

Recent progress on artificial intelligence application for COVID-19 monitoring and mitigation system in Indonesia

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ABSTRACT

COVID-19 is a serious public health issue in the world. The spread of COVID-19 has gone globally. Indonesia is a country with a high rate of infectious cases worldwide. Multidisciplinary science also brings together to fight against COVID-19 in Indonesia. One of the important roles is artificial intelligence (AI). AI was also reported to help the vital role of public health. As a developing country, Indonesia also brings innovative AI approaches to help people with COVID-19, including classification, detection, diagnosis, prediction, telemedicine, and many more. This study elaborates the recent progress on AI application in Indonesia contributing to the fight against COVID-19 which have been reported in scientific papers/reports. Although research on this field is still not so developed, the existing innovations provide a new enthusiasm for public health and the benefits of the latest technology that can support human health, especially in facing pandemic at Indonesia. It was found that there can be more research by utilizing AI approaches concerning public health and medicine in the future research work particularly in facing a pandemic condition.

KEYWORDS

Expert system; health informatics; Covid-19; healthcare; intelligent system; mHealth.

1. Introduction

Since COVID-19 became a pandemic in 2020 (Al Hakim et al., 2021; Al Hakim et al., 2020; Lipsitch et al., 2020; Wani et al., 2020) and its global challenges for the public health issue (Firth et al., 2020; Lai et al., 2020; Li et al., 2020; Lipsitch et al., 2020; Palacios Cruz et al., 2021; Sharma, 2020), also disrupting economic conditions (Ahmad et al., 2020; Malik & Rani, 2020; Zulhelmy & Hidayat, 2020), energy used (Al Hakim, 2022; Al Hakim et al., 2021; Bento et al., 2021; Ghiani et al., 2020), market challenges (Garnett et al., 2020), and increased technological innovations (Al-Humairi et al., 2020; Barnes & Zvarikova, 2021). There are many innovations in the field of technology and development of vaccines (Al Hakim et al., 2022; Gao et al., 2020; Guebre-Xabier et al., 2020; SP Kaur, 2020; Sun et al., 2021; Yu et al., 2020; Zhang, 2020), drugs (Alotaibi, 2022) that are shaken due to support COVID-19 control and prevention—one of the technological innovations for COVID-19 based on artificial intelligence (Vaishya et al., 2020). Machine learning, artificial intelligence, and data science contribute greatly to the fight against COVID-19. Using such technologies gives a huge opportunity to overcome this pandemic and follow a standard procedure as before the pandemic (Waheed & Shafi, 2020).

Indonesia is the most vulnerable country with a high spread of COVID-19 (Demartoto et al., 2020; Ritchie et al., 2020; Saidi et al., 2021). Many ways have been used to control and prevent COVID-19 in Indonesia, including technology. Artificial intelligence is the most modern technology that can be applied to COVID-19, such as early detection and diagnosis (Al Hakim et al., 2020; Vaishya et al., 2020), tracing (Al Hakim et al., 2022; Kalezhi et al.,

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2022; Vaishya et al., 2020), monitoring (Al-Humairi et al., 2020; Barnes & Zvarikova, 2021; Vaishya et al., 2020), projection of mortality and cases (Vaishya et al., 2020), development of vaccines (Satria et al., 2021) and drugs (Abdel-Basset et al., 2020; Abubaker Bagabir et al., 2022; Arora et al., 2021; Keshavarzi Arshadi et al., 2020; Lv et al., 2021; Tayara et al., 2021; Zhou et al., 2020), therapeutics (Alotaibi, 2022; Vaishya et al., 2020), reducing the workload of healthcare personnel (Borbolla & Ficheur, 2021; SP Kaur, 2020; Vaishya et al., 2020; Velichko, 2021), and prevention (Al-Humairi et al., 2020; Al Hakim, 2021; Barnes & Zvarikova, 2021; Vaishya et al., 2020). Due to combat COVID-19 using artificial intelligence (AI) in Indonesia, several studies have been done, both with computer-based and mobile phones; this study aims to review the roles of artificial intelligence (AI) in combating COVID-19 in Indonesia in scientific research articles that have been published.

2. Artificial Intelligence Theory

Artificial intelligence (AI) is a rational agent approach in the computer science branch based on the idea that computers can perform a series of reasoning processes logically and perform actions rationally based on that reasoning (Suyanto, 2014). According to Rich & Knight (1991), the definition of artificial intelligence (AI) is the study of how to make computers act and think as humans do. Four basic techniques in artificial intelligence (AI) can be used individually or simultaneously in building an application program. Basic techniques in artificial intelligence (AI) can be illustrated in Figure 1.

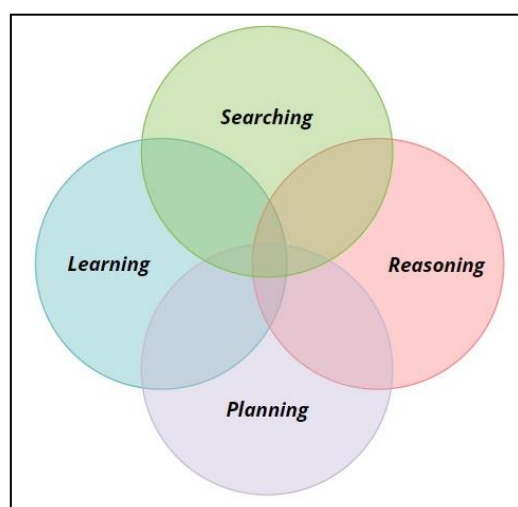


Figure 1. Four fundamentals of artificial intelligence (Suyanto, 2014).

In practical terms, artificial intelligence (AI) is always based on run algorithms. This algorithm is in the form of a learning algorithm that includes supervised, unsupervised, reinforcement, and semi-supervised learning. Supervised learning algorithms are intended to solve classification and regression problems. Unsupervised learning algorithms are intended to solve association, clustering, and dimensional reduction problems. Reinforcement learning algorithms are intended to solve problems in video games and robotics. Semi-supervised learning algorithms solve tough analysis problems, internet content classification, and protein sequences classification (Primartha, 2021). For this reason, AI also can help the role of medicine or health technology (Al Hakim, Satria, Arief, Setiawan, et al., 2021).

3. Methodology

We refer to (Al Hakim, Satria, Arief, Pangestu, et al., 2021) for a brief-review approach. The study started with a literature study using Publish or Perish 8 software. We collected $n=117$ for several scientific papers related to AI with a focused study in Indonesia during COVID-19. Some scientific papers have not met the criteria, such as the type of scientific papers, including country not Indonesia, review articles, letters to the editor, commentary, and notes from the field—the number of collected papers that meet the criteria is about $n=73$. After title identification, the abstract was read to be selected for the full text. The end of the paper number is about $n=13$, and this number was used for this review study. The paper's classification is explained in Table 1.

Table 1. Data collected paper's classification.

Authors	Type of AI	Language	Study Goal
(James et al., 2020)	Medical image processing	English	Classification
(Ansor et al., 2020)	Deep Learning	English	Detection
(Tenriawaru et al., 2021)	Deep Learning	English	Detection
(Syarif et al., 2022)	Deep Learning	English	Prediction
(Hadi et al., 2021)	Machine Learning	English	Detection
(Al Hakim, Rusdi, et al., 2020)	Expert System	English	Diagnosis
(Al Hakim, Billian, et al., 2020; Al Hakim, Muchsin, et al., 2021)	Shortest Path Algorithm	Indonesian	Prediction
(Al Hakim, Purwono, et al., 2022)	Shortest Path Algorithm	English	Prediction
(Al Hakim et al., 2021b; Al Hakim et al., 2021a)	Mobile-based AI	English, Indonesian	Multi-purpose
(Nurhudatiana & Seo, 2020; Parikesit et al., 2021); (Nurhudatiana & Seo, 2020)	mHealth or Telemedicine	English	Diagnosis

Source: own study

4. Results and Discussion

Based on Table 1, some published research explains that they use computer-based and mobile-based artificial intelligence (AI) approaches to fight against COVID-19 for many purposes, such as classification, detection, prediction, diagnosis, and multi-purpose.

Diagnose, Early Detection, and Preventing

Many studies have some novelty about using computer-based and mobile-based AI to combat COVID-19, including diagnosing, early detecting, and prevention. Research conducted by James et al. (2020) successfully classified X-ray medical imaging for patients with COVID-19 symptoms. They used a neural network approach to 160 COVID-19 and 160 normal datasets. In addition, Ansor et al. (2020) built a system for the early detection of someone who was using a mask or not based on the TensorFlow framework on the Raspberry Pi. Also conducted by Tenriawaru (2021) built a system based on a deep learning network to detect mask uses and augmented reality to determine people's distance. Besides, Syarif et al. (2022) research can predict and detect COVID-19 severity using a deep convolutional neural network. Another research by Hadi et al. (2021) built an early warning system to detect the physical distancing with a machine learning approach.

Research by Al Hakim et al. (2020) reported that using an expert system based on an AI-fuzzy approach coded to an android-based app can diagnose people who have some COVID-like symptoms. The app can determine the confidence level of diagnose-result inference. In addition, the Indonesian government launched an AI-based mobile app for COVID-19 management, such as tracing, tracking, self-diagnosis, and location report, called *PeduliLindungi* (Mustopa et al., 2020). Al Hakim et al. (2021) also used an android smartphone to prevent the spread of COVID-19 in community engagement and participation of health workers collabo.

Monitoring, Tracking, and Tracing

Al Hakim et al. (2021) found a new postulate to determine the shortest path for COVID hospitals in some areas in Java. This postulate is based on the Haversine formula calculation. The new postulate can propose to medical emergency examiners or emergency health facilities to adopt the system for handling someone who has emergency status.

Al Hakim et al. (2022) built a mobile-based app with the Dijkstra algorithm to determine the COVID-19 distribution. The app has some useful features, such as a spread map and location-based service for users to estimate the range of shortest COVID-19 cases. They also built this app for adoption in android and iOS.

Emergency Cases

Due to handling COVID-19 patients, especially in delivering to the hospital, Al Hakim et al. (2021a); (2021b)

propose a mobile app called *Smart-iMbulance* for this solution. The app can be used for emergency conditions for someone who needs quick medical handling, such as traffic accidents and emergency COVID-19. The healthcare facility's role is vital for COVID-19 cases (Klumpp et al., 2021; Toh & P. Brody, 2021).

Telemedicine

Excellent Indonesian telemedicine based on the mobile app (mobile healthcare app, mHealth app) is *Halodoc* (Nurhudatiana & Seo, 2020; Parikesit et al., 2021), and *Alodoc* (Nurhudatiana & Seo, 2020). The app can assist the COVID-19 patients with AI-based chatbot features. Besides, this app can chat with medical professionals such as doctors, specialists, and psychologists and then quickly book medical tests or lab and drug information.

Prove the Chance to Fight COVID-19

Based on these studies, it has been proven that in Indonesia, the contribution of artificial intelligence can help combat COVID-19. With artificial intelligence (AI) rapidly developing in health and medicine, the COVID-19 pandemic seems to be overcome. Although it is not entirely curable, the contribution of AI is immense in dealing with COVID-19, including in Indonesia. This country is included in developing countries, so research innovation with an AI approach is still being carried out in the future, even after this pandemic. Post-pandemic opportunities in Indonesia for implementing AI are very wide open. This study is expected to provide insights related to the development of AI in fighting COVID-19 in Indonesia.

Break the Limit with AI

Although artificial intelligence (AI) is still limited to one or more focused problems, the development of algorithms and new methods in AI allows for a breakthrough that may be impossible in the initial estimates. Concrete evidence of this, such as early detection and diagnosis, can provide opportunities for COVID-19 control in Indonesia and is believed to be applied in many countries. In addition, the discovery of vaccines and drugs and therapeutics based on AI approaches can make it able to overcome the limitations of knowledge, but with a good purpose for the benefit of humans. Of course, there need to be many ethical studies related to artificial intelligence and health or medicine (Braun et al., 2021).

Future Challenges in Indonesia

AI and other mobile technology can also be combined in some cases. Due to get the maximum performance, sometimes AI needs to be merged with another mobile technological system (Agah, 2014; Balas et al., 2019; Toh & P. Brody, 2021; Topol, 2019; Waheed & Shafi, 2020). They are the internet of things (IoT) (Vaishya et al., 2020; Waheed & Shafi, 2020), the internet of medical things (IoMT) (Ivanova, 2018), microcontrollers (Velichko, 2021), and wearable medical devices (Barnes & Zvarikova, 2021). In addition, sometimes, healthcare practitioners need to use AI (Prakash & Das, 2021).

AI and omics-based: AI also can be adopted in omics, such as genomics, transcriptomics, proteomics, and metabolomics. The omics technology is also called the molecular high throughput technique in bioinformatics. They also used big data for biological bank management. For example, recently studied using transcriptomics to analyze the effect of reproductive lifestyles tiers on the transcriptional profile of the mammary gland in a primate model (Stute et al., 2011). As we know, the primate, especially non-human primates, can be used as animal models for developing vaccines and drugs, also in this case, COVID-19 (Gao et al., 2020; Guebre-Xabier et al., 2020; Lu et al., n.d.; Russo et al., 2022; Tayara et al., 2021; Yu et al., 2020).

5. Conclusion

Based on these studies, it has been proven that in Indonesia, the contribution of artificial intelligence (AI) technology can help combat COVID-19. Many things we get with AI approaches to fight COVID-19, especially in Indonesia during the pandemic condition. Although some research is still limited to one focus of minor problems, the results have a significant impact, aiming for human benefit. Post-pandemic is expected to provide innovations based on AI concept. Although the pandemic starting to decrease and begin to endemic state, it does not rule out the possibility of future health disasters; of course, AI's role is vitally needed. This study provides an idea of how practical AI is in fighting COVID-19 in developing countries in Indonesia. Due to the limitations of existing research, it is hoped that there can be more research with AI approaches concerning public health and medicine in the future.

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ASEAN AUSTRALIAN ENGINEERING CONGRESS

Engineering Solutions in the Age of Digital Disruption

12th - 14th JULY 2022
HYBRID CONGRESS

CONGRESS TENTATIVE PROGRAMME

Day 1 - 12 July 2022 (Tuesday)

8:30am	Registration/Arrival of Participants & Speakers
9.00 am	Welcome Address from Ir. Dennis Ong, Organising Chairman of AAEC2022
Thought Leadership Forum on IR4.0 and 5G in Malaysia	
9:05am	<p>Chair: Ir. Prof. Lau Hieng Ho, Pro Vice-Chancellor and Chief Executive of Swinburne University of Technology Sarawak Campus</p> <p>Under this forum, the industry leaders will delve into the key prospects of 5G, challenges and issues and how 5G is made possible in Malaysia and Sarawak.</p>
9:10am	Mr. Mohd Ridzuan Mohd Nor Head, Digital Operations & Service Management, Digital Nasional Berhad
9:40am	Mr. Nee Ngie Sing Head of Network Engineering and Operation, Sarawak Digital Economy Corporation (SDEC)
9:50am	Ts. Amir Irsyad Bin Mohamed Samsudin Deputy Director, 5G Delivery Office, Malaysian Communications & Multimedia Commission (MCMC)
10:00am	Questions and Answers session (15 mins)
10:15am	Refreshments (15 mins) SDEC Corporate Video

Plenary 1: Industry 4.0 and Future Technologies	
10:30am	<p>Chair: Ir. Dennis Ong, Organizing Chairman, AAEC2022</p> <p>In this plenary, the current state of Industry 4.0 (IR4.0) implementation and its associated benefits and advantages in various industry sectors will be the main discussion. Stories of successful implementations of IR4 and how they have shaped the world in terms of creating smart future will be shared by the invited plenary speakers. In addition, the future of IR4.0 and how it is affecting the world in leading to future cut-edge technologies will also be in the discussions.</p>
10:35am	<p>Employment Opportunities of University Graduates in the Digital Age Dato' Ir. Dr. Lee Yee Cheong (Virtual) AAEC2022 Congress Advisor, Malaysia</p>
11:00am	<p>Mr. Vincent Wu Senior Manager, Partnership & Ecosystem Development, Digital Nasional Berhad (DNB), Malaysia</p>
11:25am	<p>Mr. Idjarmizuan bin Ibrahim (Adam) Senior Vice President, Technology Development Division, Malaysian Technology Development Corporation (MTDC), Malaysia (Virtual)</p>
11:50pm	<p>Questions and Answers session (15 mins)</p>
12:05pm- 1:05pm	<p>Lunch Livestream by SDEC (12.45 pm - 1 pm)</p>
Plenary 2: The Internet of Things, Network Communication, and Cybersecurity	
1:05pm	<p>Chair: Mr. Hazwan Razak, Head of Innovation and Entrepreneurship, Sarawak Digital Economy Corporation</p> <p>The internet of things (IoT) has been around for decades. What is the critical role that is played by the IoT in the IR4? How can it further enhance IR4? One of the major concerns with the IoT is cybersecurity. In general, industries are concerned with how these data are being stored securely and handled over the computing clouds. These questions will be the main focus in this plenary session.</p>
1:10pm	<p>Sarawak Digital Community Centre (DCC): Design & Development of Holistic and Inclusive Framework Professor Ir. Ts. Dr. Al-Khalid Bin Othman Deputy Chief Scientist and Deputy Chief Advisor for Sarawak Digital Economy, Sarawak Multimedia Authority (SMA), Malaysia</p>

1:35pm	5G Spectrum Allocation Worldwide: Licensed and Unlicensed Frequency Bands Dr. Ali R. Ebadi Advisor to Board of Directors of MEASAT, Malaysia
1:55pm	IoT – Why We Need to Embrace It Mr. Lavindar Singh Jay Solution Architect, Xperanti IoT Sdn Bhd, Malaysia
2:20pm	Questions and Answers session (15 mins)
2:35pm	Coffee Break
Opening Ceremony	
3:00 pm	Arrival of Guests and Media
3:30pm	Arrival of YAB Datuk Patinggi Tan Sri (Dr) Abang Haji Abdul Rahman Zohari Bin Tun Datuk Abang Haji Openg, Premier of Sarawak
	Negaraku & Ibu Pertiwiku
	Opening Doa by Ustaz Haji Mohammad Ihsan bin Haji Haidzir
	Welcome Speech by Ir. Dennis Ong, Organising Chairman AAEC 2022
	Welcome Speech by Prof. Lau Hieng Ho, Pro Vice-Chancellor and Chief Executive of Swinburne University of Technology Sarawak Campus
4:00pm	Opening Remarks by YAB Datuk Patinggi Tan Sri (Dr) Abang Haji Abdul Rahman Zohari Bin Tun Datuk Abang Haji Openg, Premier of Sarawak
	Presentation of Certificates of Appreciation to Partners of AAEC 2022
	Souvenir Presentation to YAB Datuk Patinggi Tan Sri (Dr) Abang Haji Abdul Rahman Zohari Bin Tun Datuk Abang Haji Openg, Premier of Sarawak
Keynote Presentations	
4:30pm	Growing the ‘Digital Economy’ Agenda in Australia and ASEAN Mr. Paul Sanda, Minister-Counsellor (Commercial) and, Senior Trade & Investment Commissioner, Malaysia & Brunei, Australian Trade & Investment Commission (Austrade), Malaysia (Virtual)
4:50pm	Engineering Future-fit Solutions: Digital and Beyond Dr. Nick Fleming, National President and Chair of Board Engineers Australia, Australia (Virtual)

5:10pm	Educating Future Engineers in the Age of Digital Disruption Professor Tan Sri Dato' Ir. Dr. Chuah Hean Teik, President, ASEAN Academy of Engineering and Technology, Malaysia (Virtual)
5:30pm	End of Opening Ceremony
	Refreshments

Day 2 – 13 July 2022 (Wednesday)

8:30am	Arrival of Participants & Speakers
Plenary 3: Artificial Intelligence & Automation in IR4.0	
9.00am	Chair: Professor Dr. Patrick Then Hang Hui, Director, Centre for Digital Futures, Head School of Information and Communication Technologies, Faculty of Engineering, Computer & Science, Swinburne University of Technology Sarawak What are the current benefits and obstacles in adopting artificial intelligence (AI) for IR4? How does AI assist in realizing the full potential of IR4? How can it be coupled with automation processes in the industry in the realm of IR4? These will be among the questions to be addressed by the invited speakers in the plenary session.
9:05am	Towards Humanised AI Technologies Professor Dr. Narayanan A/L N. Kulathu Ramaiyer Director, Institute of Social Informatics & Technological Innovations, Universiti Malaysia Sarawak (UNIMAS), Malaysia
9:30am	Standardization and Global Robotics Exchange Framework for IR4.0 Dr. Ishkandar Bin Baharin President, Malaysia Robotics and Automation Society (MyRAS), Malaysia
9:55am	Role of AI / ML / Digital Twins in Digital Transformation and Energy Transition Mr. Yogesh Agarwal (Virtual) Director, Solution Architecture, GE Digital, Malaysia
10:20am	Questions and Answers session (15 mins)
10:35am	Break (25 mins)

Technical Session 1			
	<p>Track: Artificial Intelligence and Machine Learning</p> <p><i>Session Chair: Assoc. Prof. Ir. Dr. Basil T. Wong</i></p> <p><i>Venue: Training Room, 1st Floor, TEGAS Digital Village</i></p>	<p>Track: Smart Energy and Cities</p> <p><i>Session Chair: Ir. Dr. Choo Chung Siung</i></p> <p><i>Venue: Auditorium, Ground Floor, TEGAS Digital Village</i></p>	<p>Track: Materials Science and Manufacturing</p> <p><i>Session Chair: Dr. Elammaran Jayamani</i></p> <p><i>Venue: Event Room, 1st Floor, TEGAS Digital Village</i></p>
11:00am	<p>The Potential Impact of AI and Automation in collaboration with the workforce: The Human Machine Symbiosis (Virtual)</p> <p>Dr. Ling Chen Hoe Engineers Australia, Australia</p>	<p>Smart & Sustainability City Ecosystem (Virtual)</p> <p>Ir. Kesavan Jaganathan Director - Freelance Consultant, Malaysia</p>	<p>Quantification Assessment of Kuching Municipal Solid Waste for Potential Energy Recovery (Virtual)</p> <p>Lee Yu Wee Universiti Malaysia Sarawak, Malaysia</p>
11:20am	<p>Application of Artificial Intelligence Technique and Empirical Formulas for Estimating Evapotranspiration (Virtual)</p> <p>Mr. Ang Yik Kang Monash University Malaysia, Malaysia</p>	<p>Leveraging BIM for Kuching Urban Transportation System (KUTS) (Virtual)</p> <p>Mr. Mohammad Aizatt Bin Mohd Azhar Sarawak Metro Sdn Bhd, Malaysia</p>	<p>Modification of Sulfonated Poly Ether Ether Ketone (SPEEK) Proton Exchange Membrane with Sodium Chloride for Fuel Cell Application (Virtual)</p> <p>Mr. Mohamed Afizal Bin Mohamed Amin Universiti Malaysia Sarawak, Malaysia</p>
11:40pm	<p>The application of deep learning to pipe jacking in highly weathered geology (Face-to-Face)</p> <p>Dr. Choo Chung Siung Swinburne University of Technology Sarawak Campus, Malaysia</p>	<p>A Proposed BIM-Based Construction Project Management Framework Integrated with Scheduling and Cost Estimation (Face-to-Face)</p> <p>Dr. Victor Bong Nee Shin Swinburne University of Technology Sarawak Campus, Malaysia</p>	<p>Fabrication of Sulphonated Poly(ether ketone) (SPEEK) Calcium Oxide (CaO) Multilayer Membrane for Fuel Cell Application (Virtual)</p> <p>Dr. Khairul Anwar Mohamad Said Universiti Malaysia Sarawak, Malaysia</p>

12:00pm	AgriTech Solutions from SBACE (Virtual) Mr. Lavindar Singh Jay Satok Bridge Area Consulting Engineers Sdn Bhd, Malaysia	Minimizing Life Cycle Impacts of Construction Waste Through BIM-LCA Integration (Virtual) Mr. Samwel Abuchi Mrema Swinburne University of Technology Sarawak Campus, Malaysia	Performance of Palm Oil Fractions as Rejuvenators in Bitumen (Virtual) Ms. Sharon Gooi Ai Ping Monash University Malaysia, Malaysia
12:20pm	Lunch		
Technical Session 1 (Cont'd)			
	Track: Artificial Intelligence and Machine Learning <i>Session Chair: Assoc. Prof. Ir. Dr. Basil T. Wong</i> <i>Venue: Training Room, 1st Floor, TEGAS Digital Village</i>	Track: Smart Energy and Cities <i>Session Chair: Ir. Dr. Choo Chung Siung</i> <i>Venue: Auditorium, Ground Floor, TEGAS Digital Village</i>	Track: Materials Science and Manufacturing <i>Session Chair: Dr. Elammaran Jayamani</i> <i>Venue: Event Room, 1st Floor, TEGAS Digital Village</i>
1:20pm	Cough Sound Disease Detection with Artificial Intelligence (Face-to-Face) Ms. Sarah Jane Kho Swinburne University of Technology Sarawak Campus, Malaysia	Development of an easily retro-fitted smart adaptive vent for efficient cooling (Face-to-Face) Mr. Phil Chan Siew Thong Swinburne University of Technology Sarawak Campus, Malaysia	Evaluation of Coconut Husk-Based Magnetic Sorbent for Defoaming Application (Virtual) Felicia Terry anak Lo Universiti Malaysia Sarawak, Malaysia
1:40pm	Feature Reduction of Relational Oil Drilling Data before Propositionalization and Harmonization by Measuring Relational Data Missingness using Ensemble Learning (Face-to-Face) Mr. Clement Ting Pek Wen Swinburne University of Technology Sarawak Campus, Malaysia	Space Vector Pulse Width Modulation (SVPWM) Technique for Harmonic Reduction Three Phase Inverter System (Face-to-Face) Dr. Yonis M Buswig Universiti Malaysia Sarawak, Malaysia	Track: Engineering Computing Evaluation of Interfacing Shear Strength of Various Codes vs Experimental Results (Virtual) Ir. Dr. Low Hin Foo OSD Alliance @ OSD Consultants (M) Sdn Bhd, Malaysia

2:00pm	Intent and Context Understanding for Improvement of Search Engine Results on Social Networks (Virtual) Mr. Abdullah Donanim Haber, Turkey	Production of Liquid Fuel using Waste Surgical Nose Masks as Raw Material (Virtual) Mr. John Sackey University of Mines and Technology, Ghana	Track: Engineering Computing Finite element Analysis of an electrochemical adsorbed monolayers (Virtual) Mr. Harunal Rejan Ramji Universiti Malaysia Sarawak, Malaysia
2:20pm	Refreshments		
Plenary 4: Smart Energy, Cities, and Factories			
	Chair: Dr. Ng Sing Muk, General Manager, Research and Development Department, Sarawak Energy Berhad, Malaysia <p>Through the IR4 adoption, smart energy consumption can be implemented in various industry devices and systems. The couplings between cyber-physical systems, automation, and IoT can lead to the birth of smart cities and factories. In this plenary session, strategic moves implemented by local governments in building smart energy usage, cities, and factories in Sarawak or Malaysia will be shared by the invited speakers. Discussions on the current preparation towards the adoption of IR4 locally as well as on how the IR4 can benefit both local industries and international partners will be the main focus in the session.</p>		
2:40pm	Mdm. Sim Ko Sin Senior Vice President, Sarawak Energy Berhad (SEB), Malaysia		
3:05pm	Smart Transportation System in Sarawak – The KUTS Ts. Mazli Bin Mustaffa Chief Executive Officer, Sarawak Metro Sdn Bhd, Malaysia		
3:30pm	Mr. Mandeshpal Singh Head of Product (Enterprise), Digital Nasional Berhad (DNB), Malaysia		
3:55pm	Smart Sustainable Solution on Digitalisation for the Optimization of Building Energy Efficiency Performance Mr. Philip Chan Kok Leong Director, Ting Heng Energy Consultancy Pte. Ltd, Singapore		

4:20pm	Digital Resilience in the Face of Disasters for Disaster Risk Reduction Professor Cheryl Desha (Virtual) Industry Engagement Director, School of Engineering and Built Environment Griffith University, Australia
4:45pm	Questions and Answers session
5:15pm	Conclusion of Day 2

Day 3 – 14 July 2022 (Thursday)

8:30am	Arrival of Participants & Speakers
Plenary 5: Digital Construction for IR4.0	
	<p>Chair: Ts. Dr. Chai Chang Saar, Discipline Leader – Built Environment & Senior Lecturer, Faculty of Engineering, Computing and Science, Swinburne University of Technology Sarawak Campus, Malaysia</p> <p>In this plenary session, the discussion focuses on how the implementation of digital technologies has improved the construction processes and revolutionized the industry. Digital technologies such as Building Information Modelling (BIM), 3D printing, augmented and virtual reality (AR & VR), laser scanning, robotics, analytics software, blockchain, digital twins, and internet of things are highly sought after for improving efficiencies or capacities of construction processes. Nevertheless, within the construction industry itself, the transformation effects of using these digital technologies are still not fully understood, especially on connectivity of linking up and synchronizing separate activities in the digitized construction processes. The plenary session also delves into the readiness of digital construction for IR4.0 and how it would impact the industry in ASEAN and Australia.</p>
9:00am	<p>Construction In Digital Era Mr. Andy Tiong Meng Chun Professional Services Director, PCSS Consultancy Sdn Bhd, Malaysia</p>
9:25am	<p>IR4.0 Engineering the Twins Mr. Ken Lee (Virtual) Director, Aurecon Group Pty. Ltd., Australia</p>
9:50am	<p>Digital Innovation within a Traditional Industry Ts. John Lim Ji Xiong Executive Director – Digital & Innovation, Gamuda Berhad, Malaysia</p>

10:15am	The Digital Engineering Evolution Has Arrived Mr. Kuthur Sriram (Virtual) Global Manager – Education Program, Bentley Education – Bentley Systems, Australia		
10:40am	Questions and Answers session		
11:00am	Refreshments		
Technical Session 2			
	Track: Artificial Intelligence and Machine Learning <i>Session Chair: Dr. Almon Chai Wei-Yen</i> <i>Venue: Training Room, 1st Floor, TEGAS Digital Village</i>	Track: Smart Energy and Cities <i>Session Chair: Dr. Daniel Looi Ting Wee</i> <i>Venue: Auditorium, Ground Floor, TEGAS Digital Village</i>	Track: Education 4.0 <i>Session Chair: Dr. Victor Bong Nee Shin</i> <i>Venue: Event Room, 1st Floor, TEGAS Digital Village</i>
11:20am	Detection of Artificially Generated Facial Images using Ensemble Learning (Face-to-Face) Mr. Khaled Yahya Mohamed Mahmoud ELKarazle Swinburne University of Technology Sarawak Campus, Malaysia	Using Unmanned Aerial Vehicles for Traffic Flow Analysis at Large Multi-Lane Roundabout (Virtual) Dr. Elizabeth Chong Eu Mee Swinburne University of Technology Sarawak Campus, Malaysia	Online Learning: Students' Barriers and Feedback on the Instructional Delivery Methods (Virtual) Dr. Nor Azalina Rosli Universiti Malaysia Sarawak, Malaysia, Malaysia
11:40am	Recent progress on artificial intelligence application for COVID-19 monitoring and mitigation system in Indonesia (Virtual) Dr. Yanuar Zulardiansyah Arief Universiti Malaysia Sarawak, Malaysia	Adoption of modular MEP for the Construction Industry in Singapore (Virtual) Mr. Tan Hee Wee HWT Engineering and Construction Consulting, Malaysia	Geoeducation 4.0 Augmented reality in the new reality (Face-to-Face) Dr. Choo Chung Siung Swinburne University of Technology Sarawak Campus, Malaysia

12:00pm	<p>A Systematic Literature Review on Determining the effectiveness of short-term COVID19 prediction models (Virtual)</p> <p>Dr. T. Ramraj Coimbatore Institute of Technology, India</p>	<p>The influence of weather regimes on Off-grid Peer-to-Peer Energy Trading (Face-to-Face)</p> <p>Dr. Alan Ling Sieng Yew Universiti Malaysia Sarawak, Malaysia</p>	<p>Rapid Transition from Offline to Online: The Teaching and Learning Experience in Engineering Education (Virtual)</p> <p>Dr. Koh Yit Yan Newcastle University Institute of Higher Education Pte. Ltd., Singapore</p>
12:20pm	<p>Data Analysis of Fly Ash Geopolymer Compressive Strength Using Machine Learning Method (Face-to-Face)</p> <p>Dr. Idawati Ismail Universiti Malaysia Sarawak, Malaysia</p>	<p>Investigation of Voltage Profile Variation and Stability of PV-Grid Interconnected System (Virtual)</p> <p>Associate Professor Ir. Dr. Yun Li Go Heriot-Watt University Malaysia Campus, Malaysia</p>	<p>Track: Engineering Computing</p> <p>Task-Based Multidimensional Data Visualization Framework for Diabetes Management (Virtual)</p> <p>Mr. Low Lip Shen Swinburne University of Technology Sarawak Campus, Malaysia</p>
12:40pm	<p>Track: Automation and Sensors (Virtual)</p> <p>Early Warning Exposure</p> <p>Mr. Anderson Kho Ngap Chai Swinburne University of Technology Sarawak Campus, Malaysia</p>	<p>Solar Photovoltaic Thermal Profiles Development and Visualization: Experimental, Numerical Analysis and Validation (Virtual)</p> <p>Associate Professor Ir. Dr. Yun Li Go Heriot-Watt University Malaysia Campus, Malaysia</p>	<p>Track: Engineering Computing</p> <p>Reverse Drug Discovery Web Portal (RDD) (Virtual)</p> <p>Dr. Brian Loh Chung Shiong Swinburne University of Technology Sarawak Campus, Malaysia</p>
1:00pm	Lunch		

Technical Session 2 (Cont'd)			
	<p>Track: Automation and Sensors</p> <p><i>Session Chair: Dr. Almon Chai Wei-Yen</i></p> <p><i>Venue: Training Room, 1st Floor, TEGAS Digital Village</i></p>	<p>Track: Smart Energy and Cities</p> <p><i>Session Chair: Dr. Daniel Looi Ting Wee</i></p> <p><i>Venue: Auditorium, Ground Floor, TEGAS Digital Village</i></p>	<p>Track: Simulation and Optimization</p> <p><i>Session Chair: Dr. Victor Bong Nee Shin</i></p> <p><i>Venue: Event Room, 1st Floor, TEGAS Digital Village</i></p>
2:00pm	<p>An Intelligent Monitoring and Maintenance System for Wind Turbine Foundations (Virtual)</p> <p>Mr. Liam Bekir RMIT University Melbourne, Australia</p>	<p>Development of smart HVAC thermostat with AI using visual detector for energy saving (Face-to-Face)</p> <p>Associate Professor Dr. Basil T. Wong Swinburne University of Technology Sarawak Campus, Malaysia</p>	<p>Simulation on Application of EMG Signals for DC Motor Control (Virtual)</p> <p>Dr. Evon Lim Wan Ting Swinburne University of Technology Sarawak Campus, Malaysia</p>
2:20pm	<p>Temperature Modulation of Metal Oxide Semiconductor Gas Sensors for Black Pepper Geo-tracing (Face-to-Face)</p> <p>Associate Professor Dr. Hong Siang Chua Swinburne University of Technology Sarawak Campus, Malaysia</p>	<p>UAV-based lane-changing reduction using traffic video analyser (Face-to-Face)</p> <p>Ms. Bong Jit Boon Swinburne University of Technology Sarawak Campus, Malaysia</p>	<p>Simulating Sensor Data to Inform Digital Twin of an On-Shore Wind Turbine Foundation (Virtual)</p> <p>Mr. Christiaan Pietropoli RMIT University Melbourne, Australia</p>
2:40pm	<p>Investigation of the Effect of Polyvinyl Acetate Coating on Multiple U-shaped Fibre Optic Sensors in Different Solution Conditions (Virtual)</p> <p>Mr. Alfred Jia Yee Tan Swinburne University of Technology Sarawak Campus, Malaysia</p>	<p>Development of Intelligent Control for Lower Limb (Virtual)</p> <p>Ms. Siti Nur Hanisah binti Zuhari Universiti Malaysia Sarawak, Malaysia</p>	<p>On the Impact of the Radio Hub Placement for 10Å—10 mesh-WiNoC Architecture (Virtual)</p> <p>Mr. Asrani Lit Universiti Malaysia Sarawak, Malaysia</p>
3:00pm	Break		

Plenary 6: Education 4.0

	<p>Chair: Associate Professor Dr. Ida Fatimawati bt Adi Badiozaman, Executive Dean (Research) - Interim & Associate Professor, Faculty of Business, Design and Arts, Swinburne University of Technology Sarawak Campus, Malaysia</p> <p>The digital industrial revolution has been brought into the classroom, accelerated by the advent of the COVID-19 pandemic. IR4.0 has not only changed the talents needed by the engineering industry; learning has become democratised and more accessible. This leads to learning innovations incorporating IR4.0 tech, i.e. Education 4.0. The traditional educational approaches indeed need a make-over at making students skill-ready for the ever-evolving industrial revolution. Some of the main questions to be addressed in this plenary session are “How does Industry 4.0 affect the education industry, especially in engineering?”, “How can education institutions equip engineering students for IR4.0?”, and “What innovations are there to enhance learning in a digital engineering world?”</p>
3:20pm	<p>Education with Purpose and Impact Professor Dr. Mou Ling Dennis Wong (Virtual) Dean Deputy Provost, Heriot-Watt University Malaysia, Malaysia</p>
3:50pm	<p>Shifting from Education 3.0 to Education 4.0 Professor Dr. Nor Aziah Alias (Virtual) Professor of Teaching and Learning, Universiti Teknologi MARA (UiTM) & Member, Malaysian Society for Higher Education Policy and Research Development (PenDaPaT), Malaysia</p>
4:20pm	<p>Education Challenges For Society 5.0 Mr. Jamiran bin Salam Special Administrative Officer, Ministry of Education, Innovation and Talent Development (MEITD) Sarawak, Malaysia</p>
4:50pm	Questions and Answers session
Closing Ceremony	
5:20pm	Closing Remarks by The Honourable Datuk Roland Sagah, Minister of Education, Innovation and Talent Development Sarawak, Malaysia
5:50pm	End of AAEC2022