.fftc.org.tw/article/2618

The Smart Agriculture Industry Blooms amidst COVID-19 Pandemic

- Srivardhini

The number of people living in extreme poverty decreased over the years - to only 10% in 2015, but everything changed when the SARS-COV-2 virus attacked. The Covid-19 pandemic caused a major economic fallout that could increase global poverty rates to half a billion people. **Significantly, to keep up with the losses from the pandemic as well as the growing population, agriculture will need to supply more than twice its current output in developing countries.** This calls for a profound change in agriculture practices.

The application of the Internet of Things (IoT) and Cyber-Physical Systems (CPS) is a solution to this problem as it allows resource optimization while ensuring lowered production costs and maximum yield. CPS can provide real-time data analytics and predictive models to detect and avoid process failures before they occur. Therefore,the implementation of CPS introduces multiple improvements in terms of increased efficiency, scalability, autonomy and reliability, while ensuring user-friendly interfaces to interact, monitor, and manage the whole system.

Sources:
Plantui Smart Garden™
https://plantui.com/

Farming robots
https://bit.ly/3geRX09

Plantui Smart Garden™

Smart farming with the help of precision agricultural robots.

While agriculture is one of Malaysia's major economic sectors, it is dominated by smallholder farmers who are no strangers to low crop yields, efficiency, and manpower. **To tackle this issue, the Malaysian government has aimed to increase the agricultural gross domestic product (GDP) to $ 3billion by 2025 as a part of their 5GDP project through the use of emerging 5G technology.** Many big companies are involved - IBM Malaysia is collaborating with Sarawak Multimedia Authority to introduce IoT and AI in the agriculture sector. Many startups have formed too, such as Kapitani - an online marketplace offering tech services to farming businesses. There are also companies targeting consumers - Plantui Malaysia is a company selling small automated capsules which monitor and grow plants automatically - almost no human intervention required!

But you don't need to spend a lot of money to hop onto the trend - A lot of young people are creating their own DIY smart gardens at home using hobbyist electronics like Arduinos and cheap sensors. There are plenty of options to automate your home garden - don't like watering your plants so often? Set up a DIY timed irrigation system. You can place a sensor to monitor the soil humidity and automatically switch on the irrigation when the humidity falls below a threshold.

There is a bright future in Malaysia for Smart Agriculture Technology.

Are you going to be a part of it?

Green Buildings
Diamond in the dark

- Lim Yi An

Putrajaya, Malaysia

Malaysian Energy Commission Headquarters

As we all join the march towards Industry 4.0, it is without a doubt that this movement has not only contributed in the technological field, but have definitely aided in improvements of the construction industry in Malaysia. The drive towards green building has been visible in recent years in Malaysia, as green buildings focus on enhancing the use of resources in terms of efficiency, these resources may be water, energy, or even building materials. Green buildings have the sole purpose of reducing environmental and human impacts during the buildings' lifespan. The Malaysian Institute of Architects (PAM) has implemented a rating system known as the Green Building Index (GBI), where buildings will undergo assessments for their energy and water efficiencies, sustainable site planning, etc. Buildings will be certified as green buildings in Malaysia if scored above 50 points during the assessment. **Up to date, there are 389 buildings registered as GBI certified buildings.**

Located at the federal administrative center of the Malaysian capital- Putrajaya, the Diamond Building is one of the reputable Platinum-rated green buildings. This building is also the headquarters for the Malaysian Energy Commission. This 160,000 square feet building got its name from its unique diamond-shaped building design that was purposed for self-shading and maximum natural daylight, which reportedly is four times more energy efficient than any typical office buildings in Malaysia. In addition to that, the Diamond building is also incorporated with photovoltaic panels for solar energy, rainwater harvesting and greywater recycling. Sustainable cooling systems with chilled water pipes embedded in the concrete slab itself providing direct cooling also contributes to the high energy efficiency of the building. **The Diamond building is considered a model green building design for any future building constructions in Malaysia.** With the increase of green buildings in Malaysia, this will not only provide a more sustainable environment to the Malaysian citizens, but also brings us closer towards a more sustainable world.

Green Buildings around the globe

Germany
BIQ building
First algae-powered building in the world

Australia
Nightingale Housing

Singapore
Changi Airport

Sources:
Malaysian Energy Commission
https://bit.ly/3CVddBP

BIQ
https://bit.ly/37ROX5I

Nightingale
https://bit.ly/3m9sPff

Changi Airport
https://bit.ly/3gcP14k

Research Focus

The academics from School of Engineering of Monash University Malaysia conduct exciting research works related to smart and green engineering. We present the amazing works of the academics with from different engineering backgrounds.

Dr. Chua Yie Sue

Civil Engineering

Interested in Dr. Chua's and her team's work?
Check out their publications on smart engineering!

Chua, Y.S., Liew, J.Y.R. and Pang, S.D. (2020). Modelling of connections and lateral behavior of high-rise modular steel buildings.
Journal of Constructional Steel Research, 166, p. 105901, https://bit.ly/37VhKpQ.

Liew, J.Y.R., Chua, Y.S., and Dai, Z. (2019) Steel Concrete Systems for Modular Construction of High-rise Buildings. Structures, 21, pp 135-149, https://bit.ly/3srQ2u8.

Research Focus

My research focuses on the development of smart and efficient prefabricated building system. This includes the development of fast and easy connections, light steel composite walls and columns, structural analysis of high-rise modular building, robustness design as well as structural impact protection.

Motivation

The global construction industry has fallen behind the technological innovations found in the manufacturing and automotive industries. Conventional construction methods that used cast in-situ structural elements and brick walls are still widely used due to its relatively low labour cost in some countries. However, the low productivity of such construction methods has impeded economic growth in the construction industry, and they are losing their financial advantage with increasing labour costs and tighter restrictions on labour recruitment particularly during this pandemic. This raises the awareness of shifting the construction work from the site to off-site in the factory by adopting prefabrication technology.

How does the current pandemic impact your research work?

My research focuses on structural component design and the products are required to be tested in the laboratory to ensure its structural integrity and safety. However, the experimental work being conducted in Monash University Structural Heavy Laboratory is highly disrupted by the lockdown and tighter SOP. Nonetheless, due to tighter requirements on foreign labour and stricter SOP on site and workers' quarters during this pandemic, the demands in shifting the on-site construction method to off-site prefabrication have increased.

What are your hopes for the smart and green engineering field in the future?

Overall, my research aim is to help to transform the construction industry to a more productive, greener and more sustainable one as well as providing ideal solutions for affordable housing. Ultimately, I wish to promote the transition from conventional construction methods into a manufacturing industry with the modular system product, being manufactured with precision in the factory utilizing automated machines and equipment prior to transportation to site for fast installation.

Research Focus

I set up the Computational Biomass & Biopolymer Engineering (CBBE) research group to focus on using advanced computational methods to improve the engineering of biomass (particularly cellulosic) materials. Specifically, my group specializes in using population balances to model the fragmentation of cellulose polymers, understanding the underlying physics with the aim to exert fine control over its processing. I am also interested in cybernetic modelling, where I seek to understand the response of microbes in regulating its own metabolic pathways when subject to external environmental stimuli. This is also done in line to understand the behaviour of cellulose degrading microbes. By combining various sophisticated computational approaches, I hope to solve some of the issues which prevent biomass from being used consistently for generation of high value products.

Motivation

I have always been fascinated by how everything in the world can be represented by mathematics. However, mathematics alone do not help to change the world. Therefore, I had to look around for good problems that my mathematics can help to solve. This immediately led me to look at all the untapped potential of biomass in Malaysia. We produce so much biomass wastes but to date there is still very limited ways of generating high value products from these wastes. Main reason being a lack of understanding the underlying physics behind the transformation and the lack of ability to control it. Most experimentalists perform trial and error, as well as haphazard attempts to seek value in these products, but the lack of mechanistic understanding has prevented informed and guided experimentation. This is a big gap in the area, and I decided to fill that gap.

How does the current pandemic impact your research work?

The pandemic has definitely taken a toll on research in general. For example, I have not seen my PhD students face to face for a long time. Although I am not an experimentalist, but from time to time, I do need to perform some experiments to validate the predictions generated by the models. During the pandemic season, these have been restricted. However, I have a group of very smart and dedicated PhD students working under me, and we are still trying our best to push the boundary of the field.

What are your hopes for the smart and green engineering field in the future?

I hope that going forward, we can combine both theoretical and experimental approaches and be able to master the area on solid ground. Without the best of both worlds, we will not be able to break new grounds.

Dr. Joseph Ho Yong Kuen

Chemical Engineering

Interested in Dr. Joseph's and his team's work?
Check out their publications on smart engineering!

Ahamed, F., Song, H.-S., and Ho, Y.K. (2021) Modeling coordinated enzymatic control of saccharification and fermentation by Clostridium thermocellum during consolidated bioprocessing of cellulose. Biotechnology and Bioengineering., 118 (5), 1898–1912. https://bit.ly/37XKNJ2.

Ahamed, F., Song, H.-S., Ooi, C.W., and Ho, Y.K. (2019) Modelling heterogeneity in cellulose properties predicts the slowdown phenomenon during enzymatic hydrolysis. Chemical Engineering Science., 206, 118–133. https://bit.ly/2W1FpC7.

Dr. Faranak Rabiei
Common Engineering

Interested in Dr. Faranak's and her team's work?
Check out their recent publications on COVID-19 analysis modeling!

Ali, Z., Rabiei, F., Shah, K., & Khodadadi, T. (2021). Modeling and analysis of novel covid-19 under fractal-fractional derivative with case study of malaysia. Fractals, 29(1). https://bit.ly/3CXimJL

Ali, Z., Rabiei, F., Shah, K., and Khodadadi, T. (2021) Qualitative analysis of fractal-fractional order COVID-19 mathematical model with case study of Wuhan, Alexandria Engineering Journal, 60(1), pp. 477–489., https://bit.ly/3k7x7Ru

Ali, Z., Rabiei, F., Shah, K., & Majid, Z. A. (2021). Dynamics of SIR mathematical model for COVID-19 outbreak in Pakistan under fractal-fractional derivative. Fractals. https://bit.ly/3AW7v0X

Research Focus

My current research focus is on fractal-fractional type of mathematical modelling and analysis of dynamic transmission and treatment of Coronavirus pandemic disease. Validating the simulated obtained results by new models on some existing COVID-19 disease outbreak in different regions will be one of the key elements of our research which will be used for future prediction.

Motivation

In the present time, a novel Coronavirus disease known as COVID-19 is an infectious disease that has infected human populations. The disease has spread in many countries around the world rapidly and became a global pandemic disease announced by the World Health Organization. Therefore, the implementation of effective control strategies against disease transmission is a big challenge. In this regard, mathematical modeling is one of the most powerful tools to control the disease spread in countries. Many types of research around the world have been studied for controlling procedures. In our study, we investigate the dynamic transmission and treatment of this pandemic disease on the proposed new model of COVID-19 using fractal-fractional derivatives on recorded data of disease outbreak.

How does the current pandemic impact your research work?

Our research requires the high simulation and we need to access the campus lab to run the program using the campus software lenience. Perhaps, connecting from home via VPM caused delay in our research simulations results.

What are your hopes for the smart and green engineering field in the future?

To have better and more accurate results of prediction for future data of pandemic transmission dynamic in our society.

Research Focus

My research focuses on 3 key areas, which are machine learning, mobile robots and industrial automation. Machine learning focuses on various issues that can be resolved by the application of artificial intelligence, and my work is usually focused on machine vision or automation related issues. For mobile robots, I am mainly interested in finding novel methods of controlling robots, especially in outdoor environments where you encounter uncertain terrain, and the controller has to improve itself over time. Finally for industrial automation, it usually involves trying to automate certain manual processes in factory settings, by either the application of efficient programs or the usage of AI where applicable.

Motivation

My main motivation is that by the use of AI, machine vision and automation techniques, various mundane tasks can be run without user interference, giving rise to more opportunities for the workforce to be applied to areas that require skill and human thought, while those processes that require repetitive precision can be left to machines. This leads to higher productivity as well as better allocation of resources overall. The other motivation factor is that there are quite a few fascinating areas where creative solutions are required for automation, which makes this research particularly interesting.

How does the current pandemic impact your research work?

As my research has a heavier weightage on the software side such as programming and training AI systems, majority of my work has been able to proceed without any issue. Though some key projects that require hardware that is on campus or requires visits to industrial sites for data collection have been put on hold until the current pandemic situation has improved.

What are your hopes for the smart and green engineering field in the future?

Though there are some major avenues in the smart and green engineering field that are yet to be fully developed, giving room for multiple potential research projects, there are quite a few industries that are unwilling / hesitant to be the pioneers in leading the change required for these new projects to come into play. My hope is that more companies see the possible positive long term impacts brought about by this research field, and openly collaborate with the researchers so that all parties can bring about a better future for this field.

Dr. Mohammed Ayoub Juman

Mechatronics and Robotics Engineering

Stay tuned for Dr. Ayoub's exciting publications on the MUM website!

https://bit.ly/3xYlqBI

A Monash Alumnus' Journey to the Top of Industry 4.0

Meet Monash University Malaysia's own Ph.D. alumnus - Dr. Chua Wen Shyan, who climbed the ladder from being a Ph.D. student to the head of Malaysia's Smart Factory 4.0.

- Srivardhini

> **"My advice to Ph.D. students is to get involved with student associations and activities; speaking events, engagements, career events - these are the experiences that will help you to Rise to the Top"**

- Dr. Chua Wen Shyan
Head of Malaysian Smart Factory 4.0
Selangor Human Resource Development Centre

Journey as a Ph.D. Student

Dr. Chua Wen Shyan started as a Mechatronics Engineering Ph.D. student in 2012, under Professor Tan Chee Pin to pursue a Ph.D. in fault detection identification. During his days as a student, he was very actively involved with Monash University Postgraduate Association (MUPA) for 3 consecutive years, becoming the Vice-President and then the President of MUPA. He fondly remembers advocating initiatives to improve the experience for postgraduate students and working with postgraduate community and campus-level representatives to bring career events and industry networking to students to bridge the gap between Ph.D. graduates and the industry. Even then, he noticed a large gap between the industry and academia.

Life After Graduation

After completing his Ph.D., Dr. Chua decided to explore opportunities in the industry. He landed a job at an MNC in the same field as his Ph.D. but very quickly found that his job was quite different from his Ph.D research background. He had to adapt a lot of his skills from the Ph.D. so that they would be useful at his job. He highlights that Ph.D. students gain persistence and perseverance through their journey, and these skills helped him adapt and easily find new solutions to technical problems and challenges at his job.

He mentions that in the industry, he works with people of all skill levels, and what's important is the ability to adapt to the environment and to find innovative solutions, rather than the actual topic of research. To survive in the industry, a Ph.D. graduate must be able to adapt and spin off their research topics to actual knowledge and skills which can then be applied to real world applications.

Climbing the Corporate Ladder

Dr. Chua received an offer to be the Head of the Malaysian Smart Factory 4.0 at the Selangor Human Resource Development Centre, two years after his first role at the MNC. He attributes his rise to the top to his close involvement in associations and activities, especially with MUPA, in speaking events, engagements, career events, and so on. From these experiences, he learned to pitch himself as a valuable member of the team, and also got to meet new people.

From a technical perspective, he emphasizes hands-on skills and being proactively involved with the developments and problems faced in the industry, including being aware of any open-source and community-driven technologies that are being used in your area of research.

While top universities can afford proprietary software, in most cases companies want to see a proof of concept or a prototype for applications, which can be difficult to scale up further for deployment without an initial investment on proprietary software which can be heavy for certain industries which are at an exploratory stage.

He also says that while there is a stigma around Ph.D. graduates in the industry, they are still seen as experts in their field, and expected to be fully involved in their projects in all aspects. The stigma usually arises from the differences in the objectives of the industry and academia. For example, academia emphasizes novelty, high research contribution, and publications, while the industry needs more practical and scalable solutions which are not necessarily novel. This has increased the gap between the industry and academia.

Dr. Chua advises current Ph.D. students to be more inquisitive, and question the impact and practicality of their projects towards the industry and community. Students who are developing a futuristic solution that depends on emerging or unsupported technologies might find that their solution may not be used in the industry within the next ten years - this could prove as a challenging path for those looking to wok in the industry after graduation. Instead, he urges students to assess the impact of their research on the wider community and industry, and solve existing problems in the industry, such as through industrial partnerships and grants, to bridge this gap.

Students can also list down the knowledge, skills, and competencies which they have gained throughout their Ph.D. journey and indicate transferable skills which can be used in various industries. Moving into a career into the industry may be challenging after receiving a Ph.D. but it is rewarding as you are able to connect to real industry problems and contribute to a wider community which creates a greater impact for their research contributions in the future, should they decide to move back to academia.

The Future of Graduate Researchers in the Malaysian Industry

Dr. Chua's current role is important in bridging the gap between academia and industry in his field. While there is a need for highly skilled professionals in the industry, most Ph.D. students' skill sets are too specialized to be a good fit. To address this problem, Dr. Chua is actively involved with research staff in the Mechatronics Engineering Department to propose and organize community-driven solutions that can help students work on real industry problems.

Dr. Chua and his team at the Malaysian Smart Factory 4.0 also promote high impact and unique talent development programs, and do their own application-based R&D with interns and students as a community-driven approach.

By focusing on developing high impact and unique talent development initiatives, he hopes to bridge the gap between Ph.D. graduates and industry, which would provide greater opportunities for Ph.D. graduates to advance their careers in the industry and contribute towards the development of emerging technologies.

Dr. Chua also provides mentoring support and internship opportunities for postgraduate students who would like to explore industry-based problem statements and develop community-driven solutions. He can be reached at chua.wen.shyan@gmail.com or via his LinkedIn profile at https://www.linkedin.com/in/shyanchua/.

For more information on Dr. Chua's work in SHRDC, visit the following links:

Article by the Edge:
https://www.theedgemarkets.com/article/ir40-making-it-even-easier-automate-selangor

Facebook Article by 100 Scientists of Malaysia:
https://www.facebook.com/109427157091712/posts/324120398955719/

Industry Success Story (Minute 37 onwards):
https://www.youtube.com/watch?v=dBlmxKWG6pw&t=2681s

Virtual Tour of the Malaysian Smart Factory 4.0 @ SHRDC:
https://www.youtube.com/watch?v=IFXbMxdyGmo

Exploring Smart Engineering in the Manufacturing Industry

- Khanisya

The fourth industrial revolution, more commonly known as Industry 4.0, is driven by a smart, interconnected global environment. Many prominent leaders have emerged from the race towards the digital transformation of the manufacturing industries using smart automation and systems. In conjunction with this, Malaysia Automotive Robotics and IoT Institute (MARii), was established under the Ministry of International Trade and Industry (MITI) to enhance the local automotive industry competitiveness, spurring development and adoption of robotics and IoT applications.

According to Ir. Za'im, the senior general manager of MARii, said that this agency plays a crucial role in developing automotive policies to protect the national automotive industry and ensure the competitiveness of the sector using the latest technologies and processes as a significant move towards being Industry 4.0 ready. To strengthen this, MITI has crafted the National Industry 4.0 (Industry4WRD) Policy Framework to provide a concerted and comprehensive transformation agenda for the manufacturing sectors in Malaysia. One of the action plans under the national strategy for regulation is to create tools and processes to help manufacturing firms assess their capabilities and readiness to adopt Industry 4.0 technologies and processes. Industry4WRD Readiness Assessment (RA) is a program to assess and evaluate Small to Medium Enterprises (SMEs) in Malaysia on their readiness towards the adoption of the new industrial revolution.

Over 70% of Malaysian enterprises are SMEs, which play an integral part in fostering the economic growth and transformation process. According to Ir. Za'im who is also a certified Industry4WRD Readiness Assessment assessor, the automotive manufacturing SMEs are among the manufacturing sector to be assessed to evaluate their readiness to adopt the latest technologies and systems, after which, these companies will be advised on how to make the necessary changes in the processes, manpower, and technologies (the three Industry4WRD 'Shift Factor' towards IR 4.0 transformation). With that, these companies could develop technology management roadmap and intervention plans towards companies' industry 4.0 transformation programs with the support from the government.

In particular, the research and development in the Industry 4.0 technology pillars play a key role in the digital transformation of the industry. "We are currently at the 'entry level' of Industry 3.0, which started to rely heavily on process automation, and to move forward, the integration of advanced manufacturing and smart information technology is crucial", he said.

Ir. Za'im Azyze
Senior general manager, MARii

Ir Za'im, who has worked in various industrial sectors such as electrical and electronics, aerospace and automotive and has a strong process design background, said that Malaysia is very much in need of local research and development to commercialize their smart innovations. "Currently, our industrial factories and companies adopt technologies and solutions developed by foreign companies as they are more advanced, and their solutions are widely used following the standard practices. However, many local factories could not fulfill the requirements to be Industry 4.0 due to such high costs. This is where we need talented local research and smart innovations that can be commercialized. There are many funds and grants provided by the government through local agencies like MAGIC focusing on start-up companies to commercialize their engineering and technological innovations", he said.

Speaking from his experience, he encourages more industrial collaboration in research degrees, especially in the expanding fields in Malaysia like electrical and electronics, aerospace, composite technologies, oil, and gas, and many more. With such collaborations, graduates having technical skills specializing in material and operational testing have great opportunities in the local industries.

Three-minute thesis competition

The SOE Monash University Malaysia's three- minute thesis competition was held successfully on the 4th of June 2021 in the virtual platform, for the second time! Participants competed in their respective school level and each winner represented their school to compete in the campus round.
We applaud all the contestants for their incredible effort.

School of Engineering contestants and their 3MT titles:

Darren Low Yi Sern: Realizing the 'Healing Factor' with Rubber
Carvyn Blaise: Producing Hydrogen from Sunlight: Bismuth Ferrite as Photocatalyst
Mak Nguoy Lamn: Thermochemical Ablation (TCA
Lim Chean Shen: Upcycling Palm Oil Biomass as Bio-Organic Fertilisers - A Circular Economic Framework
Mohammed Alkhatib: Acoustic Rainfall Sensing for Mapping Spatial-Temporal Variation of Rainfall Events Using Citizen Science

Congratulations to **Mr. Darren Low Yi Sern** for winning the SOE 3MT competition and representing the School of Engineering in the Monash University Malaysia round!

Congratulations to our research graduates!

We congratulate our 2020 and 2021 research graduates and wish them the best in their future endeavours! We have 34 GRS who were conferred their awards from August 2020 to July 2021 below, in order of awarded date:

Doctor of Philosophy

Dr. Fang Sheng Lim
Dr. Khang Aik Tan
Dr. Weerahennedige Ashane Madusha Fernando
Dr. Muhammad Shafiq Yahya
Dr. Firnaaz Ahamed
Dr. Shiv Ashutosh Katiyar
Dr. A S M Bakibillah
Dr. An Liang The
Dr. Mei Ling Foo
Dr. Kulandai Arockia Rajesh Packiam
Dr. Sabeeha Nushrat Bibi Aisha Khadaroo
Dr. Michael Joon Seng Goh
Dr. Sangeetaprivya P.Siva
Dr. Su Min Hoi
Dr. Nien Loong Loo
Dr. Abdul Hasif Abd Rahim
Dr. Muhammad Towfiqur Rahman
Dr. Da Ming Cham
Dr. Mundher Al-Shabi
Dr. Sanush Khyle Abeysekera
Dr. Edmund Hua Hang Lim
Dr. Boon Chin Hoe
Dr. Guo Hao Th'ng
Dr. Saeed Pirbodaghi
Dr. Chien Lye Chew

Master of Engineering Science (Research)

Jia Min Lee
Shah Mohammad Mominul Islam
Omar Ali Syadiqeen Malik
Mohammed Zeehan Saleheen
Abdulhakeem Oluwadare Adefioye
Johnathan Goh Yue Herng
Chieh Chieng Woo
See Loong Li
Jian Wei Yam

Introducing
New Academic Staff

Name: Ir. Ts. Gs. Dr. Chow Ming Fai
Position/Department: Associate Professor, Civil Engineering Discipline, School of Engineering
Expertise: Sustainable urban stormwater management; Flood risk assessment & simulation; Water quality analysis & modeling
Ongoing/ Completed Projects:
• Substrate Moisture Behavior In Extensive Green Roof: Influences of Native Plant Species And Substrate Types
• The Potential of Parameter Estimation Through Regionalization For Flood Simulations In Ungauged Mesoscale Catchments
• Deriving optimal operation rule for reservoir system using enhanced optimization algorithms
• Prototype development of Stormwater Particles & Litter Interceptor Tank (SPLIT) for Urban Stormwater Treatment
• A Nutrient Management Decision Support System For Tropical Reservoir
• Assessment of Energy and Thermal Performances of Green Roof-Photovoltaic System

Contact: chow.mingfai@monash.edu
For more information, please visit https://bit.ly/3fSOsfU

Name: Dr. Issac Lim Sing Sheng
Position/Department: Lecturer, Common Engineering, School of Engineering
Expertise: TRIZ for product conceptualization, patent circumnavigation, startup and non-profit organization formation, capital fundraising and valuation.
Ongoing/ Completed Projects:
• Creative pedagogy with the focus on solving open-problems
• Patent mining for the synthesis of innovation principles
• Multidisciplinary design methodology development
• Product innovation training and consulting

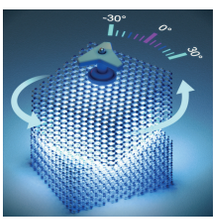
Contact: lim.sing.sheng@monash.edu
For more information, please visit https://bit.ly/3s7ZFht

Global Engineering News

Research efforts around the globe develop new materials, systems and technologies that could change the way we live. In view of the smart engineering technology that is taking the world by storm, we have collected some of the new and upcoming inventions by industry and academic researchers below.

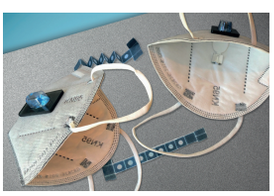
GoBe Robots

State-of-the-art telepresence solution in an increasingly virtual world where you can connect to people with social distancing in a more human way.
Check out the product demo:
https://www.youtube.com/watch?v=XEDgSblMb_4



Twistronics for bulk materials - Tuning electrical properties of a material more efficiently

The research results open up a new way to control optical properties of thin films beyond the conventionally used structures especially for applications in medicine, environmental or information technologies.



Novel face mask that diagnoses COVID-19 in 90 minutes

Engineers at MIT and Harvard University embedded face masks with synthetic biology sensors for biomolecule detection that could be adapted to detect other viruses besides SARS-CoV-2 and can be embedded in other wearables.

Remo

Humanizing online event experience where you can connect to your team with table to table networking.
Check out the product demo:
https://www.youtube.com/watch?v=7MULDTn909k

Shazam - charge-free wearable devices

Scientists from University of Massachusetts Amherst came up with an innovative solution to use the human skin to recharge smartwatches so that they stay connected even while sleeping.
Check out the product demo:
https://www.youtube.com/watch?v=zrJwZRau04E

Flying cars made possible sooner than you think using energy dense lithium batteries!

Penn State researchers are exploring the requirements for electric vertical takeoff landing (eVTOL) vehicles and designing and testing potential battery sources. They found that two energy-dense lithium batteries could recharge with enough energy for a 50-mile eVTOL trip in five to ten minutes.

Sources:
GoBe robots: https://www.gobe-robots.com/

Remo: https://bit.ly/3spe60L

https://www.sciencedaily.com/

Smart Engineering Myths

Myth: Smart building technologies are expensive

Fact: The cost of investing is outweighed by the greater returns on the cutting of operating cost and energy savings.

Myth: It is difficult to operate smart building systems

Fact: Once deployed, it requires almost no technical skills as most of the decisions are made by the system itself.

Myth: Smart buildings and green buildings are the same

Fact: Smart buildings focus on taking predictive actions to optimize usage, save energy and improve the experience and comfort of those within the building. For green buildings, the construction and operation promote a healthy environment across different areas like water, land, energy and other resources.

Myth: Smart building technology is for new buildings only

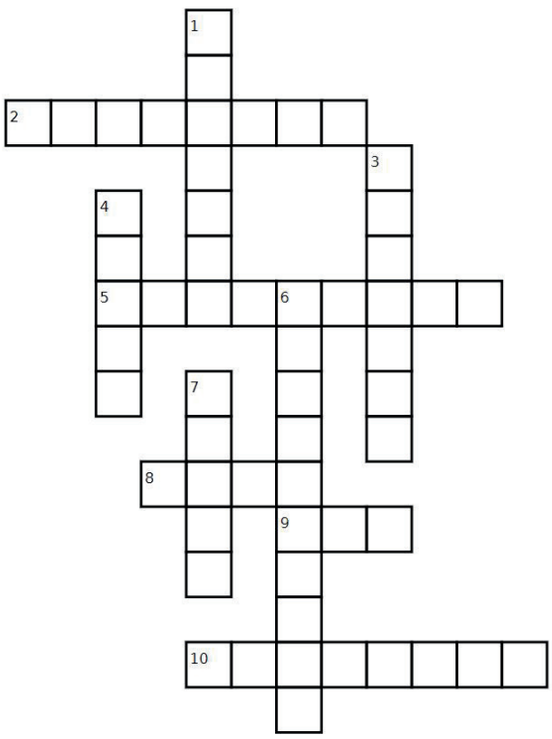
Fact: It can also be applied to old buildings by embedding sensors, connecting via gateways and sending data to IoT cloud to be processed and generate intelligence.

Myth:IoT is only ideal for smart home applications

Fact: All types of buildings- commercial or residential - can be built to become smart and highly automated using IoT and AI.

Activity

Submit your crossword answers in the form below before the 1st of October 2021 and stand a chance to be in the top five to win RM 30 worth of GrabFood vouchers!
Link to the form: https://bit.ly/3mbl0nV



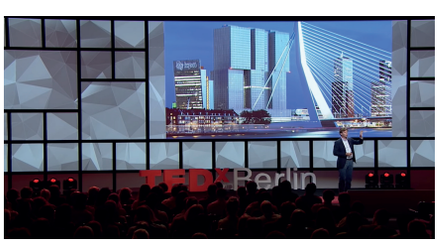
Down

1. Used to measure data in IoT.
3. A large set of information that can be used to analyze a trend or pattern.
4. Smart monitoring of _____ utilization limits participants and encourage social distancing.
6. Smart building technology helps to improve overall _____ of building.
7. _____ has accelerated the dominance of IoT.

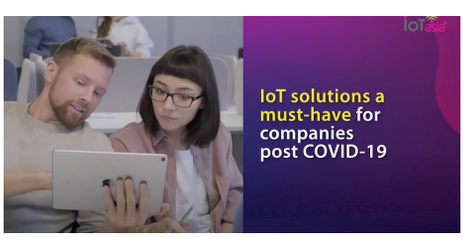
Across

2. Data from air sensors, and occupancy analytics help prioritize areas for _____.
5. Location of the most intelligent building in the world.
8. Smart _____ system analyze and predict air quality.
9. Smart building used _____ devices to monitor, analyze and generate insights around trends to optimize building's environment and operation.
10. Major limitation of smart technology.

Recommended Videos



Smart cities: How technology will change our buildings | Coen van Oostrom | TEDxBerlin
https://www.youtube.com/watch?v=hT4ZsaZsEgc



The Role of IoT in Smart Buildings Post COVID-19
https://www.youtube.com/watch?v=CqDQFasf1uo

"The Fourth Industrial Revolution is still in its nascent state. But with the swift pace of change and disruption to business and society, the time to join in is now."

- Gary Coleman, Global Industry and Senior Client Advisor, Deloitte Consulting