Vol.59 | No.1 | 2024

The Malaysian Surveyor

Shaping Tomorrow with AI Geospatial Innovation, and Built Environment Technology

EDITORIAL

Ts. Sr KHOO SUI LAI,
CQS, FRISM, FRICS
CHIEF EDITOR

Greetings from the Editorial Board, Royal Institution of Surveyors Malaysia (RISM)

As we navigate the ever-evolving landscape of our profession, it is evident that we stand at the forefront of a transformative era in surveying and the built environment. This issue of The Malaysian Surveyors magazine is dedicated to the theme "Shaping Tomorrow with AI, Geospatial Innovation, & Built Environment Technology," reflecting the profound impact these advancements have on our industry and society.

Artificial Intelligence is revolutionising how we approach complex challenges. From predictive analytics that enhance decision-making to machine learning algorithms that optimise workflows, AI offers unprecedented opportunities for efficiency and precision. It enables surveyors to analyse vast datasets, revealing previously unimaginable insights. As we embrace these technologies, we must also consider the ethical implications and the importance of maintaining the human element in our work.

Geospatial innovation is another critical component shaping our future. With the advent of advanced mapping tools, drone technology, and real-time data collection, we are empowered to visualise our environments like never before. These innovations facilitate better planning and management of resources, enabling us to create more sustainable and resilient communities. Professionals must leverage these tools to drive meaningful change in urban development and environmental stewardship.

The intersection of AI and geospatial technology is where the magic happens. Imagine a world where data from multiple sources converges to inform urban planning, disaster management, and infrastructure development. This synergy enhances our capability to shape environments and fosters collaboration across disciplines, ensuring that we address the complex challenges of tomorrow with holistic solutions.
As we delve into these themes, I encourage you to consider how we can leverage these technologies to drive innovation and elevate our practices. The future of surveying hinges on our ability to embrace new tools and adapt to emerging trends, while staying true to our core values of accuracy, integrity, and commitment to serving our communities.

In conclusion, let us seize the opportunities presented by AI, geospatial innovation, and advancements in built environment technology. Together, we can shape a future that is efficient, productive, sustainable, and resilient. I encourage you to explore the articles, share your insights, and actively participate in discussions that drive our profession toward growth and excellence.

Thank you for your continued support and dedication to excellence in surveying.

EDITORIAL BOARD

EDITORIAL BOARD
SESSION 2024/2025

PRESIDENT
Sr Dr. Ahmad Sanusi Bin Che Cob
P.S.K, FRISM

DEPUTY PRESIDENT
Sr Wan Ainon Zuraiha Binti Wan Abdul Khalid
CQS, FRISM, MRICS

HON. SECRETARY GENERAL
Sr Choy Yue Kwong
FRISM, FPEPS, ICVS, MRICS

HON. TREASURER GENERAL
Sr Steven Pang Ching Chooi
A.M.N., FRISM, MRICS

EDITORIAL BOARD

CHAIRMAN
Ts. Sr Khoo Sui Lai
CQS, FRISM, FRICS

SECRETARY
Assistant Professor Ts Sr Dr Nadzirah Binti Zainordin
CQS, FRISM

BOARD MEMBERS

Sr Dr. Loo Siaw Chuing	**QS Division**
Sr Mohamad Shazali Bin Sulaiman	**QS Division**
Dr. Myzatul Aishah Binti Hj Kamarazaly	**QS Division**
Sr Dr. Nurshuhada Binti Zainon	**QS Division**
Assoc. Prof. Sr Dr. Khairul Nizam bin Tahar	**GLS Division**
Sr Ts. Dr. Mohd Asrul bin Hassin	**BS Division**
Sr Dr. Elia Syarafina Binti Abdul Shakur	**PS Division**

SECRETARIAT
Esther Teo
Nor Diyana Binti Abd Kadir
Siti Noor Hanie Binti Salleh

ROYAL INSTITUTION OF SURVEYORS MALAYSIA

No. 64 & 66, 3rd Floor,
Bangunan Juruukur, Jalan 52/4,
46200 Petaling Jaya,
Selangor Darul Ehsan, Malaysia
t: +603 7954 8358/ 7956 9728/ 7955 1773
f: +603 7955 0253
e: editor@rism.org.my
w: www.rism.org.my

PUBLISHING & CREATIVE
Azmir Bin Othman
azmir85i@gmail.com

TABLE OF CONTENTS

INTERVIEW WITH THE PRESIDENT OF RISM

Sr Dr. AHMAD SANUSI BIN CHE COB

SUCCESS IS OUR MISSION

Shaping Tomorrow with AI, Geospatial Innovation, and Built Environment Technology

As the President of RISM session 2024/2025, what role do you see AI and geospatial innovations playing in transforming the surveying profession in the next decade?

AI and geospatial innovations will revolutionise surveying by enhancing efficiency and accuracy. Tools like drones and advanced mapping provide real-time insights for better decision-making in urban planning and infrastructure. By integrating these advancements with traditional skills, the profession remains impactful, expanding its ability to analyze and apply spatial data effectively in the years ahead.

Your background in land surveying gives you a unique perspective. How do you plan to leverage cutting-edge technologies like AI to enhance traditional surveying practices?

That's an insightful question. With a strong foundation in land surveying, I recognising the need to uphold accuracy and precision. AI offers an exciting avenue to modernise our practices by automating routine tasks and enhancing data analysis. Crucially, it's about integrating AI with the expertise of skilled surveyors. This approach preserves our profession's foundational principles while pushing boundaries, ensuring efficiency, scalability, and the delivery of high-quality results.

With advancements in geospatial technology, such as drones and 3D mapping, what steps can RISM take to ensure that surveyors are equipped with the necessary skills to stay ahead in the industry?

RISM must equip surveyors with cross-discipline training in emerging technologies like drones, 3D mapping, BIM, and AI-powered tools. Tailored programs can ensure geomatic, building, property, and quantity surveyor stay ahead, leveraging advancements to enhance precision, efficiency, and relevance across diverse industry challenges.

THE PRESIDENT OF RISM

How can AI and geospatial innovations contribute to the future of Malaysia's built environment, particularly in addressing challenges related to urbanisation and infrastructure development?

I believe AI and geospatial innovations will be key in shaping Malaysia's built environment. With rapid urbanisation, smarter management of resources is essential. AI can analyze data on traffic, population, and land use, while geospatial tools like 3D mapping provide real-time insights. Together, these technologies will help create more efficient, sustainable cities.

As Deputy Chief Director of Survey and Mapping Malaysia, how do you envision the integration of AI-driven geospatial tools in national mapping projects to improve accuracy and efficiency?

As Deputy Chief Director of Survey and Mapping at JUPEM, we're definitely working on integrating AI into our national mapping efforts, but we have to make sure it meets our specific requirements. The key is that while AI can speed up processes like data analysis and map updates, human intervention is still needed to double-check everything. At JUPEM, our products are known for being highly reliable, so we can't just let AI do everything on its own. We always run final checks to make sure the data is accurate before anything gets published. It's about combining the efficiency of AI with the expertise of our surveyors to maintain that high standard.

What initiatives do you plan to promote within RISM to encourage greater collaboration between geospatial professionals and AI experts in advancing smart city development in Malaysia?

To promote collaboration between geospatial professionals and AI experts, I plan to organising a workshops, hackathons, and mentorship programs. These initiatives will encourage idea exchange and networking, driving innovation in smart city development. By fostering collaboration, we aim to create well-rounded solutions that address urban challenges and advance Malaysia's smart city initiatives.

AI is revolutionising data analysis in many fields, including surveying. How do you see AI transforming decision-making processes for surveyors working on large infrastructure projects?

AI is set to revolutionising decision-making in large infrastructure projects by processing vast datasets, identifying patterns, and suggesting optimal designs. While AI enhances efficiency, the expertise of surveyors remains crucial for interpreting data and applying insights accurately, ensuring the best outcomes in complex projects.

What policies or frameworks do you believe are necessary to ensure the ethical and effective implementation of AI in the surveying and geospatial sectors in Malaysia?

To ensure the ethical use of AI in surveying and geospatial sectors in Malaysia, clear ethical guidelines on data privacy and fairness are essential. Regulatory standards, regular audits, and human oversight are necessary, along with ongoing training for professionals to effectively integrate AI while maintaining trust and expertise.

How do you think the combination of AI and geospatial innovations can enhance Malaysia's preparedness for future environmental challenges, such as coastal erosion or flood management?

In response on how AI and geospatial tools can help with environmental challenges, I believe these technologies play a key-roles in predicting issues like erosion and flooding. AI analyses data from satellite imagery and drones, while geospatial tools allow for detailed mapping. Together, they enable smarter planning and quicker responses, helping to protect communities and ecosystems in Malaysia.

What advice would you give to young surveyors entering the field, particularly in embracing new technologies like AI and geospatial tools, while maintaining the core principles of land surveying?

For young surveyors, my advice is to embrace new technologies like AI and geospatial tools while staying grounded in the core principles of accuracy, ethics, and land understanding. Keep refining your skills, network with experienced professionals, and be adaptable. The field is evolving, so stay curious and open to learning for success.

EXPERIENCE IN GEOMATICS AND GEOSPATIAL INDUSTRY

How do you see the role of geospatial technologies evolving in shaping the future of the built environment in Malaysia, especially in the context of smart city development?

Geospatial technologies will play a crucial role in shaping Malaysia's future built environment, particularly in smart city development. These tools enable real-time data collection and analysis for better urban planning, resource management, and sustainability. By integrating IoT and GIS, we can optimize infrastructure and improve residents' quality of life, ensuring smarter, more efficient cities.

Given the rise of artificial intelligence and automation in geospatial analysis, what impact do you think these technologies will have on traditional surveying methods in the next decade?

AI and geospatial technologies will significantly enhance surveying efficiency and accuracy, speeding up project completion and improving data quality. AI automates tasks like data analysis, aiding decision-making in complex projects. Drones and advanced mapping software enable faster, real-time data collection. However, human expertise remains essential for validating AI data and ensuring informed decisions.

Sustainability is a major focus globally. How can geomatics and geospatial technologies contribute to Malaysia's efforts in sustainable development and climate resilience?

In my view, geomatics and geospatial technologies are essential in supporting Malaysia's sustainability and climate resilience efforts. By using GIS to monitor resources like forests, water, and wildlife, we can make informed decisions about urban planning and resource management. Additionally, these technologies help model environmental impacts, improving disaster management and infrastructure resilience against extreme weather.

What do you believe are the key challenges in implementing advanced geospatial technologies like drones, LiDAR, and 3D mapping in large-scale infrastructure projects across Malaysia?

In my view, there are several key- challenges in implementing advanced geospatial technologies like drones, LiDAR, and 3D mapping in large-scale infrastructure projects. First, cost is a significant barrier due to the high investment required for both equipment and training. Second, navigating the complex regulatory environment and securing permits can be time-consuming. Data integration also poses a challenge when merging new data with existing systems. Lastly, ensuring the workforce has the necessary skills to operate these technologies effectively is crucial. Addressing these challenges is essential for successful implementation.

With Malaysia's push towards digital transformation, how do you envision the integration of geospatial innovations in public policy, infrastructure planning, and land management?

From my perspective, integrating geospatial innovations into public policy, infrastructure planning, and land management can greatly improve efficiency. Geospatial data helps policymakers visualise complex issues, like urban growth and environmental risks, ensuring more informed decisions. Tools like 3D mapping and drones enhance infrastructure planning, while GIS and LiDAR support better land management and sustainability.

The demand for skilled geomatics professionals is rising globally. What steps do you think should be taken to ensure Malaysia's workforce remains competitive in the evolving global geospatial industry?

To keep Malaysia's geomatics professionals competitive globally, we must focus on continuous education, upskilling in new technologies like AI, drones, and GIS. Offering hands-on experiences, fostering innovation, and supporting research through government initiatives will ensure the workforce stays adaptable and skilled to meet evolving industry demands.

Data privacy and security are significant concerns in the geospatial field. What measures do you think should be in place to ensure the responsible use of geospatial data, especially when it comes to mapping and monitoring sensitive areas?

To ensure the responsible use of geospatial data, especially in sensitive areas, strong data governance policies must be implemented, focusing on access control and legal compliance. Anonymisation, encryption, and regular security training for professionals will further safeguard privacy and security, ensuring responsible data handling and mitigating risks.

How do you see geomatics playing a role in enhancing disaster management and mitigation efforts, particularly in vulnerable coastal and flood-prone regions of Malaysia?

It appears to me the use of effective mapping and monitoring through technologies like GIS and remote sensing can assist in creating hazard maps to identify at-risk regions, while real-time data collection from drones and sensors allows for swift assessments during disasters. Not only that, engaging communities with accessible geospatial information empowers them to prepare better for emergencies or I shall say the crowd sourcing movement. And also integrating geospatial data into emergency planning guarantees resourceful resource allocation and evacuation strategies and in the end improving the country's disaster response capabilities.

What role do you think geospatial technologies can play in addressing rural-urban disparities in infrastructure and development, especially in Malaysia's remote areas?

In my view, geospatial technologies play a crucial role in addressing rural-urban disparities in Malaysia's remote areas. By providing accurate data on population, land use, and infrastructure, these tools help identify areas lacking essential services. GIS and satellite imagery also track development progress, while participatory mapping ensures that community needs are met, making infrastructure projects more effective and aligned with local priorities.

As someone with extensive experience in geomatics, what do you think are the most significant advancements in geospatial technology that professionals should be aware of to remain relevant in the field?

My take is that we must always stay update with the latest technologies to keep our profession relevant and impactful. Professionals in geomatics should stay update with key advancements like AI, machine learning, drones, UAVs, and LiDAR technology. These tools enhance data processing, mapping, and surveying, offering real-time, high-resolution results and detailed 3D models. Additionally, cloud-based GIS platforms simplify data storage and collaboration. Remaining proactive and curious is essential to staying relevant in the evolving field.

DIGITALISATION STRATEGIES IN QUANTITY SURVEYING

Leading Smart Nation Initiatives for Forensic Quantity Surveying and Sustainable Smart Cities

Ts. Sr Khoo Sui Lai,
CQS, FRISM
Head of Department Quantity Surveying, School of Architecture & Built Environment , UCSI University, KL Campus

Asst. Professor Ts. Sr Dr. Nadzirah Hj. Zainordin
Head of Research & Postgraduate Studies, School of Architecture & Built Environment, UCSI University, KL Campus

PP Sr Dainna Baharuddin
CQS, PPRISM
Director, Basar & Harun Sdn Bhd
Past President, Royal Institution of Surveyors Malaysia

A brief

The 21st century has witnessed an unprecedented surge in digital transformation across various industries, and Quantity Surveyor (QS) is no exception. In the context of smart nations and smart cities, the integration of digital technologies into quantity surveying practices plays a crucial role in enhancing efficiency, accuracy, and sustainability. This essay explores the significance of digitisation in quantity surveying and its role in advancing smart nation initiatives, particularly in the realms of forensic QS and the development of sustainable smart cities.

Digitalisation in Quantity Surveying

Digitisation in quantity surveying encompasses the adoption of various technologies and tools to streamline processes, improve data accuracy, and enhance decision-making. Building Information Modeling (BIM), for instance, revolutionizes traditional QS practices by providing a collaborative platform for stakeholders to visualize, simulate, and manage building projects throughout their lifecycle. BIM enables QS professionals to extract accurate quantities, assess cost implications, and identify potential clashes or discrepancies in design, thus minimizing errors and delays. Furthermore, the use of digital measurement tools and software facilitates faster and more precise quantity take-offs, cost estimations, and tender analysis. Cloud-based QS platforms offer real- time collaboration and data sharing among project teams, ensuring seamless communication and project management. These digital tools not only enhance productivity but also enable QS professionals to focus more on value-added tasks such as cost optimization, risk management, and sustainability assessment.

> ***"Digitalisation in Quantity Surveying, what are the challenges?***

In the realm of Quantity Surveying (QS), digitalisation offers numerous benefits, but it also comes with its share of challenges.

Here are some of the key challenges associated with digitalisation in quantity surveying:

1. Initial Costs and Investment: Implementing digital tools and technologies requires significant initial investment in software, hardware, and training. Small and medium-sized firms may find it challenging to allocate resources for this purpose.
2. Training and Skill Gaps: QS professionals need to acquire new skills and competencies to effectively use digital tools such as Building Information Modelling (BIM), cost estimating software, and data analytics platforms. Lack of training opportunities and resistance to change among employees can hinder successful adoption.
3. Data Quality and Integration: Digitalization relies heavily on accurate and standardized data. QS professionals may face challenges in ensuring data quality, consistency, and interoperability across different software platforms and project stages.
4. Cybersecurity Risks: With the digitization of project data and communication channels, cybersecurity becomes a critical concern. QS firms need to implement robust cybersecurity measures to protect sensitive project information from cyber threats and data breaches.
5. Legal and Regulatory Compliance: QS professionals must comply with various legal and regulatory requirements related to data privacy, intellectual property rights, and professional standards. Navigating these regulations in the digital environment can be complex and time- consuming.
6. Resistance to Change: Some stakeholders, including clients, contractors, and subcontractors, may be resistant to adopting digital technologies due to unfamiliarity, scepticism, or concerns about additional costs or complexity.
7. Interdisciplinary Collaboration: Successful digitalization in quantity surveying requires collaboration with other disciplines such as architects, engineers, and contractors. Ensuring effective communication and collaboration among multidisciplinary teams can be challenging, particularly when working with different software platforms and standards.
8. oftware Compatibility and Vendor Lock-in: QS firms may encounter issues with software compatibility and interoperability, especially when working with multiple software vendors. Vendor lock-in, where firms become dependent on a single software provider, can limit flexibility and increase long-term costs.
9. Sustainability and Environmental Impact: While digitalization can improve efficiency and reduce paper usage, it also has environmental implications, such as energy consumption and electronic waste generation. QS firms need to consider the sustainability aspects of digital technologies and strive to minimize their environmental footprint.
10. Digital Divide and Access to Technology: Disparities in access to technology and digital skills among QS professionals, particularly in developing regions, can widen the digital divide. Ensuring equitable access to digital tools and training is essential for inclusive digitalization efforts.

Addressing these challenges requires a strategic approach that involves investment in training, technology infrastructure, and cybersecurity measures, as well as fostering a culture of innovation and collaboration within QS firms and across the construction industry.

Forensic QS Digitalisation

In the field of forensic QS, digitalisation plays a pivotal role in analysing complex construction disputes, claims, and contract issues. Digital tools such as 3D laser scanning, drones, and photogrammetry enable QS professionals to capture precise as-built data, assess construction defects, and document evidence for dispute resolution. Advanced software for schedule analysis and cost tracking helps identify delays, disruptions, and cost overruns, providing critical insights into project performance.

Moreover, digital platforms facilitate the management of vast amounts of project data, contracts, and documents, making it easier to trace and analyse discrepancies or deviations from contractual agreements. This enhances transparency, accountability, and auditability in construction projects, reducing the likelihood of disputes and enhancing stakeholder trust.

Forensic Quantity Surveying and Digitalisation, what are the challenges?

Incorporating digitalisation into Forensic Quantity Surveying practices presents several challenges, despite its potential benefits. Here are some of the key challenges associated with digitalization in Forensic Quantity Surveying:

1. Data Quality and Integrity: One of the primary challenges is ensuring the quality and integrity of digital data used in forensic QS. Digital evidence, such as as-built drawings, schedules, and cost records, must be accurate, complete, and reliable. However, inconsistencies or inaccuracies in digital data can compromise the validity of forensic analyses.
2. Complexity of Digital Evidence: Digital evidence in construction projects can be complex and voluminous, including various file formats, versions, and sources. QS professionals must navigate through this complexity to identify relevant evidence and interpret it accurately. Managing and organizing large volumes of digital data for analysis can be challenging and time-consuming.
3. Legal Admissibility: Ensuring the legal admissibility of digital evidence poses a significant challenge in forensic QS. QS professionals need to adhere to legal standards and protocols to ensure that digital evidence is admissible in court. This involves documenting the chain of custody, maintaining data integrity, and following accepted forensic procedures.
4. Technical Expertise: Digital forensic analysis requires specialized technical skills and expertise. QS professionals need to be proficient in using digital tools and software for data extraction, analysis, and presentation. However, acquiring and maintaining these technical skills can be challenging, especially for professionals with limited exposure to digital technologies.
5. Cost and Resource Constraints: Implementing digital forensic techniques can be costly, particularly for small and medium-sized QS firms. Acquiring software licenses, hardware, and training resources can strain limited budgets. Additionally, dedicating sufficient time and resources for digital forensic investigations may not always be feasible, especially for firms with tight deadlines or competing priorities.
6. Data Privacy and Confidentiality: Digital evidence in forensic QS often contains sensitive and confidential information related to clients, projects, and contractual agreements. QS professionals must ensure compliance with data privacy regulations and maintain strict confidentiality throughout the forensic process. Protecting digital evidence from unauthorized access or disclosure is essential to preserve client trust and reputation.
7. Interoperability and Compatibility: Digital forensic investigations may involve analyzing data from various sources and formats, such as CAD files, spreadsheets, and project management software. Ensuring interoperability and compatibility among different software platforms and file formats can be challenging. QS professionals may encounter difficulties in integrating and analyzing data from disparate sources effectively.
8. 8. Evolving Technology and Standards: The rapid evolution of digital technologies and forensic standards presents another challenge for forensic QS professionals. Keeping abreast of the latest developments in digital forensic techniques, tools, and standards requires ongoing training and professional development. Failure to adapt to these changes may result in outdated forensic practices or methodologies.

Addressing these challenges requires a strategic approach that includes investing in training and technology infrastructure, establishing standardized forensic procedures, and fostering collaboration with digital forensic experts and legal professionals. By overcoming these challenges, forensic QS professionals can harness the full potential of digitalization to enhance the accuracy, efficiency, and credibility of forensic investigations in the construction industry.

Smart Cities and Digitisation

In the context of smart cities, quantity surveying plays a significant role in ensuring the cost-effectiveness, sustainability, and resilience of urban infrastructure projects. Digital technologies enable QS professionals to assess the life-cycle costs of infrastructure assets, optimize resource utilization, and incorporate sustainability principles into project designs. BIM-enabled smart city models facilitate urban planning, infrastructure management, and predictive maintenance, leading to more efficient and sustainable cities. Furthermore, the integration of Internet of Things (IoT) devices and sensors into built environments generates vast amounts of data on energy consumption, occupancy patterns, and environmental conditions. QS professionals can leverage this data to optimize building performance, minimize operational costs, and enhance user comfort and well-being. Additionally, digital twins allow for real-time monitoring and simulation of urban systems, enabling proactive decision-making and rapid response to emerging challenges such as climate change and urbanization.

Smart Cities and Digitisation, what are the challenges faces by Quantity Surveyor (QS)?

In the context of Smart Cities and digitisation, QS face several challenges that affect their roles and practices. Here are some of the key challenges:

Integration of BIM and Smart City Initiatives: Many Smart City projects rely on Building Information Modelling (BIM) for design, construction, and operation. However, integrating BIM with Smart City initiatives poses challenges for QS professionals. They need to adapt to new BIM processes, workflows, and standards,and ensure seamless integration of BIM data with other smart technologies used in urban development projects.

Data Management and Analysis: Smart Cities generate vast amounts of data from various sources, including sensors, IoT devices, and digital platforms. QS professionals must manage, analyse, and interpret this data to support decision- making in areas such as cost estimation, resource optimization, and asset management. However, handling big data and ensuring data quality and integrity present significant challenges for QS professionals.

Interdisciplinary Collaboration: Smart City projects involve collaboration among various stakeholders, including architects, engineers, urban planners, and policymakers. QS professionals need to collaborate effectively with these multidisciplinary teams to ensure that cost considerations are integrated into Smart City planning and implementation. However, coordinating with diverse stakeholders and managing conflicting priorities can be challenging.

Cost Estimation for Smart Technologies: Smart City projects often incorporate innovative technologies such as IoT, AI, and renewable energy systems. Estimating the costs associated with these technologies accurately can be challenging for QS professionals due to limited historical data, evolving technology standards, and uncertainties in implementation. QS professionals must develop new cost estimation methodologies and benchmarks for emerging smart technologies.

Complexity of Sustainable Infrastructure: Smart Cities aim to develop sustainable urban infrastructure that promotes environmental stewardship and resource efficiency. QS professionals play a crucial role in assessing the life-cycle costs of sustainable infrastructure projects and optimizing resource utilization. However, the complexity of sustainable infrastructure, such as green buildings, renewable energy systems, and smart transportation networks, presents challenges in cost estimation, value engineering, and risk assessment.

Regulatory Compliance and Standards: Smart City projects must comply with various regulatory requirements, standards, and certifications related to safety, quality, and environmental sustainability. QS professionals need to stay updated on regulatory changes and ensure that project costs align with compliance requirements. However, navigating complex regulatory frameworks and ensuring compliance with evolving standards can be challenging for QS professionals.

Digital Skills and Training: Embracing digitization in Smart City projects requires QS professionals to acquire new digital skills and competencies. They need to be proficient in using BIM software, cost estimation tools, data analytics platforms, and project management software. However, the lack of digital skills and training opportunities within the QS profession can hinder the adoption of digital technologies in Smart City projects.

Risk Management and Uncertainty: Smart City projects involve inherent risks and uncertainties, such as technological obsolescence, cyber threats, and market volatility. QS professionals need to assess and manage these risks effectively to ensure project success. However, quantifying and mitigating risks associated with emerging smart technologies and complex urban systems can be challenging for QS professionals.

Addressing these challenges requires QS professionals to embrace lifelong learning, adapt to digital technologies, foster interdisciplinary collaboration, and develop innovative approaches to cost estimation and risk management. By overcoming these challenges, QS professionals can play a pivotal role in realizing the vision of sustainable and resilient Smart Cities.

Key-take away

In conclusion, digitisation is transforming quantity surveying practices and driving smart nation initiatives towards greater efficiency, transparency, and sustainability. Through the adoption of BIM, digital measurement tools, and advanced software, QS professionals can optimize project delivery, mitigate risks, and enhance stakeholder value. In the context of Forensic Quantity Surveying, digitalisation enables thorough analysis and resolution of construction disputes, while in smart cities, it facilitates the development of resilient and sustainable urban infrastructure. Embracing digitisation in quantity surveying is not only essential for staying competitive in the digital age but also for contributing to the advancement of smart nations and sustainable urban development.

References

1. Akintoye, A., Beck, M., & Hardcastle, C. (2003). Public and private sector professional service firms' responses to the global market: a comparative study of quantity surveying practices in the UK and Nigeria. Construction Management and Economics, 21(2), 143-152.
2. Al-Jibouri, S. H. S., & Turner, M. (2003). Key performance indicators for construction processes. Engineering, Construction and Architectural Management, 10(5), 315-322.
3. Arayici, Y., Coates, P., Koskela, L., Kagioglou, M., Usher, C., & O'Reilly, K. (2011).Technology adoption in the BIM implementation for lean architectural practice. Automation in Construction, 20(2), 189-195.
4. Bajaj, M., & Anand, S. (2020). Forensic cost control in construction projects: a critical review. Engineering, Construction and Architectural Management, 27(10), 2391-2412.
5. European Commission. (2019). Towards a European Green Deal. Retrieved from *https://eur-lex.europa.eu/resource.html?uri=cellar:438f2b88-f8b6-11e9-a8ed- 01aa75ed71a1.0001.02/DOC_1&format=PDF*
6. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). (2020). Smart Cities made in Germany. Retrieved from https://www.bmub.bund.de/fileadmin/Daten_BMU/Pools/Broschueren/smart_cities_made_i n_germany_en_bf.pdf
7. Hsieh, P. H., Lu, S. T., Lu, W. Y., & Shang, H. Y. (2016). The application of digital twins for a BIM-based green building performance evaluation. Journal of Civil Engineering and Management, 22(4), 540-550.
8. Jallow, A. K., Dawood, N. N., & Kassem, M. (2018). Integration of BIM and GIS for sustainable urban planning and development. Journal of Urban Technology, 25(4), 75-94.
9. Kamardeen, I., & Goulding, J. S. (2013). Application of Building Information Modeling in Facilities Management. Journal of Facilities Management, 11(1), 19-34.
10. Li, H., Wu, P., & Shen, G. Q. (2020). Digital twins for sustainable building management: A critical review. Journal of Cleaner Production, 257, 120558.
11. Lu, Y., Wang, X., Yang, H., & Wang, Q. (2020). Integrated application of BIM and digital twins in building energy management. Journal of Cleaner Production, 261, 121240.
12. Shafiq, N., Farooq, S., & Rana, S. (2018). Digital twins: The convergence of multimedia technologies. Multimedia Tools and Applications, 77(12), 15257-15288.
13. Wang, Y., Jia, Y., & Li, Z. (2020). A comprehensive review of digital twins: State-of-the-art technology and future opportunities. IEEE Access, 8, 137630-137651.
14. World Economic Forum. (2020). Realizing the Potential of Urban Digital Transformation. Retrieved from https://www.weforum.org/reports/realizing-the-potential-of-urban-digital- transformation.

ENHANCING ENERGY EFFICIENCY AND CONSERVATION IN MALAYSIAN UNIVERSITIES THROUGH ARTIFICIAL INTELLIGENCE (AI)-DRIVEN MONITORING SYSTEM: *A WAY FORWARD*

Assoc. Prof. Sr Dr. Nur Azfahani Ahmad
Senior Lecturer, RBS, MRISM,
Program of Building Surveying,
Department of Built Environment Studies & Technology, College of Built Environment,
UiTM Perak Branch,
Seri Iskandar Campus, Perak

Sr Ts. Dr. Mohd Asrul Hassin
Senior Lecturer, RBS, MRISM,
Program of Building Surveying,
Department of Built Environment Studies & Technology,
College of Built Environment,
UiTM Perak Branch,
Seri Iskandar Campus, Perak

Sr Ts. Muhammad Hilmi Dzulkefli
Facilities Manager and Energy Manager
GFM Services Berhad

Abstract

Energy efficiency and conservation are crucial elements for sustainable development, especially within academic institutions like universities, which have high energy demands. In Malaysia, the implementation of energy efficiency (EE) and energy conservation measures (ECMs) in universities can significantly reduce operational costs, lower carbon footprints, and contribute to national sustainability goals. This paper explores the potential of adopting AI-driven monitoring systems to enhance EE and ECMs in Malaysian universities. AI technology can play a significant role in real-time energy consumption monitoring, providing data-driven insights to optimize the use of electricity in various campus facilities such as classrooms, labs, and dormitories. AI-powered energy management systems can track usage patterns, identify inefficiencies, and predict peak demand times, enabling proactive decision-making. Through automated controls and predictive analytics, AI can adjust lighting, air conditioning, and heating systems to reduce unnecessary energy consumption. Additionally, AI-driven predictive maintenance can ensure that equipment like HVAC systems operate at optimal efficiency, reducing energy wastage and prolonging system lifespan. The integration of AI into energy management aligns with Malaysia's strategic vision to promote green technology and achieve carbon neutrality. By implementing such AI-powered systems, universities can set a benchmark for other institutions and lead the way in achieving sustainable campus environments. This approach also fosters innovation in student-led energy research, creating a living lab for sustainability practices while reducing operational energy costs and carbon emissions on campuses.

Keywords: AI, Energy, Energy-Efficiency, Energy Conservation, Universities

1.0 Introduction

Over the past two decades (from 2000 to 2020), energy consumption in Malaysia has significantly increased. Electricity usage in Peninsular Malaysia rose from 95,000 GWh in 2010 to 108,529 GWh in 2017 (Energy Commission, 2020). TenagaNasional Berhad, the Malaysian utility company, forecasts a 13% rise in energy demand by 2025, particularly in the electricity sector (TNB, 2022). This growth is driven by rapid national development, with key industries such as transportation, manufacturing, and construction contributing to the rising demand (Malaysia Productivity Corporation, 2022). As Malaysia's population expands, electricity demand also surges, necessitating a focus on energy efficiency to reduce consumption while maintaining output levels and minimizing carbon emissions (Energy Commission, 2020).

In institutional sectors, educational institutions consume a significant amount of energy, with universities representing a large share. Malaysia's 20 public universities, 50 private universities, and 34 private university colleges contribute significantly to national energy demand (MOHE, 2022). These institutions are major energy consumers, with high electricity costs, largely due to cooling, heating, and ventilation systems (Dzulkefli, 2020). To address these challenges, AI-driven monitoring systems offer a powerful tool to enhance energy efficiency in Malaysian universities. By leveraging AI, real-time data can be collected to optimize energy use, identify inefficiencies, and predict future demand, allowing universities to implement targeted conservation measures (SENER, 2024). AI can support Malaysia's National Energy Efficiency Action Plan (NEEAP) by helping institutions achieve their energy reduction goals through intelligent, data-driven solutions, and operational adjustments. This integration aligns with the government's energy efficiency targets under the Economic Transformation Programme (ETP) and other national blueprints for sustainable energy (KeTTHA, 2015).

To help universities achieve energy efficiency, various efforts and policies need to be introduced. In line with this, the Malaysian government, under the Economic Transformation Programme (ETP) (Malaysia, 2015), has made the reduction of electricity consumption a Key Performance Indicator (KPI) for all ministries, including the Ministry of Higher Education. Additionally, the National Energy Efficiency Action Plan (NEEAP), introduced in 2015 by the Ministry of Energy, Green Technology, and Water, was designed to tackle energy efficiency challenges more effectively (KeTTHA, 2015). The NEEAP aims for a 6% reduction in electricity demand and a savings of 50,594 GWh over a 10-year period (KeTTHA, 2015). In line with this, the Malaysian Energy Commission has rolled out numerous energy-efficiency blueprints, programs, and policies (Energy Commission, 2019).

The integration of AI technology presents a new avenue to support these initiatives. AI-driven monitoring systems offer real-time insights into energy consumption, allowing universities to automate energy-saving actions and optimize the use of electricity (Long, 2023). By analyzing consumption patterns and predicting future demands, AI can help institutions meetthe KPIs outlined by the government. This technology can also identify inefficiencies, suggesting improvements that align with NEEAP's objectives. Ultimately, AI can be atransformative tool for achieving Malaysia's energy efficiency goals, reducing electricity consumption, and ensuring more sustainable operations in educational institutions. Figure 1presents on the example of Artificial Intelligence (AI)-driven Monitoring System for energy management in a university.

Figure 1 shows a representation of an AI-powered energy management system in a university setting, illustrating how AI technology can monitor and optimize energy usage across multiple campus buildings in real-time (Abdelkader & Zidan, 2023). The control roomshows various dashboards and graphs, providing insights into energy consumption trends, peak usage periods, and automated adjustments to systems like lighting and air- conditioning. The technology not only tracks energy use but also dynamically adjusts basedon real-time data, ensuring optimal efficiency and energy conservation in line with sustainability efforts (Abdelkader & Zidan, 2023). Universities could leverage this technologyto reduce energy costs, improve sustainability, and meet national energy efficiency goals.

Figure 1: Artificial Intelligence (AI)-driven Monitoring System for energy management

2.0 THE BACKGROUND

The integration of AI-driven technology marks a new era for energy efficiency and conservation in Malaysian universities. Currently, universities in Malaysia face significant energy demands, with substantial electricity costs attributed to cooling, heating, ventilation, and lighting systems. Traditional energy management practices are often inefficient, relying on manual monitoring and basic automation. This leads to missed opportunities for real-time optimization and significant energy wastage. With the increasing student population and growing number of university campuses, the need for a more intelligent and automated energy management approach is becoming urgent. AI-powered monitoring systems provide a solution by offering real-time data analysis, enabling universities to track consumption patterns, detect inefficiencies, and implement energy-saving strategies instantly (Long,2023).

Looking ahead, AI-driven technologies have the potential to revolutionize how energy is managed in Malaysian universities. Future prospects include fully automated campuses where AI systems control energy usage based on occupancy, weather conditions, and time of day, significantly reducing unnecessary energy consumption (SENER, 2024). Predictive maintenance enabled by AI can also ensure that HVAC systems and other energy-intensive equipment are operating at optimal efficiency, minimizing downtime and energy wastage. Furthermore, AI can help universities achieve national energy efficiency targets outlined in the National Energy Efficiency Action Plan (NEEAP) and align with the government's broader sustainability goals. As AI continues to evolve, Malaysian universities can lead the way in creating energy-efficient, sustainable campuses, setting benchmarks for other sectors to follow.

2.1 The Current Scenario

The current energy landscape in Malaysia presents a growing challenge as electricity demand continues to outpace supply. According to the United Nations Development Programme (UNDP), electricity demand was forecasted to reach 18,947 MW in 2020 and is expected to rise to 23,092 MW by 2030, reflecting an increase of approximately 35% (UNDP, 2017). The Building Sector Energy Efficiency Project (BSEEP) aims to enhance energy utilization efficiency in Malaysian buildings, particularly within the commercial and government sectors, by promoting energy-efficient design for new buildings and improving operational efficiency in existing structures (UNDP, 2017). Despite existing government policies and initiatives, such as the Malaysian Standard MS 1525:2019 (Standards Malaysia, 2019) (focused on energy efficiency and renewable energy usage in non-residential buildings), there remains a significant gap between energy management practices and the growing demand for energy. The building industry, including public universities, urgently needs to establish and enforce energy performance standards (Zaid & Graham, 2017).

In response to this gap, the Malaysian Energy Commission has proposed the Energy Efficiency and Conservation Act (EECA) in 2020 (Government of Malaysia, 2020), which aims to ensure compliance with the Building Energy Index (BEI) requirements and promote energy efficiency initiatives that target an 8% reduction in electricity consumption (Energy Commission, 2020). However, integrating AI technology into energy management practices offers a transformative solution to bridge this gap (Long, 2023). By leveraging AI-driven monitoring and management systems, universities and other institutions can optimize energy use in real-time, adapting to fluctuating demands and identifying inefficiencies proactively. This integration not only supports compliance with government initiatives but also aligns with Malaysia's broader sustainability goals, ultimately helping to mitigate the challenges posed by rising energy demand in an increasingly energy-conscious world.

2.2 The Way Forward for Energy Demand in Malaysian Universities

The way forward for managing energy demand in Malaysian universities lies in adopting a more strategic and data-driven approach to energy efficiency. The Ministry of Education (MOE) and the Ministry of Higher Education (MOHE) have already encouraged institutions to conserve energy through initiatives like energy audits, awareness campaigns, and monitoring programs (MOHE, 2022). These efforts are part of a broader national strategy, including the Ministry of Energy's goal to reduce electricity consumption by 10% across all buildings (KeTTHA, 2015). Universities, which typically face significant operational costs dueto energy consumption, stand to benefit immensely from these programs. A well-executed energy strategy can lead to savings of up to 20% on electricity bills, which typically constituteabout 5% of a university's overall operational expenses (Dzulkefli, 2020). However, achievingthese targets requires overcoming challenges such as limited awareness and exposure among university building users, including students and staff, regarding energy-saving practices (Zaid & Graham, 2017; Zakaria et al., 2016).

One of the most significant barriers to energy efficiency in Malaysian universities is the lack of high-efficiency technologies and the heavy reliance on energy-consuming systems like artificial lighting and air-conditioning (Dzulkefli, 2020). The tropical climate intensifies the energy burden due to increased cooling demands, while lighting remains a major issue, contributing to 10% to 30% of electricity consumption due to uncontrolled usage during daylight hours (Wan Abdullah et al., 2022). The solution lies in integrating AI-driven energy management systems to address these inefficiencies. AI technology can offer real-time monitoring and optimization of energy use, enabling universities to automatically adjust air-conditioning and lighting based on occupancy, daylight availability, and external temperature (Muniandi, et.al, 2024). By conducting comprehensive energy audits combined with AI-based solutions, universities can not only improve energy performance but also reduce operational and maintenance costs, ensuring long-term sustainability. This shift will not only help control energy wastage but also meet future energy demands in a more cost-effective and environmentally friendly manner (Long, 2023).

3.0. THE METHODOLOGY

In integrating energy management between energy efficiency and energy conservation across universities in Malaysia, it is best to incorporated both qualitative and quantitative approaches.

3.1 Energy Audits and Baseline Assessment:

Started with conducting comprehensive energy audits for all selected university buildings to establish a baseline for energy consumption (Zakaria, 2016). This has involved measuring energy usage patterns in different facilities (e.g., academic blocks, labs, libraries, and residential areas). Data collected from energy audits has focus on identifying high-energy-use systems like HVAC, lighting, and laboratory equipment (Dzulkefli, 2020). This step is vital for uncovering inefficiencies and setting realistic energy-saving targets.

3.2 Quantitative Data Collection and Analysis:

Quantitative methods have included monitoring energy consumption through smart meters and IoT sensors installed in critical areas in each university. For instance, continuous data collection on electricity consumption, peak usage times, and equipment performance will enable real-time insights (Ahmad, Dzulkefli and Abdul Rahim, 2023). Integrating AI-driven systems for data analytics can optimize energy management by predicting energy demand and automating energy-saving actions.

3.3 Interviews and Stakeholder Surveys:

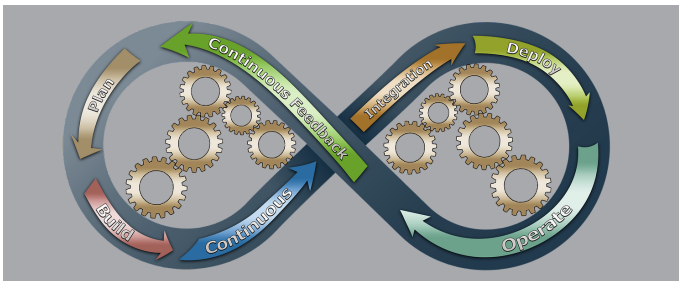
Qualitative research methods such as interviews with building managers, facility operators, and users (students, staff, and faculty) provide insights into behaviour, awareness, and challenges associated with energy conservation (Dzulkefli, 2020). These interviews and surveys help in understanding user habits, which is essential for customizing ECMs and ensuring buy-in from the university community (Ahmad, Dzulkefli and Abdul Rahim, 2023).

3.4 Experimental Design for ECM Implementation:

A pilot project in selected buildings within the universities can serve as a testbed for the ECM implementation (Ahmad, Dzulkefli and Abdul Rahim, 2023). For example, retrofitting existing systems with energy-efficient technologies (e.g., LED lighting, smart thermostats) (Latif, et.al., 2019) and testing AI integration for energy monitoring and control can reveal the most effective strategies for broader implementation (Muniandi, et.al, 2024).

3.5 Performance Monitoring and Continuous Improvement:

Using the data collected from both quantitative and qualitative approaches, universities should implement an AI-driven energy management system that continuously monitors energy performance and makes adjustments in real-time (Long, 2023). This method will track the performance of ECMs and ensure that energy savings are sustained over time. It also allows for continuous improvement based on evolving energy needs and operational demands.



> By combining these research methodologies, universities can create holistic energy management strategies that align with Malaysian national goals for energy efficiency and contribute to cost reduction and sustainability efforts.

4. THE PRECEDENT CASES

According to TNB's Medium Voltage Peak/Off-Peak Commercial Tariff (TNB, 2014), the university falls under the C2: Education tariff category. Under this tariff structure, theuniversity is charged RM 0.45/kWh for the first 100 kWh per month, RM 0.365/kWh for the next 4900 kWh, RM 0.30/kWh for any additional kWh per month, and RM 0.22/kWh during off-peak periods (TNB, 2022). Based on the energy consumption and tariff structure provided by Tenaga Nasional Berhad (TNB), several universities in Malaysia have made significant strides in meeting energy efficiency and conservation requirements, making them suitable candidates for integrating AI-driven technology for energy monitoring and management. Below are four universities that stand out in their efforts:

I) Universiti Malaya (UM)

As the oldest and most prestigious university in Malaysia, UM has implemented several energy-saving initiatives under its Green Campus Program. The university has conducted energy audits, installed energy-efficient lighting, andoptimized air-conditioning systems to reduce energy consumption. UM's comprehensiveapproach to energy conservation aligns well with the integration of AI-driven monitoring systems, which could further enhance its real-time energy management and help reduceoverall consumption (UM, 2024).

II) Universiti Teknologi Malaysia (UTM)

UTM is known for its sustainability initiatives and research on energy-efficient technologies. The university has adopted solar energy solutions and upgraded its buildings to be more energy-efficient. With its commitment to sustainability and green technology, UTM is well-positioned to benefit from AI-driven energy monitoring, allowing it to optimize energy use in its buildings and reduce peak energy consumption, especially in areas like laboratories and classrooms (UTM, 2024)

III) Universiti Putra Malaysia (UPM)

UPM has taken significant steps toward energy efficiency by incorporating green building standards and energy audits. The university is working to reduce its carbon footprint and energy costs through innovative energy management strategies. Integrating AI-driven technology would allow UPM to monitor energy usage across its campus more effectively, predict future energy demands, and automate energy-saving measures, particularly in high-consumption areas like its research centers and administrative buildings (UPM, 2024).

IV) Universiti Teknologi MARA (UiTM)

As one of the largest universities in Malaysia, UiTM faces significant energy demands due to its numerous campuses and large student population. The university has already taken steps toward energy efficiency by conducting energy audits, installing energy-efficient lighting, and implementing other conservation measures. With AI-driven technology, UiTM can further optimize its energy use by automating building systems, enhancing real- time monitoring, and analyzing energy load profiles to minimize wastage. AI wouldhelp UiTM tackle peak demand challenges and ensure efficient energy management across its diverse campuses (UiTM, 2024).

These universities have established foundational energy-saving measures and would greatly benefit from AI-driven technology to enhance their energy monitoring, optimization, and overall sustainability efforts. AI-driven systems would allow them to achieve more accurate energy forecasting, reduce operational costs, and meet Malaysia's national energy efficiency goals.

4.1 SWOT Mapping

Here is a SWOT mapping analysis for each of the four universities (UM, UTM, UPM, UiTM) in the context of integrating AI for energy management between the needs for energy-efficiency and energy conservation.

Element	UM	UTM	UPM	UiTM
Strength (S)	• Established sustainability initiatives and infrastructure supporting green technology. • Access to extensive data from previous energy audits and energy- efficient technologies. • Strong research capabilities in AI and data science, fostering a culture of innovation.	• Significant experience with green building designs and energy-efficient systems. • Strong in-house expertise in engineering and technology research, including AI. • Ongoing smart campus initiatives that align with AI- driven energy management.	• UPM's strong emphasis on sustainability and renewable energy research. • Availability of large amounts of data from agricultural, residential, and research facilities for AI analytics. • Existing partnerships with government and private entities focused on sustainability.	• Large-scale energy audit experience from campuses like Shah Alam and Tapah, identifying key areas for ECM. • Strong institutional focus on sustainability, supported by government initiatives. • Capacity to deploy AI at scale due to multiple campuses.
Weakness (W)	• High upfront costs for AI system deployment and integration into existing energy management systems. • Fragmented implementati on of energy- saving measures across different faculties and campuses	• Complex, multi-campus structure leading to challenges in unified AI implementation. • Limited human resources for the maintenance of AI systems, particularly in older campus buildings.	• High-energy consumption areas like research labs are difficult to optimize without significant AI upgrades. • Limited awareness among staff and students regarding AI technologies and their application in energy management.	• Budget constraints in updating infrastructure to fully support AI- driven energy management systems. • Gaps in faculty and student understandin g of AI technologies, potentially leading to resistance in adoption.

Opportunities (O)	• Leveraging AI to enhance real-time monitoring and predictive energy usage, reducing operational costs. • Collaborative opportunities with international partners on AI in energy efficiency and sustainability projects.	• Integration of AI with renewable energy sources like solar, offering a testbed for smart energy systems. • •Partnerships with tech companies for AI-driven solutions, as well as government grants promoting AI in energy.	• AI integration can significantly optimize energy use in UPM's diverse facilities, particularly research- intensive labs. • AI can be used to • develop new research programs related to smart energy management, strengthening UPM's research credentials.	• AI-driven energy systems can further improve ECMs like smart lighting and HVAC systems across multiple campuses. • Potential for UiTM to become a leader in AI and sustainability, promoting Malaysia's national green technology goals.
Threats (T)	• Resistance from stakeholders unfamiliar with AI technology. • Dependence on external funding or government support for large-scale AI infrastructure deployment.	• InitiaL implementation and training costs for AI systems may deter full-scale adoption. • Rapid changes in AI technology could lead to obsolescence of early investments in AI systems.	• Discrepancie s in the integration of AI across different types of buildings, from research labs to residential units. • Possible reliance on outdated infrastructure, which may limit the effectiveness of AI integration.	• High reliance on government funding to scale AI projects. • Lack of technical expertise in AI maintenance could result in inefficiencies if not addressed.

By mapping out these strengths, weaknesses, opportunities, and threats (SWOT), each university can develop tailored strategies to effectively integrate AI for energy management, improving sustainability while reducing costs.

4.2 Discussion – A Way Forward

The way forward for Malaysian universities in integrating AI-driven energy monitoring systems is highly promising, considering the SWOT analysis. AI technology offers universities significant opportunities to optimize energy consumption by providing real-time data, predicting energy usage patterns, and enabling automated adjustments based onenvironmental factors. This proactive approach aligns with Malaysia's National Energy Efficiency Action Plan (NEEAP), which targets a 6% reduction in electricity demand over 10 years and promotes energy-saving measures in non-residential buildings, including universities. AI systems can help universities manage energy more efficiently by predicting peak loads, automating HVAC systems, and optimizing lighting, especially in energy-intensiveresearch facilities. This not only reduces operational costs but also supports sustainability goals outlined in Malaysia's energy policies. Universities like UiTM, UTM, and UM can utilize their research capabilities and partnerships with technology providers to spearhead AI implementation, ensuring a smarter, more energy-efficient campus environment.

However, there are also challenges to AI integration. The SWOT analysis highlights that the high initial costs and complexity of AI systems could be major barriers for universities, particularly those with budget constraints, such as UiTM, which relies heavily on government funding. Additionally, outdated infrastructure and a lack of technical expertise may hinder the smooth adoption of AI systems in universities. Moreover, Malaysia's energy policies, while supportive of green technology, do not yet fully address the specific financial or infrastructural support needed for AI integration at scale in universities. To overcome these limitations, Malaysian universities must prioritize upgrading their infrastructure, building internal capacity for AI technology, and collaborating with both government and private sectors for funding and technical assistance. This collaborative approach, along with strategic alignment with national energy policies, will be crucial to the success of AI-driven energy management in Malaysian universities.

> Integrating AI for energy efficiency and conservation in Malaysian universities aligns with both Sustainable Development Goals (SDG) and Malaysia's National Energy Policies. By focusing on these criteria, Malaysian universities can effectively implement AI-driven solutions that are in line with both national policies and global sustainability goals. Here are four main criteria for moving forward:

Criteria	Sustainable Development Goals (SDGs)	Malaysia's National Energy Policies
Real-time Energy Monitoring and Optimization (Ahmad, Dzulkefli and Abdul Rahim, 2023)	AI enables continuous, real-time monitoring of energy usage across university facilities, which helps identify inefficiencies and predict peak energy demands. This aligns with SDG 7 (Affordable and CleanEnergy), as it promotes the efficient use of energy and reduces reliance on non-renewable sources.	Integrating AI-driven solutions into campus energy management systems would also align with Malaysia's National Energy Efficiency Action Plan (NEEAP), which aims to achieve a 6% reduction in electricity demand by 2025.
AI-Driven Predictive Maintenance (Abdelkader & Zidan, 2023; SENER,2024)	AI technology can predict maintenance requirements for energy-consuming systems such as HVAC and lighting. This helps avoid energy wastage due to system inefficiencies or malfunctions. Aligning with SDG 9 (Industry, Innovation, and Infrastructure), predictive maintenance also supports infrastructure resilience and operational efficiency.	By preventing system downtimes, AI can enhance energy conservation efforts while minimizing operational disruptions, contributing to the goals of Malaysia's Energy Efficiency and Conservation Act (EECA).

Data-Driven Energy Policy and Decision Making (Long, 2023)	AI can provide valuable data analytics that aid in developing more effective energy conservation policies within universities. By gathering usage patterns and making data-driven decisions, institutions can align with both SDG 12 (Responsible Consumption and Production)	Link with Malaysia's Low Carbon Cities Framework, which ensures that universities adopt policies that are not only environmentally responsible but also economically viable, leading to long-term sustainability.
Scalable Renewable Energy Integration (Abdelkader & Zidan, 2023; Long, 2023)	AI can optimize the integration of renewable energy sources, such as solar power, which is essential for universities aiming to reduce their carbon footprints. This directly supports SDG 13 (Climate Action) by promoting renewable energy adoption and mitigating climate change.	AI helps ensure that energy systems maximize the output from solar installations, aligning with Malaysia's Renewable Energy Transition Roadmap and the Economic Transformation Programme (ETP), which encourage the shift toward sustainable and renewable energy sources in non- residential sectors, including universities.

5. CONCLUSION

In conclusion, integrating AI-driven systems for energy efficiency and conservation in Malaysian universities is a crucial step towards achieving sustainability goals outlined in both Sustainable Development Goals (SDGs) and Malaysia's national energy policies. AI offers powerful solutions for real-time monitoring and predictive maintenance, aligning with SDG 7 (Affordable and Clean Energy) and SDG 9 (Industry, Innovation, and Infrastructure). By utilizing AI to enhance energy management, universities can optimize their energy use, reduce waste, and maintain system efficiency, which directly supports Malaysia's National Energy Efficiency Action Plan (NEEAP) and the Energy Efficiency and Conservation Act (EECA). Moreover, the role of AI in data-driven policy making and facilitating the integration of renewable energy systems, such as solar power, further strengthens its contribution toward SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action). AI-driven strategies not only improve operational performance but also ensure that universities contribute to Malaysia's Low Carbon Cities Framework and the Renewable Energy Transition Roadmap. By addressing these core areas, Malaysian universities can become leaders in sustainable campus operations while aligning with national and global sustainability targets.

References

1. Abdelkader, M. B., & Zidan, H. (2023). Artificial Intelligence-Based Techniques For Improving Energy Efficiency: A review. Renewable Energy, 206, 68-82. https://doi.org/10.1016/j.renene.2023.06.040
2. Ahmad, N. A., Dzulkefli, M. H., & Abdul Rahim, F. (2023). Assessing the Energy Performance of Public University in Malaysia by using Energy Conservation Measure (ECM): A Case Study of UiTM Tapah, Malaysia. International Journal of Sustainable Construction Engineering and Technology, 14(3), 309-319. https://publisher.uthm.edu.my/ojs/index.php/IJSCET/article/view/15035 Energy Commission (2019), the Malaysia Energy Statistics Handbook, Malaysia Energy Commission (2020), the Malaysia Energy Statistics Handbook, Malaysia Government of Malaysia (2020). Energy Efficiency and Conservation Act (EECA). Malaysia: Government of Malaysia.
3. Dzulkefli, Muhammad Hilmi (2020), Energy Audit In Malaysian Public University: Assessing The Energy Efficiency Of UiTM In Tapah Campus/ Muhammad Hilmi Dzulkefli. Master's thesis, Universiti Teknologi MARA
4. KeTTHA (2015), National Energy Efficiency Action Plan 2015, retrieved from https://www.pmo.gov.my/wp-content/uploads/2019/07/National-Energy-Efficiency-Action-Plan.pdf
5. Latif, A. F. et. al. (2019), A Review on Energy Performance in Malaysian Universities Through Building Information Modelling (BIM) Adaptation, IOP Conf. Ser.: Earth Environ. Sci. 291 012033, doi:10.1088/1755-1315/291/1/012033
6. Long, L. D. (2023). An AI-Driven Model for Predicting and Optimizing Energy-Efficient Building Envelopes, Alexandria Engineering Journal, 79, 480–501. https://doi.org/10.1016/j.aej.2023.08.041
7. Malaysia (2015), 11th Malaysian Plan, the Government of Malaysia.
8. Malaysia Productivity Corporation (2022), Productivity Report 2022, ISSN 1394-410X, Selangor, Malaysia
9. MOHE (2022), Malaysia Higher Education in Brief, retrieved from https://educationmalaysia.gov.my/malaysia-higher-education-in-brief/
10. Muniandi, B., Maurya, P. K., Bhavani, C., Kulkarni, S., Yellu, R. R., & Chauhan, N. (2024). AI-Driven Energy Management Systems for Smart Buildings. Power System Technology, 48(1). https://doi.org/10.52783/pst.280
11. SENER (2024). How can artificial intelligence help us to improve energy efficiency? SENER Group. https://www.group.sener/en/insights/how-can-artificial-intelligence-help-us-to-improve-energy- efficiency/?doing_wp_cron=1729417785.9032859802246093750000
12. Standards Malaysia (2019). Energy efficiency and use of renewable energy for non-residential buildings
13. - Code of practice (MS 1525:2019). Department of Standards Malaysia.
14. TNB (2022), Integrated Annual Report 2022 –Energy Transition, retrieved from https://www.tnb.com.my/assets/annual_report/TNB_IAR_2022.pdf
15. UM (2024), Infrastructure Maintenance Division. https://jpphb.um.edu.my/services
16. UNDP (2017), Delivering Sustainable Energy in a Changing Climate: Strategy Note on Sustainable Energy (2017-2021), United Nations Development Programme, the United Nation
17. UiTM (2024), Pejabat Pembangunan Infrastruktur & Infostruktur. https://ppii.uitm.edu.my/index.php/bahagian-pembangunan-infrastruktur
18. UPM (2024), Unit Pembangunan dan Penyelenggaraan. https://eng.upm.edu.my/lawatikami/maintenance_and_development_unit-2931?L=bm
19. UTM (2024), Seksyen Projek Dan Penyenggaraan (SPP). https://dvcdev.utm.my/spp/
20. Wan Abdullah, et al (2022), Determination of Design Solutions to Overcome the Daylighting Design Failure Observed in Existing Educational Building, International Journal of Sustainable Construction Engineering and Technology Vol. 13 No. 2 (2022) 153-167, https://doi.org/10.30880/ijscet.2022.13.02.014
21. Zaid, S. M., & Graham, P. (2017). Rising Residential Energy Consumption and GHG Emissions in Malaysia: A Case Study Of Public Low-Cost Housing Projects in Kuala Lumpur. Indoor and Built Environment, 26(3), 375–391, https://doi.org/10.1177/1420326X15616173
22. Zakaria, A. N. L. B. (2016). Energy Audit in Building: Tools to Improve Overall Energy Efficiency. Universiti Teknikal Malaysia Melaka.

The Use of Internet of Things (IoT) in Smart Home Technology Products

ABDUL GHANI SARIP
Centre for Sustainable Urban Planning & Real Estate (SUPRE)
Faculty of Built Environment,
Universiti Malaya, Kuala Lumpur

MONICA LO MEI YUEN
Department of Real Estate,
Faculty of Built Environment,
Universiti Malaya, Kuala Lumpur.

Introduction

The Internet of Things (IoT) refers to the network of physical devices that communicate and exchange data via the internet. In smart homes, IoT connects devices such as lighting systems, thermostats, security cameras, and home appliances, enabling homeowners to remotely control and automate various functions. Studies have shown that smart home technology can improve security, energy efficiency, and convenience, transforming the way individuals interact with their living spaces (Chen et al., 2018; Gothesen, S., 2023; Laura etal., 2023; et al.). IoT has become a significant technological advancement that allows devices to communicate and share data over a network without requiring human interaction. When applied to homes, IoT enables smart home technology, which automates functions like lighting, security, heating, entertainment systems, etc. offering greater convenience and control to homeowners. Globally, the adoption of smart home technology is growing rapidly, particularly in developed nations such as the United States, Sweden, Japan, and South Korea. In Malaysia, however, the adoption of IoT in smart homes has been slower, with fewer homebuyers investing in this technology. This paper aims to explore the factors influencing the adoptionof smart home technology, considering the potential benefits and their challenges to widespread implementation.

The Concept of IoT and Smart Homes

IoT is a framework where all objects possess a representation and exist within the Internet, as defined by the IEEE Communication Journal. The IoT specifically strives to provide novel applications and services. The concept of linking the physical and virtual worlds involves the use of machine-to-machine (M2M) communications. This type of communication serves as the foundation for enabling interactions between physical objects and applications on the cloud. Gathering data from sensors and transmitting it via a network is the primary objective of M2M technology. An M2M system relies on sensors, wireless technologies (Wi-Fi, RFID, etc.), cellular communications lines, and autonomous computing software to help network devices comprehend, communicate, and make decisions based on data. Public networks and access methods, such cellular or ethernet, are often relied upon by systems (Babangida et al., 2022).

In the same way that local area networks (LANs) and wide area networks (WANs) enable machines, sensors, and controls to communicate with one another, machine-to-machine (M2M) networks do the same, promoting cost and time savings. Gundar, S. et al., (2023) mentioned that connectivity is the fundamental support system of the IoT that is built via the implementation of communication standards. A range of wireless network protocols are utilized in smart home applications, including IEEE 802.11 (Wi-Fi), Bluetooth LE (Low Energy), cellular, ZigBee (a low-power wireless technology), Z-Wave, and Thread. The rapid increase of internet users over the past decade has made the internet an essential aspect of life and IoT in fact, is the latest and evolving web technology. The IoT is advancing continuously, encompassing both small-scale and large-scale machines that are capable of exchanging data and performing tasks even when users are engaged in other activities. Advancements in cloud technology and data analytics have enabled smart and intelligent systems to efficiently process and analyse data (Vignesh et al., 2022). By 2020, there will be over 75 billion IoT devices in our environment, or over seven gadgets per person, according to projections made by Business Insider Intelligence (A. Nabi, 2018). Smart homes, cellphones, cars, and other sensor- equipped gadgets are just a few of the numerous uses for the IoT.

A similar opinion was expressed by Mehrdad.S (2022), the world's consumer markets and ecosystems are entering a new era characterized by interconnected business models facilitated by the IoT. This device serves as a router, security camera, smart TV, home assistant (such as Amazon Echo or Google Assistant), doorbell (like Google Nest), energy management system (like Smart Grid), healthcare management system (like heart monitors), urban life management system (like Smart City), and smart fridge. In another word, the integration of the internet with different embedded devices results in the realm of the IoT andits technology is significantly enhancing the convenience and comfort of users' lives, and it isexerting an enormous impact on many different aspects of our daily existence.

Evolution of IoT

Technological advancements, market demands, and societal expectations have all contributed to significant progress in the IoT. Throughout its growth, the IoT has stayed loyal to its initial vision: a network of interconnected devices that can share data wirelessly. Table 1.1 depicts the evolution of IoT beginning in the 20th century.

Conceptualization and Early Development (Late 20th Century)

In the late 20th century, researchers envisioned a future where everyday things could be connected to the internet to enable communication and data sharing, giving rise to the notion of IoT (Atzori, Iera, & Morabito, 2010). This era was defined by theoretical investigations and initial trials focused on proving the possibility of linking devices to the internet.

Emergence of Enabling Technologies (Early 2000s)

The advancement of IoT accelerated with the development of technologies like Radio-Frequency Identification (RFID), wireless sensor networks, and low-power communication protocols. According to Al-Fuqaha et al. (2015), these technologies established the fundamental framework that linked tangible entities to the digital realm, facilitating smooth communication and the exchange of information.

Expansion of Connectivity (Early to Mid-2000s)

The increase in wireless communication technologies such as Bluetooth, Wi- Fi, and Zigbee significantly contributed to the growth of connection among IoT devices. The standards facilitated communication between devices and the internet, promoting the development of networked ecosystems (Atzori, Iera, & Morabito, 2010).

Integration with Cloud Computing and Big Data Analytics (Mid to Late 2000s)

The incorporation of IoT with cloud computing and big data analytics was a key achievement in its development. Cloud platforms offer scalable infrastructure for storing and processing large volumes of data from IoT devices, while analytics tools help organisations extract useful insights from this data (Dey et al., 2019).

Convergence with Artificial Intelligence and Edge Computing (2010s)

At the network edge, real-time processing and intelligent decision-making were made possible in the 2010s as a result of the convergence of the Internet of Things (IoT) with artificial intelligence (AI) and edge computing. According to Shi et al. (2016) and Dorri et al. (2019), AI algorithms improve the intelligence and autonomy of IoT systems, and edge computing moves computation and data storage closer to the sourceof data generation, lowering latency and bandwidth needs.

Diversification of Applications (2010s)

Internet of Things (IoT) has expanded its uses in the last decade to encompass many other industries, such as transportation, agriculture, healthcare, smart cities, and industrial automation, among others. Various applications of IoT solutions are being implemented to keep tabs on assets, maximise the use of resources, boost operational efficiency, and improve overall quality of life (Al-Fuqaha et al., 2015).

Future Directions (Ongoing)

Taking a look into the future, it is anticipated that the Internet of Things will continue to develop, which will be driven by developments in technology, increasing connectivity, and expanded use cases. The landscapeof the Internet of Things (IoT) is about to undergo a transformation as a resultof emerging developments such as 5G networks, blockchain integration, andthe Internet of Everything (IoE). This will usher in a new era of unprecedented connectedness and creativity.

Architecture of IoT

One of the biggest challenges with IoT is that it is exceptionally wide and boundless. Implementing IoT concept is largely dependent on the architecture. In the preliminary stages of research, the three-layer architecture was introduced (Miao et al., 2010). Khan et.al (2012) and Mouha (2021) stated that the architecture consists of three layers which are perception layer, network layer and application layer. The structure of IoT is shown in Figure 1.1 and these layers are briefly described below.

Figure 1: The IoT Architecture (Source: Parihar et al., 2024)

The three-layer architecture of the Internet of Things (IoT) consists of three main layers: Application, Network, and Perception. The Application layer provides application-specific services to end users, enabling applications such as smart homes, agriculture, roadway congestion control, parking systems, logistics, drone autonomous delivery, andmanufacturing. It consists of three main components: data storage module, data inquirymodule, and IoT client side (Zhang et.al, 2011).

The Network layer is the intermediate layer in the IoT architecture, used to transmit and process data from the Perception Layer to the Application Layer without causing harm or damage. It consists of two components: IoT-WM and IoT-DNS. The IoT system enables the interconnection of physical objects, allowing them to become "intelligent products" with dynamic information (Choudhary et.al, 2021). The IoT-WM bridges the gap between the sensing layer and the computer network, while the IoT-DNS assigns a distinct code to each tagged object, corresponding to the network localization address of the information server system.

The Perception layer, also known as the Physical Layer, Device Layer, or Sensing Layer, encompasses Internet of Things devices, sensors, and actuators responsible for detecting and monitoring the physical environment (Daniel et.al, 2022). Sensors may include RFID readers, 2D barcodes, gas, pressure, proximity, accelerometers, gyroscopes, infrared, temperature, and smoke sensors. The primary function of this layer is to identify and gather data and information related to certain objects through sensor devices. After gathering data, it is transferred to the Network layer for secure transmission to the information processing system(Sharbaf M.S., 2022).

Smart Home Technology

The development of smart home technology has been a journey of innovation, driven by the fusion of digital connectivity, automation, and consumer demand for convenience. The progression from early home automation systems to the current interconnected network of IoT- powered gadgets has significantly transformed household management. Advancements such as cost-effective wireless protocols and voice-activated assistants have transformed how we engage with our homes. In the 21st century, smart home technology is advancing to integrate with developing innovation, resulting in intelligent and adaptive living environments. The development of smart home technologies since the 1970s is depicted in Table 1.2.

Table 1.2: Development of Smart Home Technology

Period	Description
Early Home Automation Systems (1970s-1980s)	The concept of home automation began to take shape in the 1970s and 80s when basic systems were launched to automate basic household chores like temperature control, lighting, and security. Morris (2005) observed that early systems used mechanical timers, relays, and wire to automate lightingand temperature adjustments. As Sullivan (1988) also points out, a number of prototypes and trial systems appeared around this time, showing that technology could be used in homes. Though these systems were often too costly for the average user and had limited functionality in comparison to current smart home technologies, they laid the groundwork for further advancements in the industry. Experimental and innovative research by Morris (2005) and Sullivan (1988) led to the development of advanced home automation technology and the smart home ecosystem.
Advancements in Home Automation (1990s-2000s)	The early 1990s and 2000s saw growth in home automation, which led to the widespread acceptance of smart home systems and their ease of use. Mayer, Aghassi-Hagmann, and Reichl (2009) found that wireless protocols like X10's can alter home automation by offering remote device control without complicated wiring. Wireless protocols allowed smart home technologies to be integrated into existing homes, making automation more accessible. The advancement of home automation during that era was significantly influenced by the internet, as highlighted by Al-Safi, Khedr, Elmisery, and Sangaiah (2018). Internet connectivity allowed networked smart home devices to be handled and monitored remotely, making them more convenient for consumers. These advances made home automation systems more affordable and accessible, which led to their popularity and the smart home ecosystem.
Rise of the Smart Home (2010s)	Driven by the increasing adoption of smartphones and the Internet of Things (IoT), the advent of the smart home in the 2010s represented a critical turning point in the evolution of home automation. As smart gadgets with sensors, connection, and intelligent software began to appear, Lee (2015) calls this era "pivotal," since it allowed homeowners to remotely monitor and manage a variety of house elements. Smart technologies like thermostats, lighting systems, security cameras, and door locks gave homeowners unprecedented convenience and flexibility, turning houses into networked ecosystems. Zanella et al. (2014) further note that IoT technology allows smart devices to communicate and exchange data, enabling smart home system integrationand interoperability. Due to these advances, the smart home market grew rapidly, with consumers embracing linked living. Smart homes improved homeowners' convenience and comfort and opened new doors in energy management, healthcare, and environmental sustainability.
Acquisition of Nest Labs by Google (2014)	A major turning point in the development of smart home technology was reached in 2014 when Google acquired Nest Labs, indicating the tech giant's calculated entry into the linked house industry. As pointed out by Barnett, Jansen, and Mirkovic (2019), this acquisition was a turning point that demonstrated Google's determination to influence the trajectory of home automation. Innovations like the Nest Learning Thermostat and the Nest Cam security cameras, developed by Nest Labs, added sophisticated sensing,AI, and connection capabilities to Google's product line. This acquisition strengthened Google's smart home position and highlighted the confluence of technology, data analytics, and consumer electronics in the house. Liu, Li, and Wang (2017) further note that Google's large resources and Nest's smart home technological competence could improve product development and ecosystem integration. In sum, Google's purchase of Nest Labs was a major milestone on the road to building smart, networked homes that are easy to use and operate.

Introduction of Amazon Echo (2015)	It was a big step forward for smart home technology when Amazon released the Echo in 2015, especially important for voice-activated virtual assistants. As pointed out by Sugumar and Thenmozhi (2020), the introduction of the Echo was an iconic event that changed the norm for smart device interactions with users. Echo users may operate smart home devices with voice commands using Alexa, making the experience simpler. This innovation led to widespread voice-controlled smart home technology adoption and improved user ease. In addition, the Echo has made smart home capabilities accessible to consumers of all ages and technical skills, according to Hao, Zhu, Hu, and Song (2018). The Echo's success in merging voice control with smart home devices inspired other tech companies to build similar products, boosting smart home industry growth. Amazon Echo changed the smart home ecosystem and how we use our living spaces.
Integration of Smart Home Platforms (2016)	Smart home platforms were introduced in 2016 to improve interoperability and centralise smart device control in home automation. It was a key time when Apple, Google, and Samsung launched HomeKit, Google Home, and SmartThings, according to Dhawan and Balakrishnan (2018). These platforms provide users centralised hubs or apps to monitor and control smart home devices from many manufacturers. Previously, the fragmentation and compatibility difficulties that plagued smart home technologies could be resolved by these platforms, which established common standards and protocols for device communication. Al-Safi, Khedr, Elmisery, and Sangaiah (2018) found that smart home platforms improved automation and customisation. Users could now construct complicated multi-device routines and scenarios to suit their needs. The 2016 integration of smart home platforms helped create a more cohesive and integrated smart home ecosystem, giving users more control and flexibility over their living spaces.
Expansion of Smart Home Ecosystem (2019)	Technology breakthroughs and rising consumer demand for connected living solutions drove the spread of the smart home ecosystem in 2019, which was a major development in the field of home automation. Yaqoob et al. (2020) indicate that smart home devices will incorporate AI and ML during this expansion. These advances allowed devices to learn and adapt to user preferences, making domestic automation more personalised and efficient. More than just lights and thermostats, a lot of different types of goods, like smart cameras, doorbells, and appliances, have become smart home devices. Sugumar and Thenmozhi (2020) found that diversifying the smart home ecosystem gave users more options for developing linked settings. AI and ML technologies also enabled smart home applications in healthcare, energy management, and environmental monitoring, improving user experience and smart home technology's value. Overall, the smart home ecosystem expanded in 2019, reflecting the industry's maturing, with a greater emphasis on intelligence, interoperability, and user-centered design.
Continued Growth and Innovation (2020s)	Technology advances and new smart home device features have driven smart home industry growth and innovation in the 2020s. According to Islam et al. (2021), smart home devices will be able to integrate new technologies like 5G connection, edge computing, and augmented reality (AR) throughout this era, which will increase their capabilities and open up new applications. 5G connectivity allows smart home devices and cloud services to communicate and respond in real time. Edge computing also letssmart devices handle and analyse data locally, lowering server load and boosting response times. AR technology allows users to visualise and interact with virtual components in their physical environment, improving the user interface and interaction experience. These innovations have improved smart home device performance and usefulness and created new market prospects for innovation and differentiation. Thus, driven by technical innovation and consumer demands, the smart home sector continues to grow and evolve rapidly.

Smart Home Applications

Throughout the past few years, the technology that is used in smart homes has revolutionised how we interact with our living spaces. The use of cutting-edge technology in smart home applications allows for the automation and control of numerous elements of house management, which not only improves convenience and security but also increases energy efficiency. These apps comprise a wide variety of equipment and systems that are connected to the internet. As a result, users are able to remotely monitor and manage their houses from any location as long as they have access to the internet.

Smart Lighting

Smart lighting refers to lighting systems that have integrated smart technology, allowing users to remotely manage their lights via smartphone apps or voice commands using virtual assistants such as Amazon Alexa or Google Assistant. The systems provide functions including scheduling, automation, and colour management, enabling users to set up lightingto switch on/off at designated times, modify brightness levels, or alter colours to establish various atmospheres. Smart lighting typically incorporates energy monitoring features to monitor and enhance energy consumption, leading to reduced costs and improved environmental sustainability (Merrill, 2019). Connecting to other smart devices allows for smooth automation and improves security by coordinating lights with motion sensors or home security systems. Smart lighting is utilised to save energy by adjusting to surrounding conditions and dynamically controlling lights according to user requirements, therefore reducing wasteful energy usage. Energy efficiency leads to cost reduction and supports environmental sustainability. Smart lighting systems can be created with Solid State lighting, such LEDs, or IP-enabled lights that are controlled through the internet or remotely (Timoth and Priti, 2017).The systems function by sensing occupancy, temperature/humidity, and LUX levels in the surroundings. This enables smart modifications to optimise energy use while ensuring the appropriate illumination levels and comfort.

Smart Appliances

Internet-connected smart appliances with advanced sensors allow users to remotely monitor, control, and automate their functions for enhanced convenience and efficiency (Timothy and Priti, 2017). This includes tasks such as collecting status information, scheduling activities, and coordinating with other appliances during operation. These devices enhance efficiency indaily activities and improve energy efficiency by offering functions like remote control and energy tracking. Smart refrigerators can notify users of low goods and recommend recipes depending on available items. Smart thermostats can change temperature settings accordingto occupancy patterns to decrease energy usage (Buchanan, 2018). Smart appliances provide cost savings, better convenience, and enhanced usefulness, making them popular among modern households adopting Internet of Things (IoT) technologies.

Smart Security System

According to Lavelle (2018), homes and properties may be adequately protected and monitored with the help of smart security systems, which use cutting-edge technology. These systems usually include networked devices like security cameras, motion sensors, door/window sensors, and smart locks. They can be remotely controlled and monitored by smartphone appsor online interfaces (Gardner, 2020). Smart Security Systems provide real-time alerts for suspicious activity, video recording and replay, two-way audio communication, and compatibility with other smart home devices (Henderson, 2019). Users may personalise settings, establish schedules, and get alerts on their mobile devices, improving security and providing reassurance whether they are at home or elsewhere. Some systems include professional monitoring services, allowing security professionals to react to alerts and send emergency services if needed (Babcock, 2021). Overall, Smart Security Systems provide innovative, adaptable, and user-friendly solutions for protecting houses and maintaining occupant safety.

Intrusion Detection

Subsequent to Kumar and Kumar (2019), intrusion detection is the systematic procedure by which malevolent activities or unauthorised access to a computer network are identified. This security strategy involves actively monitoring network traffic, system records, and useractivity to identify any unusual behaviour or abnormalities that could signal a securitycompromise. Intrusion detection systems (IDS) use signature-based detection, anomaly detection, and heuristic analysis to detect and notify administrators of potential security threats (Rashidi et al., 2020). When an intrusion is identified, the Intrusion Detection System (IDS) can take actionby limiting traffic, notifying administrators, or recording data for futureexamination. Intrusion detection systems can notify users via email and text messages, and offer comprehensive reports with photos or audio/video clips to enable prompt response and required security measures (Timothy and Priti, 2017). Intrusion detection assists organisations in promptly recognising and addressing security concerns by consistently monitoring networkand system activity, thus securing sensitive data and defending against cyber threats.

Smoke or Gas Detection

Smoke/gas detection in smart home applications requires the integration of sensors andsystems that can monitor air quality and identify the presence of smoke, fire, or dangerous substances in the home. These smart detectors can be remotely monitored and can send out alerts through smartphone applications or notifications when they are linked to a smart home system or central hub. If a hazard is detected, such smoke from a fire or a gas leak, the systemcan activate alarms, send notifications to residents' smartphones, and perhaps inform emergency services automatically if set up accordingly. Certain intelligent smoke and gas detectors can connect with other smart home devices like smart thermostats or lightingsystems to improve safety measures. Smart smoke/gas detection systems offer early detectionand notifications to help homeowners safeguard their family and property from potential hazards, enhancing safety and delivering peace of mind in smart home settings (Bracken, 2020).

Factors Influencing Adoption of IoT in Smart Home Technology Products

A new era of connectedness has been brought about by the IoT, which has transformed traditional homes into smart homes. Consumers are increasingly looking for convenience, efficiency, and improved living experiences, making the integration of IoT in smart home technology products a key focus of innovation and customer attention. Multiple factors influence the diverse rates of adoption among different groups and areas. These elements include Cost-effectiveness, Ease of use, Security and privacy concerns, Integration with other devices, Energy efficiency and Customization and personalization options. In order to successfully adapt their products or services to the varied demands of consumers and navigate the ever-changing smart home industry, it is vital that industry stakeholders have a comprehensive understanding of these influences.

Cost Effectiveness

Cost-effectiveness, or the perceived balance between the initial investment in IoT-enabled smart home goods and their long-term advantages, is critical for consumers given their budgetary restraints. They assess the initial expenses in comparison to the prospective savings in energy expenditures, convenience, and security. The data from the survey of urban homeowners, which included Kuala Lumpur residents, provided by Li et al. (2019) lend credence to this classification. Consumers preferred IoT devices that had a good cost-benefit ratio, especially in homes with limited financial resources, highlighting the importance of affordability in increasing adoption rates.

Ease of use

Ease of use, defined as the ease with which IoT-enabled smart home goods may be operated, is an essential factor for people when making adoption decisions. Consumers prioritise items that are easy to set up and use, as they have various demographic and technological literacy levels. This minimises the need for technical expertise or comprehensive user manuals. This factor has a direct influence on the user experience and satisfaction with smart home technologies. Tan et al. (2020) highlighted the importance of user-friendly design in promotingthe adoption of IoT technology in smart home goods by urban homeowners, especially those in Kuala Lumpur. Researchers discovered that people are more inclined to buy products that they see as easy to use and don't need much effort to operate. Thisemphasises the significanceof user-friendliness in encouraging broad adoption (Tan, Lim, & Lee, 2020).

Security and Privacy Issues

The adoption of IoT-enabled smart home products is influenced by consumers views towards security and privacy issues. These concerns include anxieties about protecting personal data and devices from cyber threats. Such technology may deter consumers if they fear hacking, unauthorised access, or data breaches, which could compromise their privacy and safety. It is essential to address these concerns in order to inspire consumer confidence and trust in the dependability and security of IoT devices installed in their residences. According to a study by Ng et al. (2018), homeowners in urban regions, including Kuala Lumpur, face major obstacles in adopting IoT technology due to security and privacy concerns. IoT devicevulnerabilities, particularly data privacy and unauthorised access, influenced participants' decision-making and caused many to delay or avoid adoption until these concerns were addressed (Ng, Wong, Chong, Lin, & Chan, 2018).

Integration with other devices

One of the most important considerations for homeowners in Kuala Lumpur when it comes to adopting IoT smart home items is the ease with which these products can integrate with other devices already installed in the home. Consumers give priority to goods that are compatible with a variety of platforms and devices because this allows them to build a harmonious smart home ecosystem in which various gadgets complement one another to improve usefulness and ease. Hui et al. (2020) examined how integration drives urban residents' adoption of IoT technology in smart home devices, including Kuala Lumpur. The study indicated that consumers preferred smart home devices that could seamlessly interface with other devices and systems for centralised control and automation. This emphasises integration's significance in adoption by improving user experience and ease (Hui, Wong, Lee, & Li, 2020).

Energy Efficiency

With growing concerns about the environment and the cost of utilities, energy efficiency has become an important consideration for homeowners in Kuala Lumpur when looking at smart home goods that are connected to the internet. This means that these products may optimise energy use without sacrificing functionality. To manage energy use, consumers prefer gadgets with energy monitoring, scheduling, and automation. According to Khan et al. (2019), energy efficiency drives IoT adoption among urban dwellers, particularly Kuala Lumpur citizens, who seek sustainable and cost-effective products. Participants wanted smart home devices with energy-saving features like monitoring and optimisation to make informed energy usage decisions and reduce waste (Khan, Islam, Hossain, & Alhamid, 2019).

Challenges in Adopting IoT in Smart Home Technology Products

With the integration of IoT technology into smart home surroundings, homeowners can expect to experience a significant improvement in convenience, efficiency, and security. Nevertheless, there are obstacles in the way of this transformational potential. The IoT is driving widespread adoption of smart home goods, therefore it's important to recognise and resolve the challenges people have when trying to install these systems in their homes. Understanding these obstacles allows stakeholders to build strategies to overcome barriers and promote widespread adoption, allowing IoT to improve residential living experiences.

High Initial Cost

High initial cost, which refers to the hefty upfront expenditure required for purchasing and installing IoT-enabled smart home gadgets, is a key barrier for Kuala Lumpur residents considering adoption. This financial barrier may discourage potential adopters, particularly those with low financial resources or budgets, from incorporating IoT technology into their homes. Although the perceived cost of acquiring smart devices and the potential for additional expenses related to installation and setup may be advantageous in the long run, homeowners may be dissuaded from implementing smart home solutions due to the perceivedexpense involved, despite the potential savings and long-term benefits of IoT technology. Al-gahtani et al. (2018) found that high initial costs were a major concern for consumers considering iot- enabled device adoption, highlighting the importance of affordability in smart home iot adoption.

Concerns about data privacy and security

Kuala Lumpur homeowners' adoption decisions are influenced by data privacy and security concerns, including the protection of personal data and the cyber security of IoT-enabled smart home equipment. Internet of Things (IoT) devices create concerns about unauthorised access, data breaches, and privacy violations, making consumers wary of smart home technologies. These worries were seen to be major obstacles to adoption, according toresearch by Park et al. (2019) among people living in urban areas, including Kuala Lumpur. Participants voiced concerns about the vulnerability of IoT devices to hackers and unauthorised access, emphasising the necessity of protecting personal information and guaranteeing smart home security. Resolving these issues is essential to building consumer confidence and trust as well as promoting the IoT's widespread adoption in smart homes (Park, Kwak, Park, & Kim, 2019).

Lack of awareness or understanding about IoT technology

The lack of awareness or understanding of IoT technology, which denotes customers' inadequate knowledge or comprehension of its idea, features, and benefits in the context of smart home devices, is a significant barrier to adoption for Kuala Lumpur homeowners. There is a risk that many customers may be sceptical or unsure of the Internet of Things (IoT)since they do not completely understand its capabilities and possible uses. Misunderstandings concerning IoT security, privacy, and interoperability may further hamper adoption. Lai et al. (2020) discovered that a lack of awareness or understanding was a significant barrier to adoption in urban areas, including Kuala Lumpur, with participants expressing limited knowledge about IoT concepts and functionalities, as well as uncertainties about the benefits and practical applications of IoT-enabled smart home devices. In order to fill in these information gaps and encourage consumers to embrace Internet of Things (IoT) technologies in smart homes, the study stresses the significance of awareness and education campaigns (Lai, Ngai, & Cheng, 2020).

Limited compatibility with existing home devices

Limited compatibility with existing home equipment, which refers to the difficulties homeowners encounter when integrating IoT-enabled smart home goods with their existing technologies and systems, is a key barrier to adoption for Kuala Lumpur inhabitants. Due to the variety of devices in use, from traditional appliances to smart devices, this issue may disrupt or complicate the setup. Cheah et al. (2019) discovered that consumers were frustrated and hesitant to accept IoT goods that were incompatible with their home setup. Cheah, Chong, & Lin (2019) note that consumers' concerns about integration challenges and the possibility of having to upgrade existing equipment highlight the significance of interoperability and compatibility in promoting the use of Internet of Things (IoT) technologyin smart homes.

Reliability and stability issues

Reliability and stability difficulties, such as worries about the constant operation and dependability of IoT-enabled smart home equipment, are substantial challenges for Kuala Lumpur residents considering adoption. Frequent malfunctions, connectivity challenges, and system failures can shake confidence in IoT technology and make smart home goods unpopular. Certain areas of Kuala Lumpur are characterised by unreliable power supplies and internet connectivity, which may further aggravate these concerns. The study conducted by Tanet al. (2020) revealed that homeowners residing in urban areas, such as Kuala Lumpur, encountered substantial obstacles in the form of stability and dependability concerns. The participants expressed discontent and exasperation with the devices that displayed thesechallenges. These problems must be addressed to build consumer trust and encourage smart home IoT technology adoption (Tan, Lim, & Lee, 2020).

Conclusion

This study predicts that the integration of IoT technology in smart home products is transforming the housing market in Kuala Lumpur. It emphasizes the need to understand consumer viewpoints and address security, interoperability, and ease of use concerns tosupport widespread adoption. Challenges include high costs, privacy concerns, and a lack of digital skills. To improve adoption, developers, policymakers, and technology providersshouldreduce device costs, enhance cybersecurity measures, and raise public awareness of IoT benefits. This will help Malaysia capitalize on the growing demand for smart home technology and position the country as a leader in IoT adoption. Policymakers should introduce incentives for homeowners investing in energy-efficient smart home products,strengthen regulations on data privacy and cybersecurity, and offer affordable packages to attract tech-savvy buyers. Partnering with technology firms to provide free installation services and training can reduce the digital skills gap and ensure more individuals caneffectively use smart home technologies. Technology providers should focus on developing affordable, entry-level products to cater to a broader market. Enhancing cybersecurity features is crucial for building consumer trust, as users are increasingly concerned about the security of their personal data.

Reference

1. Atzori, L., Iera, A., & Morabito, G. (2010). The Internet of Things: A survey. Computer Networks, 54(15), 2787-2805.
2. Al-Fuqaha, A., Guizani, M., Mohammadi, M., Aledhari, M., & Ayyash, M. (2015). Internet of things: A survey on enabling technologies, protocols, and applications. IEEE Communications Surveys & Tutorials, 17(4), 2347-2376. https://doi.org/10.1109/COMST.2015.2444095
3. Al-Gahtani, S. S., King, M., & Mohammed, F. (2018). The role of costs in consumer adoption of smart home products: A study in Saudi Arabia. Telematics and Informatics, 35(4), 837-849.
   Al-Safi, S., Khedr, A. M., Elmisery, A. M., & Sangaiah, A. K. (2018). A comprehensive survey on smart home IoT-based healthcare applications. Future Generation Computer Systems, 88, 88-114.
4. Babangida, L.; Thinagaran Perumal; Norwati Mustapha; Razali Yaakob. (2022). Internet of Things (IoT) Based Activity Recognition Strategies in Smart Homes: A Review. IEEE Sensors Journal (Volume: 22, Issue: 9, 01 May 2022)
   Babcock, C. (2021). The Best Smart Home Security Systems for 2021. PCMag. Retrieved from https://www.pcmag.com/picks/the-best-smart-home-security-systems

5. Barnett, J., Jansen, J., & Mirkovic, J. (2019). Nesting in the Home: A Research Agenda for Smart Home Technologies. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (pp. 1-12).
6. Cheah, J. H., Chong, A. Y., & Lin, B. (2019). Investigating factors influencing consumers' intention to adopt Internet of Things (IoT) in their homes. Information Systems Frontiers, 21(2), 355-372.
7. Chen, M., Ma, Y., Song, J., Lai, C. F., & Hu, B. (2018). Smart home technology: An intelligent controller for smart home. IEEE Transactions on Consumer Electronics, 64(2), 207-216. https://doi.org/10.1109/TCE.2018.2822920
8. Dey, A. K., Abowd, G. D., & Salber, D. (2001). A conceptual framework and a toolkit for supporting the rapid prototyping of context-aware applications. Human-Computer Interaction, 16(2-4), 97-166.
9. Dey, N., Ashour, A. S., Shi, F., & Ashour, A. S. (Eds.). (2019). Internet of things and big data analytics toward next-generation intelligence. CRC Press.
10. Dorri, A., Kanhere, S. S., Jurdak, R., & Gauravaram, P. (2019). Blockchain for IoT security and privacy: The case study of a smart home. In IEEE PerCom Workshops (pp. 49-54).
11. Gardner, J. (2020). How Smart Home Security Systems Work. Consumer Reports. Retrieved from https://www.consumerreports.org/home-security/how-smart-home-security-systems-work/
12. Goundar, S., Bhardwaj, A. and Bandhana, D. (2023). Internet of Things and Its Significance on Smart Homes/Cities. Journal of Information Technology Research, January 2022, 15(1):1-13
13. Hao, Y., Zhu, S., Hu, Y., & Song, L. (2018). Smart home system based on indoor positioning and event-driven architecture. IEEE Access, 6, 32558-32570.
14. Henderson, N. (2019). Smart Security Systems. ASecureLife.com. Retrieved from https://www.asecurelife.com/smart-security-systems/
15. Hui, K., Wong, C. Y., Lee, A., & Li, C. (2020). Understanding the Adoption of Internet of Things (IoT) in Smart Home: The Moderating Role of Individual Differences. IEEE Transactions on Engineering Management, 67(1), 107-120.
16. Islam, M. S., & Aung, Z. (2018). Analyzing and designing the subscription business models for IoT-based smart homes. In 2018 IEEE International Conference on Internet of Things (iThings) (pp. 819-826). IEEE.
17. Islam, S. R., Kwak, D., Kabir, M. H., Hossain, M., & Kwak, K. S. (2021). The internet of things for health care: a comprehensive survey. IEEE Reviews in Biomedical Engineering, 14, 23-44.
18. Khan, M. M., Islam, M. R., Hossain, M. A., & Alhamid, M. F. (2019). Factors Influencing the Adoption of Internet of Things (IoT) for Smart Homes: Insights from Bangladesh. IEEE Access, 7, 17139-17149.
19. Kumar, D., & Kumar, P. (2019). Intrusion detection system: A survey. Procedia Computer Science, 165, 16-23.
20. Lai, K. H., Ngai, E. W., & Cheng, T. C. (2020). Understanding the antecedents of consumer acceptance of Internet of Things (IoT) devices for residential smart homes: An empirical investigation. Technological Forecasting and Social Change, 157, 120076.
21. Laura Ferreira, Tiago Oliveira, Catarina Neves. (2023). Consumer's intention to use and recommend smart home technologies: The r ole of environmental awareness. Energy, Volume 263, Part C, 15 January 2023, 125814
22. Lee, C. C., & Li, J. (2018). Security and privacy issues in smart home environments: A survey. International Journal of Security and Networks, 13(1), 14-29.
23. Li, D., & O'Brien, R. (2020). A study on the privacy concerns of smart home users. Journal of Cyber Security and Mobility, 9(2), 123-137.
24. Li, L., Liao, Y., & Guo, Q. (2018). Design and implementation of a cost-effective smart home energy management system. In 2018 IEEE International Conference on Smart Grid and Smart Cities (ICSGSC) (pp. 1-5). IEEE.
25. Mayer, S., Aghassi-Hagmann, J., & Reichl, P. (2009). Power consumption of communication networks: A case study of X10. In 2009 3rd International Conference on Communication Theory, Reliability, and Quality of Service (pp. 1-4). IEEE.
26. Merrill, D. (2019). How smart lighting solutions are leading the charge on energy efficiency. IoT For All. Retrieved from https://www.iotforall.com/smart-lighting-energy-efficiency
27. Ng, A. Y., Wong, Y. D., Chong, A. Y., Lin, B., & Chan, H. C. (2018). Understanding consumer adoption of Internet of Things (IoT) services in smart homes. Journal of Service Management, 29(5), 883-908.
28. Park, S., Kwak, D., Park, J., & Kim, J. (2019). Understanding the factors influencing consumer acceptance of smart home technologies. Industrial Management & Data Systems, 119(7), 1461-1480.
29. Gøthesen, S., Moutaz Haddara and Karippur, Nanda Kumar (2023). Empowering homes with intelligence: An investigation of smart home technology adoption and usage. Internet of Things, Volume 24, December 2023, 100944

An introduction of the Electronic Land System, "*E-Tanah Selangor*" for Leasehold Extension at the Petaling Land District

Penny Goh Pei Nei
Manager and Special Assistant to
Managing DirectorVPC Alliance
(PJ) Sdn. Bhd.

Sr Dr. Shubashini Ganisen
Head of Real Estate Programme,
Business Studies Department,
UCSI College

Introduction

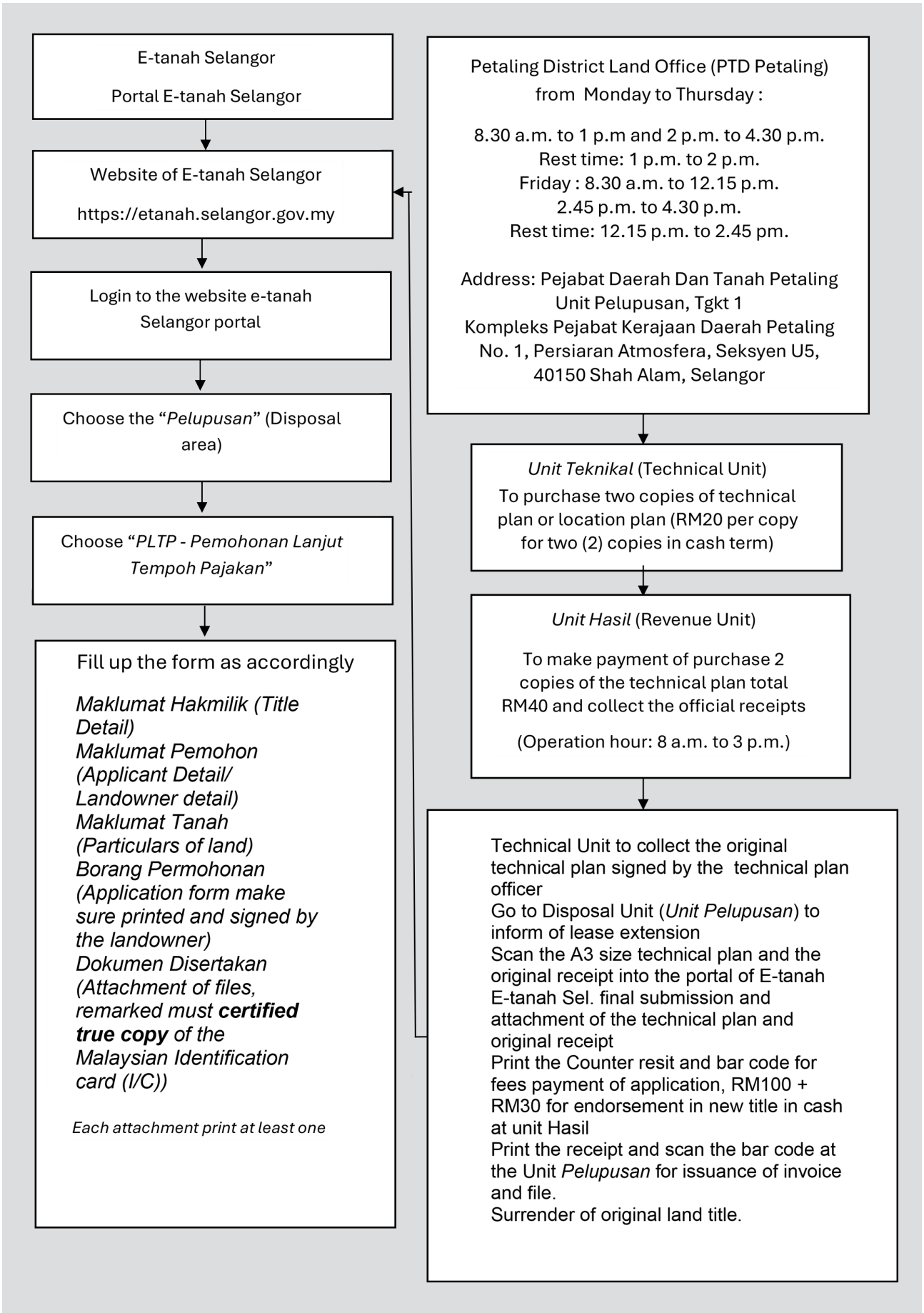
The aim of this paper is to show the methods of leasehold extension application to the public at the Petaling District Land office and the Selangor Land and Mines office by the principle of self submission and self application. The applicants will be able to understand the way to have a proper procedures under the e-tanah Selangor softcopy submission and the manually submission at the counter. That ease the land owners headaches and procrastination, query and worry in own submission having the attitude to be positive and timely submitting the lease extension with the implementation of the E-government system in the E-tanah Selangor. The research or analysis is important to enhance the operation of the land administration system into computerized system under the Schedule 16 of the National Land Code and to arrange for computerised system for the strata title for Schedule 6, Strata Title Act 1985 in the state land administrative to be more efficient and effective. The electronic land system has been carried out in Selangor started with the agreement under the State Government in Selangor begin with year 2021, and officially operated from the District Land Office and the Land and Mines Office in Selangor started on 30 October 2023. The first state in Malaysia started the E-tanah System is theState of Kuala Lumpur (2017), Perak, Labuan and Putrajaya in year 2021.

The "Leasehold land" is a property's tenure that there is a time limit to own the leasehold property and the ownership of the land owner is just merely to own the piece of land for a certainperiod (Salleh, 2013). When the lifespan for the leasehold reached the date of expiry as stated in the land title, the land will be reverted to the state government (Salleh, 2013; Penny, Siti, & Tuti,2024; Ainul & Sharifah, 2022). Therefore, the property is nor longer owned and belongs to the land owner. However, there is only one resolution for the leasehold property ownership to be continuous owned by the land owner before the expiry date is through application of leasehold extension of 30-year, 60 year, and 99-years according to the number of years to be applied for the lease extension (Ainul & Sharifah, 2022; KPPPTMNB, 2005). The leasehold land that had expired are only allowed to reapply back for the land from the State Government for a specific term. The most safer way is to apply for lease extension of another 30-year, 60-year or 99-year before the lease is expired. There is without any mercy ("tanpa belas kasihan") the land to be re-alienate to the land owner by the state government when the land is expired and take away by the state government (Salleh, 2013).

What does an "E-Tanah Selangor" electronic land system mean to the public interest?

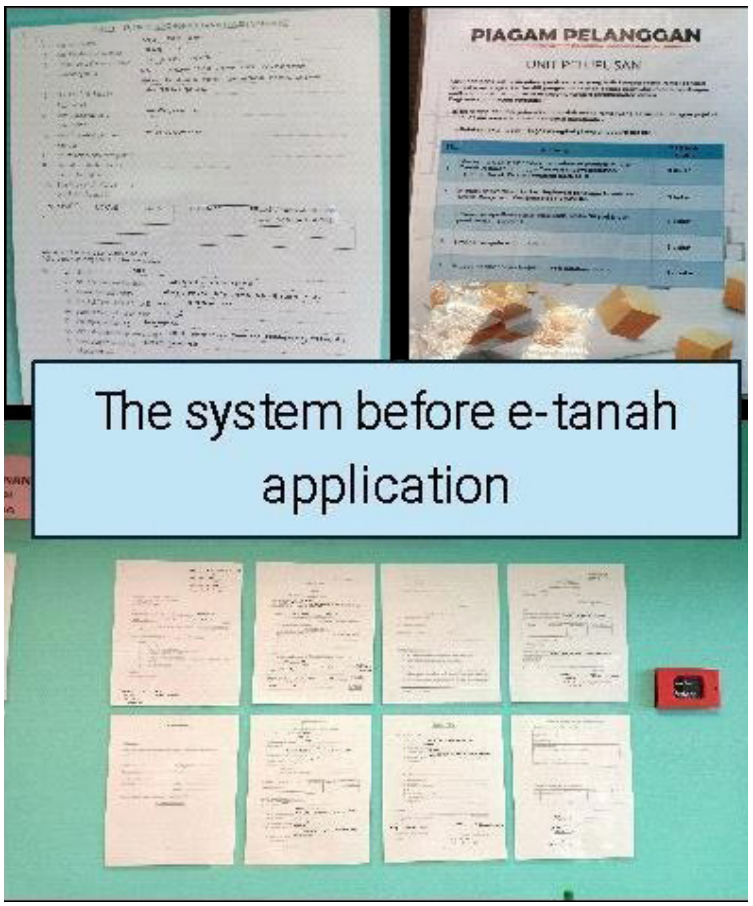
Electronic Land System or "E-Tanah Selangor" is a web portal for the customer to make an application in relation to the land administration system of the e-Government. This E-Tanah Selangor was developed by the central government of Malaysia. This is a comprehensive land management system to be computerised and to record the business communication and application between the public and the land officers under the e-Government. According to Schedule 16 of the National Land Code and the Schedule 6 of the Strata Title Act 1985, the purpose of this E-Tanah Selangor was created to mold the public land administration system into the computerized system such as computerize the title search, quit rent search, application of land alienation and leasehold extensions. Hence, this system provides better data management in the Selangor Land and Mines office and the Petaling District Land offices using information and communication technology (ICT). Meanwhile, the experience of interaction and communication among the customers or the public with the land officer are further strengthened by the better management and experience encountered in the e-submission and the e-filing and hardcopy submission.
This E-Tanah Selangor is newly introduced to the public to be used more frequently whenever there is single entry point or multiple application of land services at the Single Point of Contact (SPOC) counter.

Methods for leasehold extension application from E-tanah and the PTD Petaling



Findings

The system in E-tanah Selangor, Malaysia have been successfully introduced and implemented by the Selangor State Government to allow the nine main modules of land matters in the land administration office to be conducted successfully. The nine (9) modules are included the registration, revenue, consent, strata, auction, land disposal, land acquisition, land development and enforcement (Media Selangor, 2023). The land disposal is the main option for the leasehold extension application purposes. Currently, there are about 170 cases have been submitted to the Petaling District land office to process the leasehold extension application andto dates there are multiples cases have been approved under the E-tanah Selangor after the official submission by the applicants through online and on-site physically concurrently.



Our findings are the new procedures for online electronic land system were required for the applicants to made submission online and subsequently submission in hardcopy to be presented at the office onsite for the leasehold extension after 30th October, 2023. Meanwhile, theapplication are computerised and digitalised and the physical submission at the land office were required after 30 days of submission in online application. The E-tanah leasehold application uses the new web portal system developed for the Land Administration office in Selangor. This system E-tanah are implement to the Selangor Land and Mines office and the District Petaling Land Office or more commonly known as the Pejabat Tanah dan Galian Selangor (PTGS) and Pejabat Daerah dan Tanah Petaling (PTD). Each land office differentiated by the types of land title holding identified as the Qualified title Mukim (H.S (M)) and Qualified title Negeri (H.S (N)) or Leasehold title Negeri (PN) or Leasehold Title Mukim (PM). The land title under thestate for Hakmilik Sementara Negeri (H.S (N)) and Pajakan Negeri (PN) are held under title in the PTGS for Selangorand the District land office and the Mukim titles will be held under the PTD.

The leasehold extension required to follow the state land rules to calculate the premium. The premium is charged to the land owners that have successfully received the approval for leasehold extension due to the land is surrender and re-alienate to the land owners for another extended years as stated in the application forms. The formulae of the premium as according to the State Land Rules are 1/4 x 1/100 x period of extension say 99 years (99 years less the remaininglease period) x land area in square metres x the Market Value of the land determine bythe JPPH valuation officer.

The applicant is not allowed to appoint another Valuer to appeal for the premium received for the lease extension approval and the applicants must adhere to the Notice 5A requirements to make the full premium payment within six (6) months. Unless, he is willing to pay for the costs of the Valuation Report fees by the land lord and to appoint the

private Valuer to determine the Market Value of the land in a written format. Then according to the jurisdiction of the Government licensed Valuer to decide whether to consider reducing the amount of the premium when the premium determined are more than the current land market value after receiving the appeal letter and the valuation report for the subject property. Alternatively, there is another option in my opinion the landlord or the applicant can do to reduce the current burden of thelease extension premium after calculation from the Land Office issuance under the Notice 5A, notice of premium charge. He (she) can ask for reduce the number of leasehold extension tenure period applied by the land lord by writing in to apply for a shorter period of 30-year and 60-year instead into 99-year or he can apply to pay for a nominal fee at the rate of RM5,000 whichever islower after the land market value has been determined. However, consideration have to be made that the lumpsum payment of premium are allowed and there is another 30% less for the total premium paid.

Delivery of the E-Tanah System

Besides, the submission process in the system E-tanah and the communication in the counter desks with the land officers were needed to be improve and to overcome the obstacle of the E-tanah user to use the system to apply for the first time to make the leasehold extension.

A. Tedious process in Online Submission for first time user

The online submission is a tedious process, the first experience for the applicant to apply online with the service provided by the Valuer, ranked from one to ten is nine, due to the reason the experience professional is knowledgeable to advice the new applicant the methods to do online purchase of the title search, searching for the e-statement for quit rent and assessment, preparing the photographs of the house boundary from four (4) direction in the compass, i.e. north, west, south and east. In the same time, to support the applicant to make decision to consider the premium calculation amount to be paid to the land office.

B. Knowledgeable that the Malaysian Identification Card must be certified true copy (CTC)

Thereafter, the landlords have to certified true copy of the original Malaysian identification card (I/C) at the lawyer office or the Pengulu of the District area and imagine if the applicants are aging. Alternatively, the applicant can present the identification card in original to the lawyer or the Gred 41 officers and above to certified the I/C is a true copy.

C. Online submission ease the application and also length-en the time taken to understand the format

Now, the online submission become more easier at the comfort of the applicant to do the online application at home in a specific time and space. The purchase of the technical plan from the Technical Department required onsite and cannot scan before-hand due to the technical plan / location plan needed to be signed by the technical officer and printed in colour. Moreover, the original receipt must be attach in the lease application of extension from the applicant in softcopy and hardcopy. The files size of the attachment for softcopy are to be submit in the JPEG and PDF files format. Most important the applicant needed to get reminded to bring cash to the land office when doing the process of purchasing technical plans during the application process, the land office does not collect other form of money except cash and bank draft only.

D. There are desktops and a scanner but no officer standby at the counter for to ask for help

There are two (2) desktops and a scanner are readily available at the land office e-tanah station situated at the ground floor for the ease of communication and the movement of the applicants to ensure submission of leasehold extension can be done on the same day after purchasing the technical plan and obtained the original receipt. However, there is no designated land officer readily available or standby beside the counter desk of E-Tanah station to help the applicants to the online application.

E. Simple and quick procedures with one page of Appendix A as the application form

The procedure to make lease application are shown in the process flow chart in the methodology. Moreover, the application for leasehold extension became easier and more simple to print out in one page. The application now only required two pages of Appendix A as compare to the previous submission needed to filled up in hardcopy application forms for about 7 pages. This forms and appendices are stated in the Form 12 A under section 197 of the National Land Code 1965 for the surrender back of the property for leasehold extension. The form needed to be printed out in hardcopy for signature of the applicant(s).

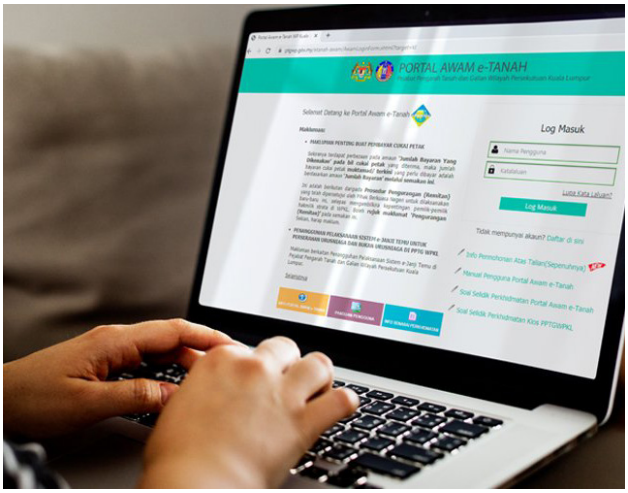
F. Official letter from the bank for the original title as a collateral charged to the bank

Thereafter, an official letter is required from the bank if the subject property is still under the bank collateral and the land owner must get the consent from the bank to apply for the lease extension. The reason is the original title is needed to be surrender to the PTD during the hardcopy submission and the applicant is not allowed to withdraw from the lease extension application and in the same time to sell the house during the period of lease extension. The original title is kept in a room known as store "bilik kebal" for a duration until the approval is granted to the applicant of the subject property and the full premium are paid.

Therefore, in order to ensure the lease extension is successfully made under the e-tanah system from the District land office or the Land and Mines office, the applicant must follow theprocedures and first need to be patience to get ready all the important telephone numbers, internet service, computer to do the online submission and a printer to print out the necessary documents as stated in the lease application checklists.

The checklist for the lease applications are stated herein:

1. Application form with Appendix A (under section 90A National Land Code) print cover up and bottom (2 copies)
2. Certified true copy of the Malaysian identification card cited by the lawyer, the Penghulu or the Gred 41 officer in the land office with the original identification card presented
3. Original copy of title and the B1 and B2 Plans
4. Permission letter from the Bank / Individual (provided the title has mortgage / caveat)
5. Official Title Search (Carian Rasmi) (valid for 1 month from the date of purchase of title search) -HS (M) or PM: Petaling District Land Office -HS (D) or PN: Land and Mines office, Selangor
6. Location Plan certified by the Technical Unit officer, of the Petaling District Land Office and marked in red border for the subject property.
7. To make payment of the processing fee RM100.00 per lot for the application for surrender back the land under the section 197 (Form 12A)
8. A copy of the latest quit rent receipt (latest for current term and year)
9. A copy of the assessment receipt (latest for current term and year)
10. A copy of the official receipt for plan purchased and application fees purchased of the Schedule 1 form.



Conclusion

The E-tanah Selangor is a process for leasehold extension application by the applicants through online and to communicate with the land office through offline at the counter desk during the hardcopy submission. Although, the system of E-Tanah Selangor is newly implemented in Selangor, there are other states have also take this initiatives to develop the electronic land system successfully. Therefore, to motivate the landlord to make the leasehold extension submission earlier before the end of the expiry of the leasehold tenure for the subject property, the landlord should be responsible to submit all the leasehold extension application by ownself. If this problem to make online application through e-tanah persist some more then the applicant shall get some assistant from the graduates in Estate Management and Real Estate, academician and researchers or experienced licensed Valuer, Property Manager and the Estate Agent to solve this matter together seriously. There are more public that could be benefited by reading this paper to hear from the opinion of the professional Valuer about the various methods and suggestion to handle the leasehold application successfully until the approval granted to the applicants

References

1. Ainul, J. M., & Sharifah, Z. S. (2022). Malaysian Land Law and Procedure. Subang Jaya, Malaysia: Thomson Reuters Asia Sdn Bhd.
2. KPPPTMNB. (2005). A Manual On the National Land Code. Kuala Lumpur: Koperasi Pegawai Pentadbiran dan Pengurusan Tanah Malaysia Berhad (KPPPTMB) in cooperation with Department of Director General of Lands and Mines, Kuala Lumpur.
3. Media Selangor. (2023, November 6). Selangor Journal. Retrieved from E-Tanah system expanded to Selangor: *https://selangorjournal.my/2023/11/e-tanah-system-expanded-to-selangor/#:~:text=PUTRAJAYA%2C%20Nov%206%20%E2%80%94%20The%20electronic,in%20Selangor%20 since%20Oct%2030.*
4. Penny, G. P., Siti, U. M., & Tuti, H. J. (2024). The Importance of the Lease Extension Premium Calculation Formulae for a Landed Residential Premium. Petaling Jaya: Royal Institution Surveyors .
5. Salleh, B. (2013). State Authority and Land Alienation. In S. Buang, Land Tenure in Peninsular Malaysia Prospects for Reform (pp. 1-47). Kuala Lumpur: Solid Press Sdn. Bhd.

ARBITRATOR'S PROTOCOL FOR CREATIVE MANAGEMENT OF DELAY EXPERTS TO REDUCE PROLONGED ARBITRATION PROCEEDINGS AND COSTS

Sr John Wong @ Wong Weng Long

Construction Claims
Expert, Adjudicator, Arbitrator
BSc (Hons) LLB(Hons) Dip. Int. Arb, FCIArb, FMSAdj, MRISM,
Registered Quantity Surveyor
Director, Charlton Martin Consultants Sdn Bhd

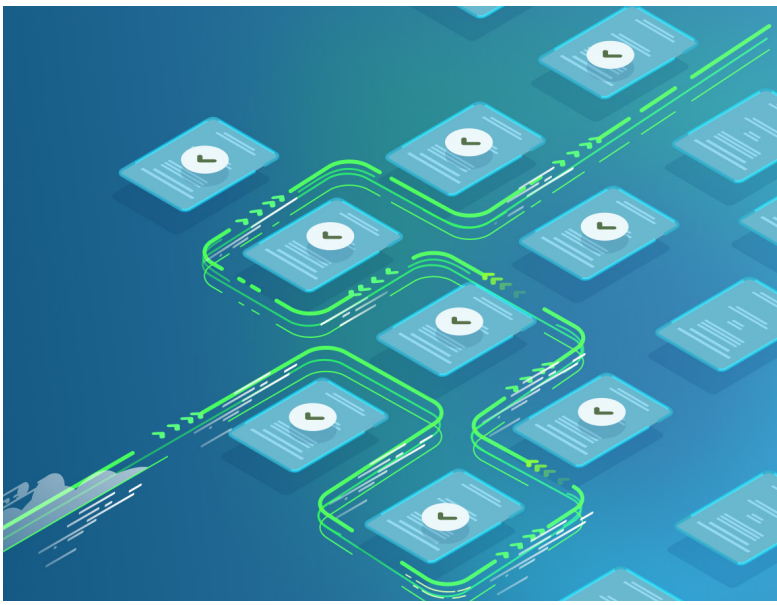
Keywords: delay experts, method of delay analysis, baseline program, and facilitationmeeting

Abstract

From the perspective of a Quantity Surveyor who has been trained not only by an arbitration counsel but also by quantum claim/delay experts, this paper seeks to examine causes of prolonged arbitration proceedings in respect of construction delay disputes and to offer creative management solutions to reduce the risks of protracted arbitration proceedings and costs thereof. Because the construction delay disputes are centred on the input of the parties' respective experts, the solutions are equally focused on managing the experts' input and views. Such solutions are then crystalised in a form of an arbitrator's protocol.

Introduction

In a construction delay dispute, parties to an arbitration proceeding often appoint their respective delay expert to present their respective assessment of the delays to an arbitral tribunal. The delay experts carry out their own delay analysis using their own selected baseline programs and present their findings in their respective expert reports.The arbitration proceeding that begins with expert reports submitted by both experts may escalate to rebuttal reports and further replies to the rebuttal reports, thereby prolonging the arbitration proceeding and increasing the costs thereof. How should an arbitral tribunal manage both experts so as to reduce the arbitration timeline and costs?



Cause of Protracted Arbitration Proceedings and Costs thereof

An arbitrator in an arbitration proceeding usually directs that both experts produce and exchange their expert reports that set out their respective delay analysis based on their own selected respective baseline program. The arbitrator also directs both experts to, meet at a Joint Expert meeting to discuss and produce a Joint Statement setting out their agreed views and/or disagreed views. Thereafter, if there are disagreed views, which are almost a usual certainty, both experts are directed to produce their respective rebuttal reports. That should be the last report from the experts before the hearing takes place. However, more often than not, parties usually apply to the arbitrator for leave to serve an expert's reply to the opposing expert's rebuttal report, thereby increasing cost and delaying the arbitration proceeding. Why is this the case?

When preparing expert reports, opposing experts selects different programs as the baseline program and different method of delay analysis. The result is two polarizing outcome of delay analysis set out in both experts' reports.

After the completion and exchange of expert reports between the experts, both experts usually meet in a joint expert meeting to discuss and arrive at agreed views. However, because the expert reports are now completed, it would be difficult for experts to swallow their pride to depart from the expert reports and to agree to the opposing expert's views. This gives rise to both experts' entrenched positions and thus disagreed views.

After the completion of a Joint Statement by both experts that highlight more disagreed views than agreed views, if any, both experts would start to churn out rebuttal reports that criticize one another's selection of program as the baseline program and of the method of delay analysis. Because one expert learned, during the earlier joint expert meeting, of the other expert's reasons for disagreeing with the former's expert report findings and the reasons included the former's own errors set out in his or her expert report, the former's rebuttal report has incorporated a new but alternative delay analysis to remedy the former's own errors set out in his or her expertreport.

Because one expert's rebuttal report has introduced a new but alternative delay analysis to remedy the former's own errors set out in his or her expert report, the otherparty usually demands for an opportunity to serve an expert's reply to the new delay analysis set out in the expert's rebuttal report.

Creative Solutions

The solution to the problem lies in managing raw data input adopted by the experts from the outset prior to finalising their respective expert reports because the reports represent the initial reports that will determine whether the experts evince divergent views or otherwise. Such views will in turn determine how deeply entrenched the experts' respective positions will be which will in turn determine whether the experts will produce not only rebuttal reports but also further replies to the rebuttal reports. The production of reports after reports due to the experts' divergent views will certainly have a domino effect on the arbitration timeline and costs thereof. The solution is then to introduce an Arbitrator's Protocol for Delay Analysis to reduce timeand cost in arbitration proceedings.

The Arbitrator's Protocol

The author introduces an Arbitrator's Protocol for Managing Opposing Expert Witnesses in Delay Analysis as appended hereto. The Protocol requires both experts to study the existing documentation in their respective party's possession.

The documentation includes:

1. The conditions of contract that govern the contractor's extension of time applications;
2. the existing Extension of Time applications and delay events therein;
3. the nature, quality and availability of programs submitted by the contractor; and
4. the nature, quality and availability of site records on actual start and actual finish dates of activities in a program.

The Protocol mandates both experts to attend a facilitation meeting with the Arbitrator where the Arbitrator will chair the meeting and conduct a Q&A session to enquire of both experts what documentation is available and what is the most suitable method of delay analysis based on the criteria for the selection thereof as set out in Section 11.5 on page 34 of the Society of Construction Law – Delay and Disruption Protocol -Second Edition 2017 and which program is the most suitable program to be adopted as the baseline program in accordance with the definition of 'baseline program' as inferred from paragraph 14.216 of Keith Pickavance's Delay and Disruption in Construction Contract-3rd Edition, that is, a program that is submitted at the initial stage of the Contract that shows the contractor's planned sequence for the original scope of Works under the Contract.

Where a deadlock ensues because both experts could not agree to one single baseline program and one method of delay analysis, the Arbitrator may use his or her own expert knowledge or experience in delay analysis coupled with experience as anarbitration counsel to ask the experts leading questions that may tow the experts to give reasonable answers that may yield a mutually agreed baseline program and method of delay analysis. The success of this method depends largely on the Arbitrator's skills in persuading and cajoling the experts with concrete reasons and supporting text authorities. It is likely that an expert would yield to the text authorities where the expert is unable to produce any conflicting text authority to support his or her own view.

Benefits of the Arbitrator's Protocol

In summary, the Arbitrator, armed with his or her own expert knowledge or experience in delay analysis, may successfully steer and persuade both experts to agree on the most suitable baseline program and method of delay analysis for the purpose ofpreparing their expert reports. Since both expert reports are using the mutually agreed baseline program and method of delay analysis based on the same available documentation, thelikelihood of both expert reports producing the same findings, if not similar findings arehigh. This may bring about a desired outcome where the gap or difference between bothexpert reports may be narrowed so as to expedite the arbitration proceeding and thus reduce the cost thereof.

Where both expert reports' findings are the same, then both experts may proceed straight to producing a Joint Statement with ease and speed, thereby dispensing with theneed for a rebuttal report and even a reply to the rebuttal report. However, where both expert reports' findings are similar with a small difference between them, then both experts may still proceed straight to producing a Joint Statement setting out their agreed views and disagreed views with ease and speed, and thereafter produce a short rebuttal report on the disagreed views also with ease and speed, and very likely thereby dispensing with the need for a reply to the rebuttal report.

Conclusion

Parties to construction delay disputes often fall victim to protracted arbitration proceedings resulting from two opposing expert reports having set out divergent views on the method of delay analysis and the baseline program that forms part of the analysis. As a result, the arbitration timeline and costs often spiral out of control. For this reason, the Arbitrator's Protocol is introduced so that arbitrators may apply the protocol in conducting facilitation meetings with the experts in order to guide both experts to agree on a common method of delay analysis and a common baseline program with an objective of narrowing any gap between both experts' findings. The chances of success may increase where the arbitrator utilises his or her own expertise or experience in delay analysis to persuade the experts with the aid of persuasive text authorities on delay analysis.

A succinct overview of the Arbitrator's Protocol is set out as follows:

1. Thorough Documentation Review:
   Both delay experts must delve into essential documentation, including contract conditions, historical extension of time applications, submitted programs, and reliable site records. This comprehensive understanding sets the stage for informed decision-making.
2. Facilitation Meeting with the Arbitrator:
   The Arbitrator chairs a meeting where experts discuss suitable delay analysis methods. Criteria from established industry protocols guide these discussions. The baseline program—the initial plan submitted by the contractor—receives careful scrutiny.
3. Breaking Deadlocks:
   When experts reach an impasse, the Arbitrator's expertise comes into play. Leading questions encourage experts to find common ground. Text authorities on delay analysis provide a compass for resolution.

In summary, let us embrace creative solutions that empower arbitrators to manage delay experts effectively—a step toward more efficient and cost-conscious dispute resolution in the construction industry.

Reference

1. Keith Pickavance, Delay and Disruption in Construction Contract (3rd Edition, LLP 2005) 547
2. P.J. Keane and A.F. Caletka, Delay Analysis in Construction Contracts (2nd Edition, Wiley Blackwell 2015) 50 & 127
3. Society of Construction Law Delay and Disruption Protocol (Second Edition, Society of Construction Law (UK) 2017) 32-35

Appendix

Arbitral Tribunal's Protocol for Managing Delay Expert Witnesses

1. Introduction

1.1 What is Arbitration?

Arbitration is a form of alternative dispute resolution where disputing parties agree to have their conflict resolved by an impartial third party, the arbitral tribunal. The arbitral tribunal's decision, known as an award, is binding and enforceable in a court of law.

1.2 What is a Construction Dispute on Delays to a Construction Project?

A construction dispute on delays occurs when one party, typically the contractor, claims additional time and/or costs due to delays caused by the other party, usually the developer or owner. These disputes often involve complex technical issues and significant financial implications.

1.3 What is Delay Analysis and What Role Does it Play in the Construction Dispute on Delays to the Construction Project?

Delay analysis is a method used to determine the extent and cause of delays in a construction project. When demonstrating that a delay entitles the contractor to an extension of time, the delay must be shown to be critical, by reference to a reliable critical path analysis. The carrying out of a successful delay analysis requires the preparation of, amongst others, a reliable baseline programme. The effectiveness of delay analysis techniques can be greatly increased when it can be demonstrated that the baseline programme is reasonable. In this respect, the baseline programme is a useful contemporaneous evidence of a contractor's original intentions and should serve as the starting point when identifying delays.

The 6 primary methods of delay analysis are set out in Section 11.5 of the Society of Construction Law – Delay and Disruption Protocol (Second Edition 2017) as follows:

1. Impacted As-Planned Analysis
2. Time Impact Analysis
3. Time Slice Windows Analysis
4. As-Planned vs As-Built Windows Analysis
5. Retrospective Longest Path Analysis
6. Collapsed As-Built Analysis

The methods in items a) & b) above analyse causes and effects of delay events prospectively while item f) above analyses causes and effects of delay events retrospectively. In contrast, the remaining methods analyse effects and causes of delay events retrospectively.

A delay analysis can be carried out either through a computer modelled method or an observational method. As stated on page 127 of a text authority, Delay Analysis in Construction Contracts -2nd Edition, by Keane and Caletka, an observational method is a passive method that requires a process of deduction from comparing different programs, and thus it does not require a delay analyst to actually quantify the delay through computer programming simulations by 'adding/impacting' or 'subtracting' delay events to or from a program respectively. In contrast, a computer modelled requires an active intervention by way of a computer 'what if' program simulation to arrive at 'before' and 'after' status of the work progress in order to quantify the effect of the delay, that is, by 'adding/impacting' or 'subtracting' delay events to or from a program respectively.

Furthermore, prospective analysis identifies likely impact of delay events on a completion date as stated in the Society of Construction Law – Delay and Disruption Protocol (Second Edition 2017)-pg 34-para 11.4(e) which states:

> *"Delay impact is determined in one of two different ways. A prospective delay analysis identifies the likely impact of historical progress or delay events on a completion date. The conclusions of a prospective delay analysis may not match the as-built programme because the Contractor' s actual performance may well have been influenced by the effects of attempted acceleration, re-sequencing or redeployment of resources in order to try to avoid liability for liquidated damages or due to other Employer and Contractor Risk Events. A retrospective delay analysis identifies the actual impact of the delay events on the identified actual or as-built critical path."*

In summary, delay analysis plays a crucial role in construction disputes by providing an objective assessment of delay events and their impact on the project timeline. The analysis assists the arbitral tribunal in deciding the contractor's entitlement to extensions of time and compensation for costs.

1.4 What is the Benefit of an Arbitration Proceeding Compared to a Court Proceeding?

Arbitration offers several benefits over court proceedings, including confidentiality, flexibility, speed, and the ability to select an arbitral tribunal with specific expertise in construction disputes. It often leads to a more efficient and specialized resolution.

1.5 What is an Expert Witness?

An expert witness is a specialist with extensive knowledge or experience in a particular field relevant to the dispute. Their role is to provide independent, impartial, and informed opinions to assist the arbitral tribunal in understanding complex technical issues. In the context of the construction dispute on delays, the expert witness is a specialist with knowledge and experience in delay analysis which is a crucial tool in ascertaining the contractor's entitlement to an EOT, if any.

1.6 How Do Two Opposing Parties Appoint Their Own Expert Witness?

Each party in the dispute appoints its own expert witness to present and support their case. These experts prepare expert reports, participate in joint expert meetings, and provide testimony during the arbitration proceedings.

2.0 Why Construction Disputes are Delayed and Prolonged, Increasing the Cost of Arbitration

2.1 Production and Exchange of Expert Reports

An arbitral tribunal directs both experts to produce and exchange their delay analysis reports based on their selected baseline programs. They also meet in a Joint Expert Meeting to discuss and produce a Joint Statement of agreed and disagreed views. However, parties often seek to serve additional rebuttal reports, increasing costs and delaying proceedings.

2.2 Different Baseline Programs and Methods of Delay Analysis

Opposing experts often select different baseline programs and methods of delay analysis, leading to divergent conclusions in their reports.

2.3 Challenges in Joint Expert Meetings

During joint meetings, experts may be reluctant to concede points or agree with the opposing expert's views, resulting in entrenched positions and minimal agreed views.

2.4 Rebuttal Reports and New Delay Analyses

Experts produce rebuttal reports that criticize each other's methods and baseline programs. These reports may introduce new delay analyses to address errors in the initial reports, leading to requests for further replies and prolonging the proceedings.

2.5 Requests for Additional Reports

The introduction of new delay analyses in rebuttal reports prompts parties to request opportunities for further replies, extending the arbitration timeline and increasing costs.

3.0 How to Solve the Problem of Protracted Arbitration Proceedings on Construction Delay Disputes

3.1 Introducing an Arbitral tribunal's Protocol for Delay Analysis

The protocol aims to reduce time and cost in arbitration by ensuring a structured and agreed approach to delay analysis from the outset.

3.2 Review of Documentation

Experts must review the existing documentation, including contract conditions, extension of time applications, submitted programs, and site records on actual activity dates.

3.3 Facilitation Meeting with the Arbitral tribunal

The arbitral tribunal chairs a facilitation meeting with both experts to determine the available documentation, suitable method of delay analysis, and appropriate baseline program. The parties' counsels may attend the meeting as observers but should not influence the experts' exchange of views with the arbitral tribunal. The arbitral tribunal acts as a facilitator in guiding both experts to reach a mutually agreed method of delay analysis and baseline program.

The selection of the suitable method of delay analysis is based on the criteria stipulated in Section 11.3 of the Society of Construction Law – Delay and Disruption Protocol (Second Edition 2017) for selecting a method of delay analysis. The criteria includes, amongst others, the availability and quality of project records, the complexity of the project, and the nature of the delay events. As explained in paragraph 1.3 above, there are 6 primary methods of delay analysis with their respective pre-requisites as set out in Section 11.5 of the Society of Construction Law – Delay and Disruption Protocol (Second Edition 2017).

As for the selection of the appropriate baseline program, the definition of 'baseline program' in paragraph 14.216 of Keith Pickavance's Delay and Disruption in Construction Contracts (3rd Edition) and paragraph 2.6.2 of Delay Analysis in Construction Contracts -2nd Edition by Keane and Caletka provide a guidance to selecting a program from existing programs submitted by a contractor. In summary, a baseline program is the initial project schedule that is contractually compliant and reflects the contractor's original intention and planned sequencefor the original scope of work. 'Contractually compliant' is inferred to meancomplying with the Commencement date and Completion dates of the Works or Sections thereof as stipulated in the Contract. Accordingly, the baseline program is the base from which a change should be measured, or which can be used to predict the impact of a change.It serves as the benchmark against which project progress and delays are measured.

3.4 Handling Deadlocks

If experts cannot agree on a baseline program or method of delay analysis, the arbitral tribunal may use its expertise in delay analysis or experience in construction delay disputes to guide the experts towards a mutually acceptable solution. Either the experts agree on a method of delay analysis proposed by the arbitral tribunal which is supported by reasons, or the experts agree on either expert's method. The same process may apply to the experts' agreement to a common baseline program.

The arbitral tribunal may utilize its past experience as an arbitration counsel to ask any expert leading questions so as to persuade the expert to agree to a method of delay analysis that meets the criteria for selection in accordance with Sections 11.3 and 11.5 of the Society of Construction Law – Delay and Disruption Protocol (Second Edition 2017). In the same manner, the arbitral tribunal may skillfully persuade or cajole both experts to agree on a common baseline program which serves as a base for the method of delay analysis on the basis that the baseline program meets the definition of a baseline program provided in text authorities.

3.5 Summary and Expected Outcomes

By agreeing on a baseline program and delay analysis method, the likelihood of producing similar findings in expert reports increases. This narrows the gap between expert reports, thereby expediting the proceedings and reducing costs.

3.6 Joint Statement and Rebuttal Reports

With similar findings, experts can quickly produce a Joint Statement, potentially eliminating the need for rebuttal reports. If minor differences exist, a concise rebuttal report can address these, further reducing the likelihood of prolonged proceedings and thus the costs thereof.

4.0 Summary

By adhering to this protocol, the arbitration process may become more efficient, reducing time and cost while ensuring a fair resolution to construction delay disputes.

LEVERAGING AI FOR FUTURE DEVELOPMENT:

Leveraging AI for future development: Promoting environmental sustainability through smart innovations

Eddie Shahrizad
Degree in Estate Management (Hons)
Studies of Real Estate
School of Real Estate and Building Surveying
College of Built Environment
UiTM Shah Alam

Abstract

As global environmental issues become more pressing, the integration of technology into sustainable development practices is gaining unprecedented importance. Artificial Intelligence (AI) emerges as a transformative tool in this context, offering a range of innovative solutions that significantly enhance environmental sustainability, particularly within the realms of urban planning, construction, and building management. This article examines how various AI applications are contributing to sustainability efforts in these areas.

The discussion focuses on several key applications of AI. One notable area is energy efficiency, where AI-powered smart grids play a crucial role. These grids use advanced algorithms to monitor and manage energy distribution in real time, allowing for optimised energy use, reduced waste, and better integration of renewable energy sources. Similarly, AI- driven waste management systems leverage predictive analytics to improve waste collection and sorting processes, leading to more efficient recycling and reduced operational costs.

In addition to energy and waste management, AI is making significant strides in water conservation. Intelligent water management systems utilize AI to forecast water demand, detect leaks, and manage resources more effectively. Flood prediction systems, powered by AI, analyse weather patterns and soil moisture levels to anticipate and mitigate potential flood risks, thereby enhancing urban resilience.
AI also plays a pivotal role in integrating renewable energy sources into existing infrastructure. By predicting the availability of renewable resources like solar and wind energy, AI helps balance the energy grid and optimize energy storage systems, ensuring a more reliable and efficient use of renewable power.

Transportation systems benefit from AI through enhanced traffic management and public transit planning. AI algorithms analyse real-time traffic data to optimize flow and reduce congestion, while predictive models support the design of more efficient public transportationnetworks. Additionally, AI contributes to the planning and maintenance of urban green spaces by analysing environmental data to optimize vegetation growth and simulate climate change impacts, resulting in more resilient and ecologically balanced urban landscapes.

In the construction sector, AI aids in the selection of sustainable materials and the optimisation of resource use, reducing environmental impact and minimising waste. However, it is crucial to also address the environmental footprint of AI itself. The energy consumption associated with AI systems and data centres needs to be managed carefully to ensure that the deployment of AI aligns with broader sustainability objectives.

This article highlights the transformative potential of AI in advancing sustainable and resilient urban development. By leveraging AI's capabilities while simultaneously addressing its environmental impact, we can develop urban areas that are both technologically advanced and environmentally responsible, paving the way for future growth that aligns with global sustainability goals.

Keywords: Artificial intelligence, Climate change, Environmental Sustainability

Artificial Intelligence (AI) refers to the advanced technology that allows computers and machines to emulate human capabilities such as learning, understanding, problem-solving, decision-making, creativity, and self-management. (What Is Artificial Intelligence (AI)? | IBM, n.d.). Pamela Beckvagni, the Assistant Director of Sustainability Programs at Southern New Hampshire University (SNHU), defines environmental sustainability as the careful and balanced use of natural resources. This approach ensures that current needs are met without undermining the ability of future generations to fulfil their own needs. The ultimate goalis to achieve long-term ecological stability and maintain a healthy environment for futurelife. (Patterson, 2024)

The United Nations has established 17 Sustainable Development Goals to guide efforts towards a more sustainable future (Martin, 2023). These goals address critical global issues, including:

1. Clean Water and Sanitation: Promoting the efficient use of water and preventing wastage.
2. Climate Action: Taking immediate steps to combat global warming and mitigate climate change effects.
3. Life Below Water: Reducing plastic use to keep oceans free from pollution.
4. Life on Land: Engaging in activities like tree planting to preserve terrestrial ecosystems.
5. Responsible Consumption and Production: Encouraging the recycling of materials such as paper, plastics, glass, and metals.
6. Sustainable Cities and Communities: Fostering sustainable transportation options, such as biking, walking, or using public transit.

In the context of new developments, leveraging AI technologies focused on environmental sustainability can greatly enhance the processes of design, construction, and operation. The following are some key AI applications that play a significant role in promoting sustainability within new development projects:

1.0 Smart Building Design and Energy Optimization

AI-Enhanced Architectural Design:
AI technologies can significantly improve building design by optimising factors like climate, orientation, and material selection. These algorithmsensure that buildings benefit from optimal natural lighting, ventilation, and insulation, which minimises the reliance on artificial heating and cooling systems. Additionally, augmented reality can superimpose virtual design elements onto actual spaces, providing a realistic preview of design choices and their effects (Abbas, 2023). The adoption of AI in architectural design is gaining momentum globally, driven by the desire to achieve environmentally sustainable green designs for indoor spaces.

Energy Management Systems:
AI-powered Building Management Systems (BMS) leverage sensors to oversee and adjust lighting, heating, cooling, and ventilation. These systems learn from patterns of occupancy and make real-time adjustments to energy use, thus reducing waste and enhancing efficiency. For instance, lighting and HVAC systems automatically deactivate in unoccupied spaces. By utilising AI algorithms, building owners and operators can acquire detailed insights into energy usage, detect inefficiencies, and apply targeted measures to minimise energy waste (Design21, 2024).

AI in Material Selection:
AI tools can assist in choosing eco-friendly building materials by evaluating factors such as environmental impact, cost, and durability. This ensures that new constructions have a reduced carbon footprint. Furthermore, these AI systems can adapt to evolving conditions, such as changes in occupancy and weather forecasts, to optimise energy efficiency and cut operational expenses (Design21, 2024).

Smart building features based on IoT solutions
(Source: Smart Building | Anian. (n.d.). Anian. *https://www.anian.co/smart-building-1)*

2.0 AI-Enhanced Smart Grids for Efficient Energy Distribution

Effective energy management is essential for minimising environmental impact in new developments. AI plays a pivotal role in this process through the use of smart grids:

AI-Enabled Smart Grids:
These advanced grids utilize AI to forecast energy demand in emerging developments and ensure efficient electricity distribution. AI helps manage renewable energy sources, such as solar and wind, by predicting their generation patterns, storing surplus energy in batteries, and allocating it during peak usage times. According to Ryanix (2024), the push for smart grid technologies is driven by the growing integration of renewable energy sources, which are often decentralized and intermittent. This necessitates innovative approaches to integrate and balance these energy sources effectively within the grid.

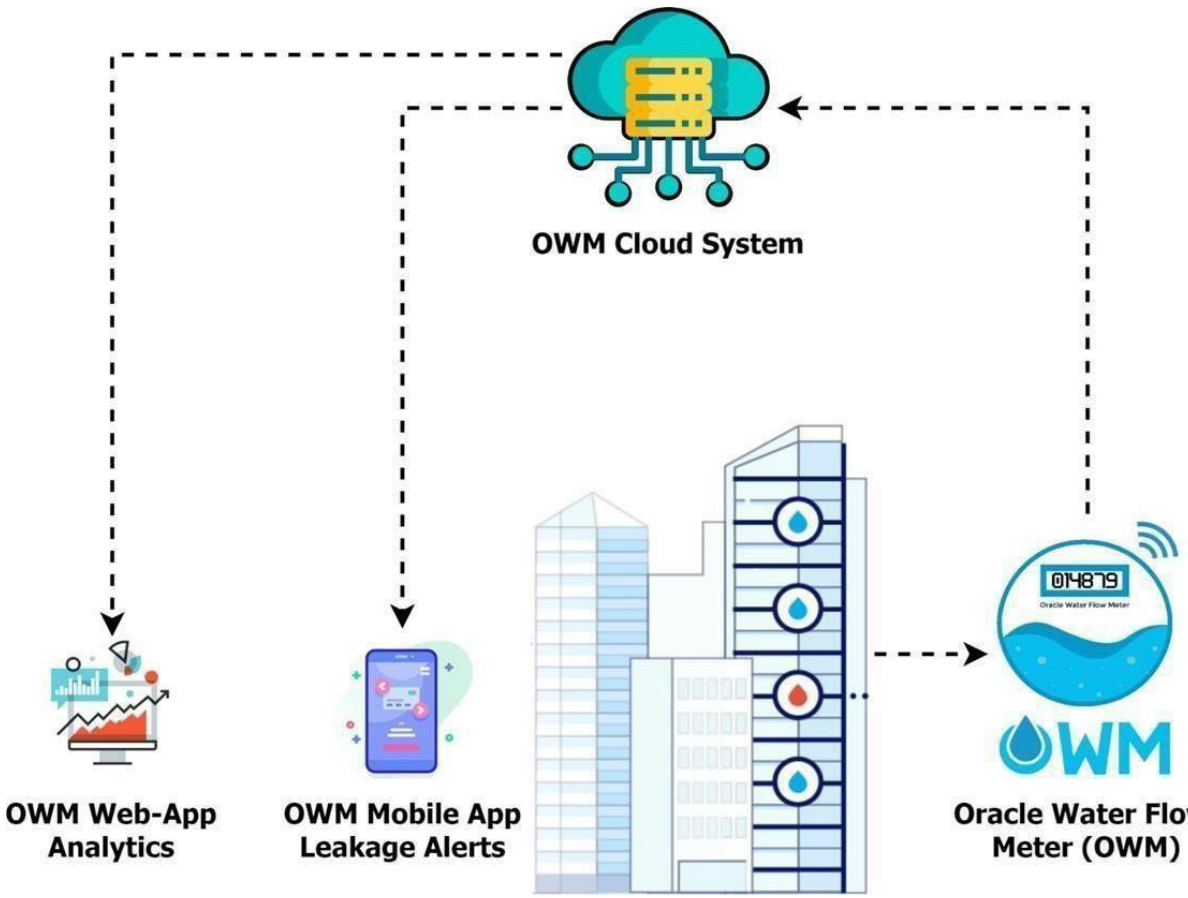
Demand-Response Systems:
AI-driven demand-response systems adjust power supply in real time to accommodate fluctuations in demand. This dynamic adjustment helps prevent energy waste and enhances the integration of renewable sources into the grid. As part of smart grid technologies, these systems enable utilities to modify electricity consumption in response to variations in supply and demand, thereby maintaining grid stability and reducing the risk of outages (Ryanix, 2024).

3.0 Water Conservation and Management

Artificial Intelligence (AI) plays a crucial role in managing and conserving water resources, ensuring their efficient use, and minimizing waste in new developments:

AI-Enhanced Irrigation Systems:
In urban landscapes, AI-powered irrigation systems optimize water usage by continuously monitoring soil moisture levels, weather conditions, and plant health. This technology ensures that water is applied precisely as needed, preventing over-irrigation and conserving resources. Smart irrigation relies on collecting data from various sensors, such as those measuring soil moisture, temperature, and atmospherichumidity, to make informed decisions about water application (Sinwar et al., 2019).

Intelligent Water Grids:
AI systems are also employed to enhance water distribution networks. These systems can detect and address leaks by analysing data from various sensors within the grid. By predicting potential leaks or inefficiencies before they occur, AI enables proactive maintenance and reduces water loss. For instance, the Oracle Smart Grid Water Flow Meter (OWM) is a sophisticated smart meter that utilises AI and machine learning to monitor water usage and automatically identify and rectify leaks, offering a sustainable solution that compensates for its cost through the savings generated from reduced water loss.



Oracle Water Smart grid system
(Source: Intelligent Oracle Smart Grid Water Flow Meter Based on AI, n.d.)

4.0 Sustainable Construction with AI

In the construction phase of new developments, Artificial Intelligence (AI) offers significant benefits by minimising environmental impacts and optimising various aspects of the construction process:

AI-Enhanced Construction Management:
AI can revolutionise construction management by cutting down material waste, forecasting potential delays, and improving the efficiency of resource use. For instance, AI systems can review data from previous projects to recommend the most effective methods for minimizing energy consumption during construction. According to Pan and Zhang (2021), leveraging AI in construction can boost labour efficiency by up to 40% and stimulate economic growth by 2035, underscoring its potential to advance sustainable development practices.

Predictive Maintenance for Machinery:
AI is also instrumental in predictive maintenance for construction equipment. By analysing data, AI can forecast when machinery requires servicing, thus reducing downtime and avoiding fuel and energy waste associated with malfunctioning equipment. This proactive maintenance strategy not only prevents operational disruptions but also extends the longevity of construction machinery and buildingsystems. Efficiently addressing maintenance needs ensures optimal performance, reduces energy usage, and lowers overall operational costs (Design21, 2024).

5.0 AI in Sustainable Transportation and Mobility

Incorporating sustainable transportation solutions into new developments is essential for reducing carbon emissions, and AI plays a crucial role in enhancing these systems:

Traffic Management Systems:
AI can significantly improve traffic flow in new urban areas by minimising congestion and reducing vehicle emissions. Through real-time adjustments of traffic signals and the use of sensors, AI-driven systems ensure smooth and efficient vehicle movement.

Electric Vehicle (EV) Integration:
AI optimises the management of EV charging stations in new developments by forecasting charging demand patterns. This facilitates efficient energy distribution to charging points and supports the broader adoption of electric vehicles.

Autonomous Transportation Solutions:
AI also contributes to sustainable mobility through the deployment of autonomous electric shuttles or vehicles for transportation within communities. These solutions reduce the need for traditional vehicles, thereby cutting down emissions.

Furthermore, the use of AI technologies has the potential to decrease global greenhouse gas (GHG) emissions by 4% by 2030, equivalent to 2.4 gigatonnes of CO_2e. This reduction is comparable to the total annual emissions of Australia, Canada, and Japan combined (Price water house Coopers, n.d.).

6.0 AI in Waste Management for New Developments

Artificial Intelligence (AI) is transforming waste management systems, making it possible to significantly reduce and efficiently handle waste in new developments:

Intelligent Waste Sorting:
AI-powered robots and systems enhance the efficiency of waste sorting by accurately separating recyclable materials from non-recyclables. This improved sorting process increases recycling rates and decreases the volume of waste that ends up in landfills. For instance, advanced waste-sorting robots equipped with deep learning algorithms and optical sensors can precisely identify and classify various types of waste (Mao et al., 2022).

Waste Prediction and Optimization:
AI can forecast the volume of waste generated by new developments and provide strategies to manage and reduce it effectively. This includes optimizing the operation of recycling facilities and implementing waste-to-energy technologies. By integrating AI-based predictive analysis with smart waste management practices, this approach transforms waste management into a more sustainable and efficient process. It allows waste management authorities to enhance waste collection, recycling, and landfill operations, thereby minimising environmental impact and promoting resource conservation. Embracing AI in waste management supports a greener future by viewing waste as a valuable component of the circular economy (Gandhimathinathan, 2023).

The growth of AI in global waste management market (source: AI in Waste Management Market Size. *https://market.us/report/ai-in-waste-management-market/)*

7.0 AI for Green Spaces and Environmental Monitoring

Integrating green spaces into modern developments enhances biodiversity and environmental health. AI plays a crucial role in monitoring and managing these areas:

AI-driven environmental monitoring:
AI technology enables real-time monitoring of air and water quality, noise pollution, and soil conditions. This allows developers to respond quickly if pollution levels spike or environmental degradation occurs. Chisom et al. (2024) emphasised that AI's intelligence serves as a catalyst for precise interventions, helping conservationists and authorities prioritize vulnerable areas, allocate resources efficiently, and enforce regulations with unmatched precision. This forward-thinking approach protects environmental equilibrium and sets a global benchmark for utilizing technology to tackle ecological challenges.

Optimising green spaces:
AI tools assist in planning and maintaining green spaces in new developments, ensuring they contribute to urban cooling, carbon absorption, and enhanced biodiversity.

8.0 AI in Renewable Energy Integration

Artificial intelligence (AI) has garnered significant attention recently due to its transformative potential across multiple industries, including renewable energy. The World Economic Forum's 2021 report highlighted AI's ability to accelerate the transition to renewables by addressing key areas such as governance, design, and risk management. AI enhances the seamless integration of renewable energy systems into new developments

AI-powered solar energy systems:
AI algorithms can determine the optimal placement of solar panels on buildings, maximising sunlight exposure and boosting energy efficiency. Ukpanah (2024) noted that AI is revolutionising solar energy by enabling more efficient and cost-effective installations. AI-based systems can increase energy output by up to 25% while lowering operational costs by 30%. By utilising these algorithms, solar companies can reduce shading, optimise panel tilt, and maximise energy capture.

Wind energy optimization:
In wind-prone areas, AI predicts wind patterns and determines the best locations for wind turbines, maximising renewable energy production. According to Morkos (2023), AI provides continuous and near-instant analysis of environmental data, allowing for accurate weather predictions and real-time adjustments. This improves planning, boosts operational efficiency, reduces unnecessary weather-related shutdowns, and minimises equipment damage from environmental factors.

Conclusion

AI technologies are transforming the approach to making new developments more environmentally sustainable. By optimizing energy consumption, enhancing water management, and reducing waste, AI equips developers with the tools to significantly lower the environmental impact of both the construction and operational stages. As AI advances, its contribution to sustainability will play an increasingly pivotal role in shaping the future of eco- friendly cities and developments. By integrating AI-driven solutions, developers can create more efficient, sustainable, and environmentally conscious spaces.

Reference:

1. Abbas F (2023) AI in Interior Design: Transforming Spaces with Intelligent Technology, Architectural Chronical.
2. Chisom, Onyebuchi & Biu, Preye & Umoh, Aniekan & Obaedo, Bartholomew & Adegbite, Abimbola & Abatan, Ayodeji. (2024). Reviewing the role of AI in environmental monitoring and conservation: A data-driven revolution for our planet. World Journal of Advanced Research and Reviews. 21. 161- 171. 10.30574/wjarr.2024.21.1.2720.
3. Design21. (2024, April 25). AI-Driven Sustainable Design: Optimising energy efficiency in buildings. https://www.linkedin.com/pulse/ai-driven-sustainable-design-optimising-energy-efficiency-buildings- tsqac/ Gandhimathinathan (2023, September). Particle swarm Optimization for AI based Predictive Waste Management: Revolutionizing sustainability and efficiency. https://smartcities.ieee.org/newsletter/september-2023/particle-swarm-optimization-for-ai-based- predictive-waste-management-revolutionizing-sustainability-and-efficiency
4. Intelligent Oracle Smart Grid Water Flow Meter based on AI. (n.d.). MIT SOLVE. https://solve.mit.edu/challenges/solv-ed-youth-innovation-challenge-2/solutions/69817
5. Mao W-L, Chen W-C, Fathurrahman HIK, Lin Y-H (2022) Deep learning networks for real-time regional domestic waste detection. J Clean Prod 344:131096. https://doi.org/10.1016/j.jclepro.2022.131096
6. Martin. (2023, October 20). Global Partnerships - United Nations Sustainable development. United Nations Sustainable Development. https://www.un.org/sustainabledevelopment/globalpartnerships/
7. Pan Y. and Zhang L. 2021 Roles of artificial intelligence in construction engineering and management: A critical review and future trends. Autom. Constr. 2021, 122, 103517.
8. Patterson, N. (2024, January). What is environmental sustainability? Goals with examples. https://www.snhu.edu/about-us/newsroom/stem/what-is-environmental-sustainability#:~:text=Environmental%20sustainability%20refers%20to%20the,future%20generations%20to%20meet%20theirs.
9. PricewaterhouseCoopers. (n.d.). How AI can enable a sustainable future. PwC. https://www.pwc.co.uk/services/sustainability-climate-change/insights/how-ai-future-can-enable- sustainable-future.html
10. Rene Morkos. (2023, February 15). https://www.windsystemsmag.com/ai-applications-in-wind- energy-systems/
11. Ryanix, L. (2024, March 4). The Future of Power Distribution: Exploring Smart Grid Technologies. Medium. https://medium.com/@luke.ryanix/the-future-of-power-distribution-exploring-smart-grid- technologies-bff771436023
12. Sinwar, Deepak & Dhaka, Vijaypal & Sharma, Manoj Kumar & Rani, Geeta. (2019). AI-Based Yield Prediction and Smart Irrigation. 10.1007/978-981-15-0663-5_8.
13. Ukpanah, I. (2024, March 27). How AI can Improve Solar Energy Output by up to 25%. GreenMatch.co.uk. https://www.greenmatch.co.uk/blog/ai-for-solar-panel-optimisation
14. What is artificial intelligence (AI)? | IBM. (n.d.). https://www.ibm.com/topics/artificial-intelligence

AI-DRIVEN GEOMATICS FOR POTHOLE AND CRACK DETECTION:

Enhancing Malaysia's Infrastructure Resilience

Ezzatul Arifah Abd Rahim
Operation Manager
Jurukur Hasruzei Daud

Khairulanwar Ab Rahman
Managing Director
Sky Phantom Empire (Malaysia)

Assoc. Prof. Sr Gs. Ts. Dr. Khairul Nizam Tahar
School of Geomatics Science and Natural Resources,
College of Built Environment,
Universiti Teknologi MARA

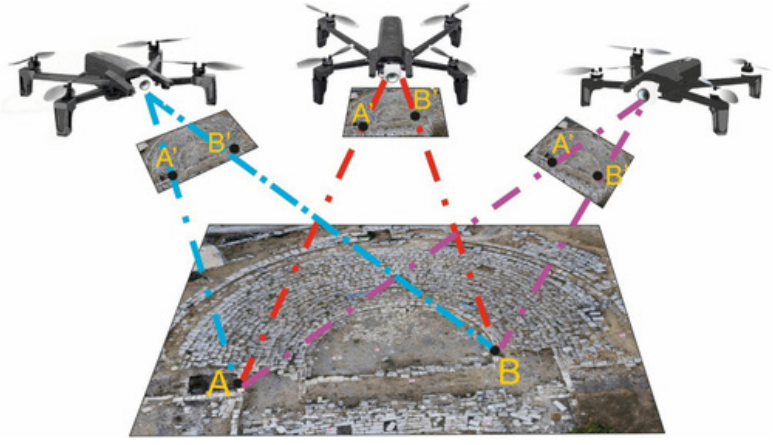
Abstract

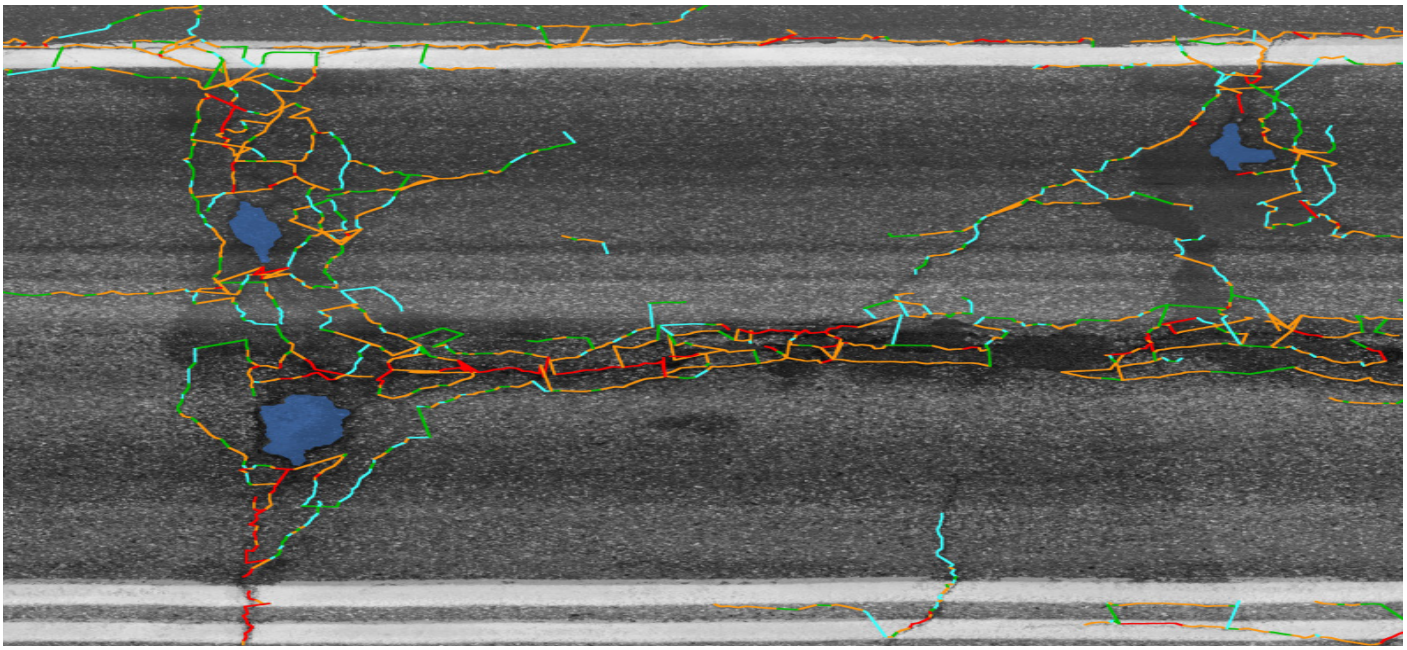
Potholes and building cracks pose significant challenges for infrastructure maintenance in Malaysia, highlighting the urgent need for effective monitoring solutions. This study addresses these critical issues through the development of a 3D model of potholes using multispectral imaging and the inspection of building cracks with UAV photogrammetry. By employing advanced multispectral images processed with the Speeded Up Robust Features (SURF) algorithm, the study successfully achieved accurate 3D reconstructions of potholes. The analysis revealeda intriguing variations across different spectral bands, emphasising the necessity of identifying optimal bands for precise measurements. In tandem, the UAV-based method for detecting building cracks emerged as an efficient and reliable approach forassessing structural integrity. Utilizing specialised software for both 3D modelling and crack measurements, the study demonstrated impressive accuracy, showcasing the potential of drone technology in enhancing infrastructure assessments. This integrated approach not only promises to improve real-world maintenance efforts but also significantly reduces data collection time while enhancing measurement precision. Looking ahead, future research should explore the synergy between various spectral bands and refined software techniques to further elevate the accuracy of 3D models in diverse infrastructure applications. By paving the way for smarter and more efficient maintenance strategies, this research contributes to the ongoing dialogue about leveraging technology for sustainable urban development.

Keywords: Pothole Detection; Crack Detection; UAV Photogrammetry; Multispectral Imaging

1.0 Introduction

Photogrammetry-based AI (Artificial Intelligence)-assisted 3D model reconstruction has gained traction across various fields, including automotive engineering, forensics, building maintenance, and healthcare. This AI-enhanced, non-contact measurement method streamlines processes, cutting both time and labour costs while providing highly accurate results. With advancements in high-resolution cameras and AI, 3D reconstruction has becomemore accessible, shifting from expensive laser scanners to simple photograph-based techniques.





A particularly relevant application of AI-driven 3D reconstruction lies in road surface assessment, specifically in identifying potholes bowl-shaped depressions that can reach depths of up to 20 cm. These hazards, often caused by heavy vehicle loads or natural disasters like floods, pose significant risks to vehicle performance, ride quality, and overall road safety. Regular inspections and timely repairs are essential to maintaining road safety, yet traditional pothole detection methods often rely on labour-intensive manual inspections, which can be costly and hazardous for personnel. Moreover, skilled inspectors are crucial for accurately assessing damage, making the process evenmore resource-intensive.

To tackle these challenges, innovative AI-powered automated pothole detection systems have emerged. For instance, Ahmed (2021) developed a system that leverages accelerometer data from vehicles to detect potential potholes through vibration sensors. However, this method struggles with accuracy in defining the exact shape and volume of potholes, sometimes misclassifying road joints as potholes. Similarly, Wang et al. (2020) explored using dual laser scanners on specialised sensing vehicles, but the high costs associated with equipment and maintenance have hindered broader adoption.

AI-assisted 3D reconstruction techniques have also been utilized for road surface maintenance by agencies such as Malaysia's Public Works Department (JKR). Road infrastructure is often damaged by vehicle pressure and natural disasters like landslides or floods, making regular inspections and maintenance vital. Studies show that road repair costs can soar sevenfold over five years if left unattended. By creating AI-powered 3D road surface models, JKR can remotely assess road conditions, measure essential attributes, and consistently monitor surface quality. Technologies like AI-driven photogrammetry and LiDAR provide accurate 3D data, empowering agencies to make informed maintenance decisions without the need for on-site inspections.

Traditionally, 3D reconstruction has relied on standard imaging methods. However, the introduction of AI-enhanced imaging has offered new possibilities for capturing fine details and enhancing computer vision applications. Since then, numerous AI-powered 3D reconstruction methods and algorithms have emerged to boost accuracy and efficiency. Key AI algorithms used in 3D reconstruction include the Difference of Gaussian (DoG) algorithm, which identifies stable feature points through local extremum detection in 2D space. The Scale- Invariant Feature Transform (SIFT) algorithm provides scale and rotational invariance by analysing pixel gradients in specific feature fields, although it can be slow. The Speeded Up Robust Feature (SURF) algorithm was developed to enhance processing speed while reducing dimensionality. Meanwhile, the Harris algorithm excels at extracting feature points based on gradient changes and image grey values, though it may lack scaling consistency.

In building inspections, visual assessments by personnel remain the norm for monitoring structural conditions. These conventional methods are particularly effective for assessing cracks in stone and concrete structures, as noted by Eschmann et al. (2012). Research by Choi et al. (2021) on historical buildings has shown that manual methods can effectively detect damages, including biological changes or moisture-related issues. Fan et al. (2018) further explored building pathology, highlighting that while inspectors' expertise can enhance accuracy, traditional methods still rely heavily on subjective interpretations. AI-assisted photogrammetry mapping

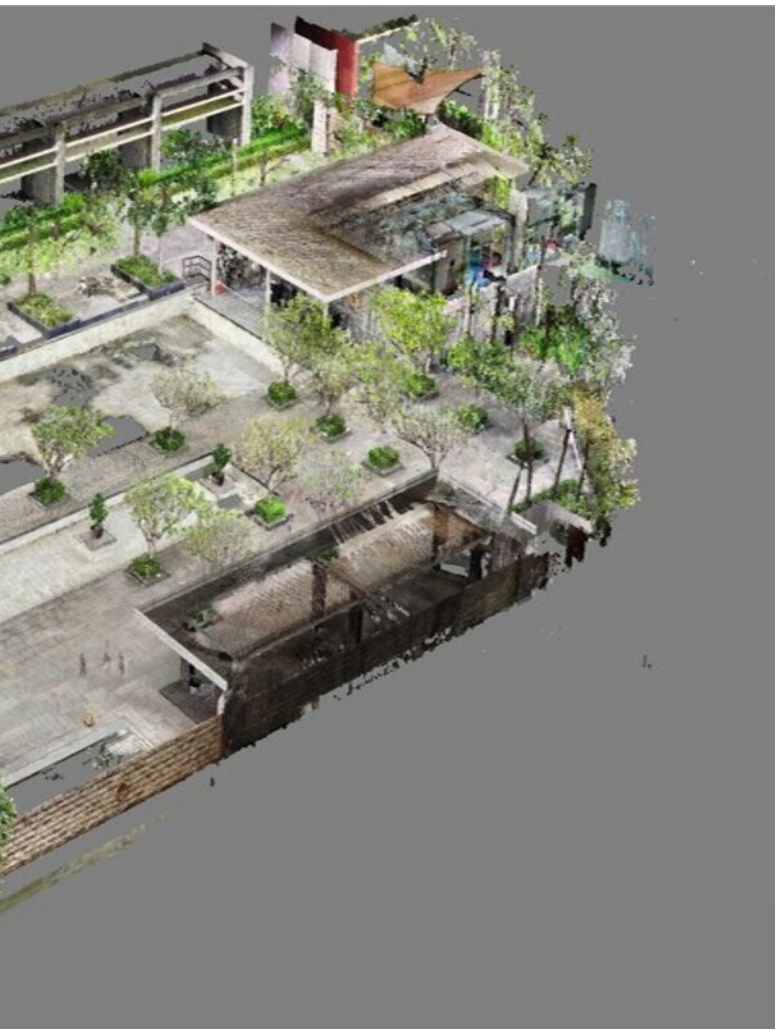
whether through manual, semi-automatic, or automatic approaches has demonstrated potential in quantifying facade defects like cracks and mortar spalling for maintenance purposes.

The use of AI-enabled 3D terrestrial laser scanning has also gained momentum in building inspections, as highlighted by Bhowmick et al. (2020). This technique generates high- resolution digital surface models that capture intricate building details, including roof shapes. Integrating aerial imagery with Light Detection and Ranging (LiDAR) can further refine the accuracy and detail of 3D models. By merging these datasets, missing boundaries and rooftop patches can be corrected automatically, resulting in highly precise building models.

Identifying damage in buildings is crucial, as such defects can degrade material performance over time. Wei et al. (2019) emphasize that manual mapping of defects can be both costly and time-consuming, with outcomes influenced by factors such as building accessibility and assessment methods. Some methodologies, like those explored by Meena and Mittal (2013), assess specific defect parameters, including area, location, and length. AI-powered photogrammetry can enhance these assessments by reducing errors caused by individual interpretation.

Recently, AI-enabled Unmanned Aerial Vehicles (UAVs) have emerged as valuable tools for photogrammetric assessments across multiple domains, as discussed by Alidoost and Arefi (2015) and Remondino et al. (2012). UAVs can operate in manual, semi-automatic, and fully automated modes, supported by GPS/INS sensors for precise positioning. Capable of surveying large areas with minimal space requirements for launch and landing, UAVs are well-suited for frequent inspections, including weekly or monthly assessments. Operating at altitudes ranging from ground level to three kilometres, UAVs offer flexibility in capturing high-precision images tailored to project needs.

UAVs present an economical and efficient platform for close-range, real-time imagery, making them ideal for infrastructure monitoring. Compared to traditional laser scanners, AI-enhanced UAV systems are less expensive and require fewer personnel, significantly reducing operational costs. When deployed effectively, UAV mapping can achieve centimetre-level accuracy, making it particularly suited for detailed inspections. Tahar (2012) notes the advantages of UAVs, including their ease of use, safety, and capability to operate athigh altitudes.



Until recently, building inspections heavily relied on manual visual assessments, necessitating significant resources and scaffolding for accessibility. Today, AI-powered UAV technology is revolutionizing this process, offering efficient and cost-effective monitoring solutions for hard- to-reach areas. Rodríguez et al. (2015) summarize various crack measurement methods, including visual inspection, image processing, smart film technology, and optical fibre, which facilitate accurate assessments of crack initiation, width, and location. However, traditional crack monitoring remains time-consuming and expensive, highlighting the need for improved image acquisition through AI-based UAV methods.

UAVs can capture high-resolution images or videos of difficult-to-access structures, enabling live monitoring on remote screens to ensure accuracy. AI-assisted close-range photogrammetry facilitates detailed crack detection and measurement on buildings, effectively addressing challenges associated with high-rise structures that are hard to reach manually.
This study aims to transform infrastructure maintenance by harnessing AI-driven imaging technologies for both road and building assessments. By comparing multispectral and RGB sensors for AI-enhanced 3D model reconstruction, the research enhances pothole detection for more efficient road upkeep. Simultaneously, it delves into AI-assisted UAV photogrammetry to accurately monitor and assess building cracks, providing a practical approach to structural maintenance. Together, these advancements offer innovative and reliable solutions for preserving critical infrastructure

2.0 Materials and Methods

This study employs a dual-phase data collection strategy to provide an innovative approach for assessing potholes and road conditions.

2.1 UAV-Based Data Collection: Pothole Assessment

The first phase utilises a multi-rotor DJI Phantom 4 Pro UAV, equipped with a Parrot Sequoia+ multispectral sensor, designed to capture high-resolution images and multispectral data for environmental monitoring, agriculture, and land management. This combination of UAV technology and advanced sensors allows efficient data collection over extensive areas. The Parrot Sequoia+ sensor, mounted beneath the drone, captures images across various wavelengths, providing vital insights into vegetation health and land surfaces. It connects to a power bank to ensure continuous operation and minimise downtime during extensive mapping. To optimise imaging quality, a sunshine sensor is attached to the drone's top. This sensor balances incoming light, automatically adjusting for varying conditions andeliminating the need for pre-flight calibration, streamlining the data collection process.

The drone operator uses the DJI Go 4 app on a mobile device to monitor the UAV's flight path in real time. This user-friendly interface allows for immediate adjustments during the flight, ensuring optimal data collection. Flight data is recorded using Pix4D software, which enables remote configuration of sensor settings via Wi-Fi, allowing users to tailor datacollection to project requirements. This phase is crucial for accurately mapping the studyarea. The integration of the DJI Phantom 4 Pro and Parrot Sequoia+ sensor facilitates the collectionof detailed multispectral images, essential for creating high-quality 3D models. These models enhance analysis and decision-making based on collected data. This innovativeUAV-based approach significantly improves the effectiveness of the research initiative.

2.2 UAV-Based Data Collection: Crack Detection

The project employs a dual approach for data acquisition, integrating precision 3D modelling with targeted crack detection through a micro UAV setup featuring the DJI Phantom 3 Professional drone. This combination leverages the drone's robust flight capabilities through the DJI Go app, which offers intelligent flight modes like "Point of Interest" (POI) and manual control options for efficient data capture essential for effective building inspections. In the 3D model reconstruction phase, the POI mode is vital. The UAV orbits the target building in a circular flight path, capturing images from multiple angles to ensure optimal overlap. This method generates detailed imagery necessary for creating a seamless andaccurate3D model, allowing comprehensive analysis of the structure's dimensions andarchitectural features. High- resolution models facilitate better visualization, aiding maintenance planning and architectural assessments.

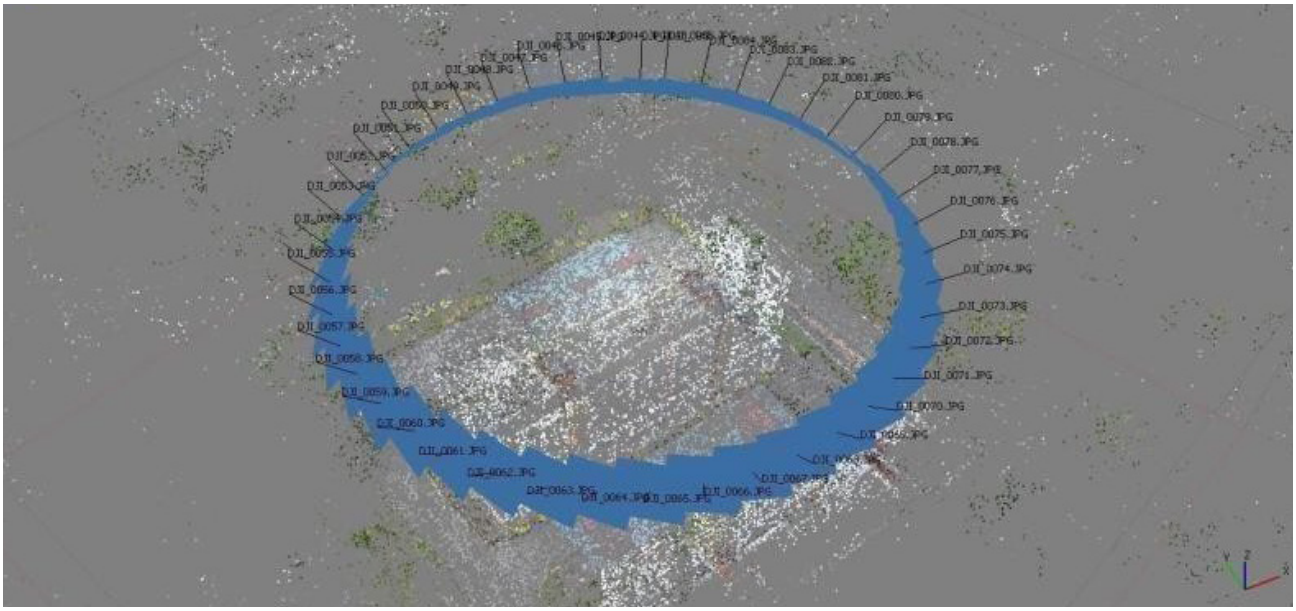


Figure 1: Camera location during image acquisition

For crack detection, the UAV pilot manually guides the drone along pre-planned flight lines, adjusting the UAV's position to capture close-up images of potential cracks in the building facade. This meticulous control enables a detailed examination of structural integrity, allowing precise assessments of crack dimensions and their implications for the building's safety. To ensure top-quality results, the drone's camera is calibrated with a specialised Calibration Grid and managed through photogrammetry software like PhotoModeler. This software provides vital feedback metrics for assessing calibration accuracy, ensuring consistent image quality crucial for reliable crack measurements.

Meticulous flight planning considers factors such as lighting conditions and overlap percentage, enhancing the data acquisition process. The flight line strategy involves starting inspections at the building's top left and moving horizontally across each section, ensuring comprehensive coverage. By merging automated 3D modelling with manual crack detection, this innovative approach streamlines the inspection process, significantly enhancing structural analysis and supporting accurate maintenance planning, ultimately improving the safety and longevity of building infrastructure.

Figure 2: Inspection of building cracks

2.3 Data Processing for 3D Modelling of Potholes

For data processing, we employ MATLAB, Pix4D, and ArcMap software. MATLAB runs the Speeded Up Robust Features (SURF) algorithm for image detection, producing key points essential for 3D modelling of the study object. Pix4D generates orthophotos of the pothole, while ArcMap creates Triangulated Irregular Networks (TIN) and Digital Elevation Models (DEM) for subsequent volume calculations.

The SURF algorithm is ideal for object tracking, as it is scale-invariant and rotation- independent. In MATLAB, we input captured images, stacking four types from different single bands for interest point generation. This process yields interest points necessary for constructing 3D models from 2D images, ultimately forming the point cloud for 3D reconstruction. Following interest point generation, the next stage involves producing the orthophoto in Pix4D. The generated DEM is then used to calculate the volume and area of the pothole after masking the area. The 3D model of the pothole undergoes several stages in ArcGIS, allowing for comparison with conventional volumetric assessments.

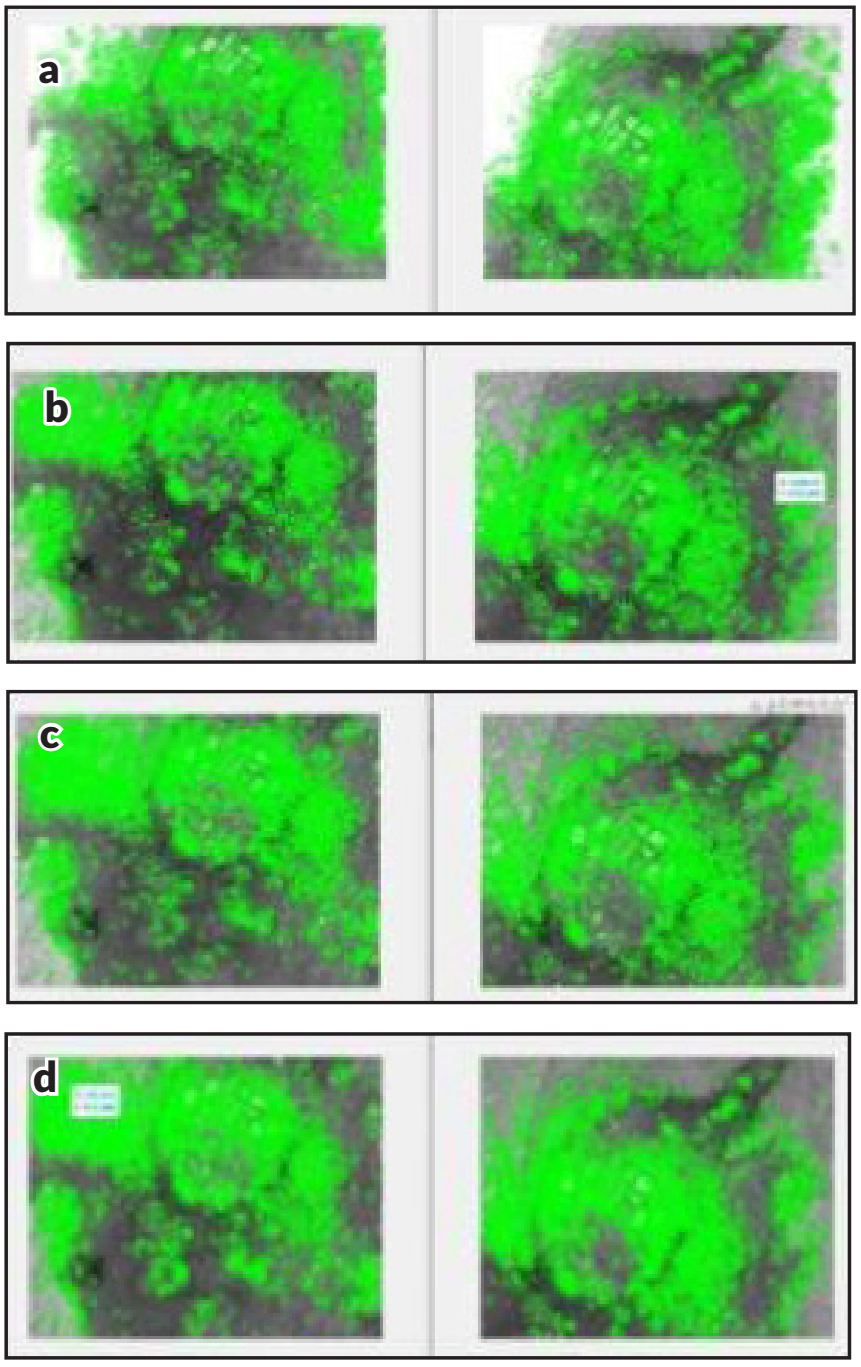


Figure 3: Feature Detection with SURF Algorithm; a) Green band, b) Red band, c) NIR band, d) Red Edge band

2.4 Image Selection and 3D Model Creation for Building Inspections

After image acquisition, it is essential to select high-quality images for data processing. Given the numerous images captured, only those that are clear and sharp will be used to create the 3D model. Images are chosen based on their position, view, and angle. Agisoft Photoscan software is then utilised to construct a 3D model, providing an overview of the building's dimensions and aiding in crack identification.

A significant number of images captured during building inspection necessitate thorough analysis before measuring defects. Each image must have its cracks manually identified and verified before proceeding. It is crucial to have at least two similar images to ensure adequate overlap for accurate defect measurement. The identified defects, referred to as cracks, will be measured using photogrammetry techniques.

From the selected images, crack measurements can be conducted in subsequent steps, facilitating detailed analysis of the building's structural integrity. This systematic approach enhances the accuracy of the inspection process, ensuring that identified defects are precisely measured and documented, ultimately supporting effective maintenance planning.

Figure 4: 3D Model Creation for Building Inspections

3.0 Results and Analysis

The initial step in data processing involved detecting keypoints for 3D modelling using the Speeded Up Robust Features (SURF) algorithm. This technique generates feature detection images across various spectral bands, including Green, Red, NIR, and Red Edge. After feature matching, the final interest points essential for generating the 3D model of the potholewere extracted. An extension script in MATLAB efficiently retrieves the X, Y, and Z coordinates of these points, summarizing the number of detected tie points for each spectral band. The outcome of the SURF algorithm script results in 3D points that represent the pothole, visualized as consistent point clouds across the spectral bands. This data is instrumental for generating the Digital Elevation Model (DEM), which is crucial for accurate area and volume calculations.

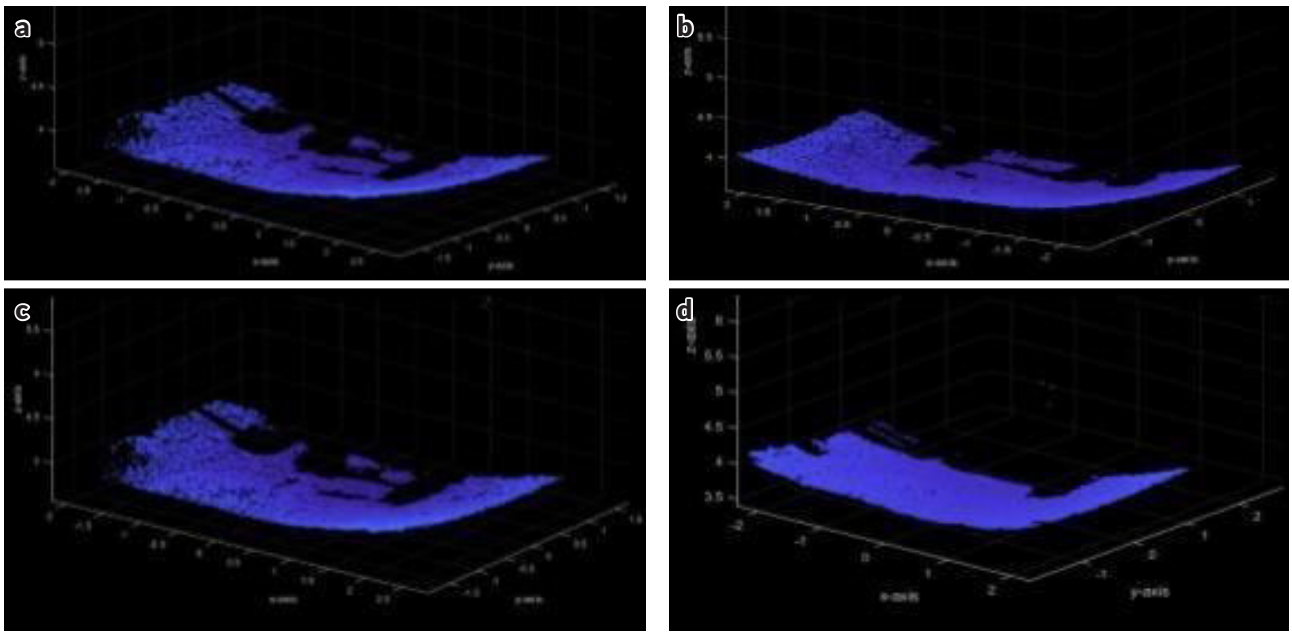


Figure 5: Point Cloud Generated in MATLAB; a) Green band, b) Red band, c) NIR band, d) Red Edge band

Orthophotos of the pothole were produced from each spectral band, aiding in the necessary area digitization for volume assessments. The matched X, Y, and Z data facilitated thecreationof Triangulated Irregular Networks (TIN), from which DEMs were derived. This process not only enhances the accuracy of volume analysis but also enables a robust comparison of area and volume results derived from both MATLAB and Pix4D. The analysis revealed consistent discrepancies between conventional measurement techniques and software processing methods. For instance, in MATLAB, the difference between conventional and processed area measurements ranged from 7400 cm^2 to 7500 cm^2, indicating potential errors during the on- site data collection. Similarly, using Pix4D software,the error remained consistent, with a range from 2822 cm^2 to 2827 cm^2. These findings underscore the necessity for refining traditional data collection practices to improve accuracy.

In the assessment of building cracks, the study also demonstrated the effectiveness of UAV photogrammetry. The accuracy of UAV photogrammetry for crack measurements was calculated at ± 0.8 cm, reflecting its efficiency in capturing structural defects. As with pothole measurements, minimal differences were noted between UAV and conventional measurement techniques, with discrepancies largely stemming from image matching quality, impacting overall distortion.

Both assessments highlight the advantages of employing advanced imaging technologies. Ultimately, this study validates UAV photogrammetry as a viable method for achieving centimetre-level accuracy in structural assessments, showcasing its potential in enhancing maintenance strategies for both road and building infrastructure.

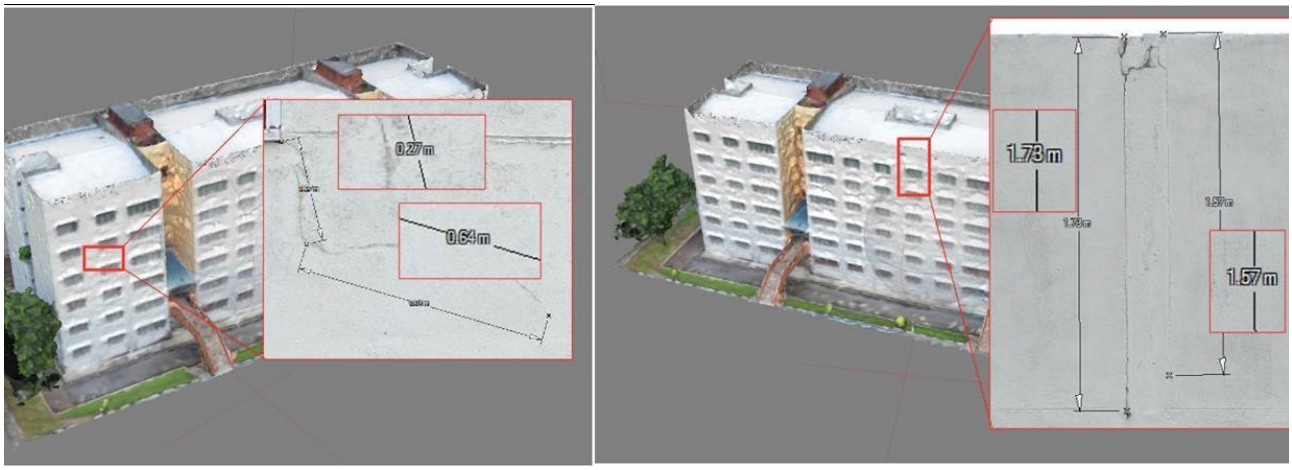


Figure 6: Building crack measurements

4.0 Conclusion

This study successfully explored the innovative use of multi spectral band layers for creating 3D models of potholes, employing data from various spectral bands. By applying the Speeded Up Robust Features (SURF) algorithm, we generated Digital Elevation Models (DEMs) that are crucial for volume calculations. Each spectral band provided valuable data, with the differences in detected features highlighting the strengths of each band in modelling accuracy. When comparing these advanced 3D pothole models with traditional ground measurements, we found noteworthy differences that emphasize the benefits of software-based methods over conventional techniques. The results indicate that software-derived data can significantly improve measurement accuracy, particularly in assessing the area and volume of potholes.

On the other hand, our investigation into UAV platforms for capturing building defects showcased their effectiveness in accurately measuring cracks. The UAV technology not only facilitated detailed assessments but also proved to be a reliable tool for monitoring infrastructure conditions.

In conclusion, this research advocates for the continued use of UAVs in infrastructure assessments, suggesting enhancements such as improved endurance and safety features for close-range imaging. Furthermore, ensuring proper camera calibration and incorporating reference scales can elevate the quality of future data collection. Ultimately, aerial photogrammetry emerges as a convenient and efficient method for monitoring and assessing critical infrastructure, offering exciting possibilities for the future of geomatics.

References

1. Ahmed, A. (2021). Pothole 3D reconstruction with a novel imaging system and structure from motion techniques. IEEE Transactions on Intelligent Transportation Systems, 1-10. https://doi.org/10.1109/TITS.2021.3074019
2. Choi, D., Bell, W., Kim, D., & Kim, J. (2021). UAV-driven structural crack detection and location determination using convolutional neural networks. Sensors, 21(8), 2650. https://doi.org/10.3390/s21082650
3. Bhowmick, S., Nagarajaiah, S., & Veeraraghavan, A. (2020). Vision and deep learning- based algorithms to detect and quantify cracks on concrete surfaces from UAV videos. Sensors, 20(22), 6299. https://doi.org/10.3390/s20226299
4. Qiao, W., Ma, B., Liu, Q., Wu, X., & Li, G. (2021). Computer vision-based bridge damage detection using deep convolutional networks with expectation maximum attention module. Sensors, 21(3), 824. https://doi.org/10.3390/s21030824
5. Wei, X., Yang, Z., Liu, Y., Wei, D., Jia, L., & Li, Y. (2019). Railway track fastener defect detection based on image processing and deep learning techniques: A comparative study. Engineering Applications of Artificial Intelligence, 80, 66–81. https://doi.org/10.1016/j.engappai.2019.02.006
6. Fan, Z., Wu, Y., Lu, J., & Li, W. (2018). Automatic pavement crack detection based on structured prediction with the convolutional neural network. arXiv. https://arxiv.org/abs/1802.02208
7. Lucieer, A., Jong, S. M., & Turner, D. (2014). Mapping landslide displacements using structure from motion (SfM) and image correlation of multi-temporal UAV photography. Progress in Physical Geography, 38(1),97-116. https://doi.org/10.1177/0309133313515293
8. Siebert, S., & Teizer, J. (2014). Mobile 3D mapping for surveying earthwork projects using an unmanned aerial vehicle (UAV) system. Automation in Construction, 41, 16-28. https://doi.org/10.1016/j.autcon.2014.01.004
9. Nex, F., & Remondino, F. (2014). UAV for 3D mapping applications: A review. Applied Geomatics, 6(1), 1-15. https://doi.org/10.1007/s12518-013-0120-x
10. Alidoost, F., & Arefi, H. (2015). An image-based technique for 3D buildingreconstruction using multi-view UAV images. ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 2, W5, 43-50. https://doi.org/10.5194/isprsarchives-XL-1- W5-43-2015
11. Remondino, F., Barazzetti, L., Nex, F., Scaioni, M., & Sarazzi, D. (2012). UAV photogrammetry for mapping and 3D modelling – current status and future perspectives. ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 39, 1-6. https://doi.org/10.5194/isprsarchives-XXXVIII 1-C22-25-2011
12. Mahmoud, M. S., Oyejedi, M. O., & Xia, Y. (2021). Path planning in autonomous aerial vehicles. In Advanced Distributed Consensus for Multiagent Systems (pp. 331-362). Springer. https://doi.org/10.1007/978-3-030-42079-9_10
13. Eschmann, C., Kuo, C. M., Kuo, C. H., & Boller, C. (2012). Unmanned aircraft systems for remote building inspection and monitoring. NDT.net. http://www.ndt.net/?id=14139
14. Tahar, K. N. (2012). Aerial terrain mapping using

unmanned aerial vehicle approach. International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 39, 23-28. https://doi.org/10.5194/isprsarchives-XXXIX-B1-23-2012
15. Thomas, M. A., Hassan, M. F., Salim, W. S. I., Osman, S. A., Mustafa, H., & Abd Jalal, M. (2019). Reconstruction of 3D models in automotive engineering applications using close- range photogrammetry approach. Journal of Advanced Research in Fluid Mechanics and Thermal Sciences, 61(2), 220-232. https://doi.org/10.31978/jarfmts.2019v61n2.04
16. Wu, S., & Feng, B. (2019). Parallel SURF algorithm for 3D reconstruction. Advances in Intelligent Systems Research, 165, 153-157. https://doi.org/10.2991/ise-19.2019.34
17. Al-Fakih, A. (2022). Applications of UAV photogrammetry in construction monitoring: A review. Journal of Construction Engineering and Management, 148(8), 04022061. https://doi.org/10.1061/(ASCE)CO.1943-7862.0002137
18. Wang, Y., Zhang, Q., & Liu, G. (2020). Automated detection of road surface cracks using deep learning. Sensors, 20(5), 1378. https://doi.org/10.3390/s20051378
19. Kim, K., & Dorr, D. (2020). Comparison of UAS and terrestrial laser scanning for measuring and monitoring changing landslides. Remote Sensing, 12(3), 540. https://doi.org/10.3390/rs12030540
20. Rutzinger, M., & Resch, B. (2020). Trends in UAV photogrammetry for 3D modelling. Photogrammetric Engineering & Remote Sensing, 86(7), 487-497. https://doi.org/10.14358/PERS.86.7.487

INTEGRATING AI INNOVATIONS IN HERITAGE BUILDING CONSERVATION

Assoc. Prof. Sr Ts. Dr. Mohammad Ashraf Abdul Rahman
RBS, MRISM
Head, Centre for Conservation, Archaeology, Survey and Heritage Rehabilitation (KASTURI), UTHM Pagoh Branch Campus

Sr Ts. Dr. Mohd Hasrul Hassin
RBS, MRISM
Senior Lecturer, Collage of Built Environment, UiTM Seri Iskandar Perak

Abstract

Modern technology has completely changed a lot of businesses in the 21st century, including the field of heritage conservation. Among the increasingly important tools in supporting the preservation of heritage buildings is Artificial Intelligence (AI). AI's ability to process large amounts of data, predict future trends and automate complex tasks makes it a powerful tool to ensure the survival of heritage buildings. These structures, which have high cultural and historical value, often face threats such as environmental degradation, neglect and improper restoration. AI offers innovative solutions to these challenges through predictive modelling, advanced data analytics and automation. This article explores the role of AI in the conservation of heritage buildings, emphasising its transformative potential in monitoring, documenting and restoring these buildings for future generations.

Keywords:

Heritage Conservation, Artificial Intelligence (AI), Predictive Analytics, Smart Sensors, Structural Monitoring

1.0 Introduction

Artificial Intelligence (AI) is revolutionising heritage conservation by increasing accuracyand efficiency in the restoration process. AI-based tools such as 3D scanning, LiDAR and drones enable detailed documentation and monitoring of heritage structures, detecting damage and predicting future risks. Machine learning algorithms analyse big data fromsensors to detect structural issues earlier, thus optimising maintenance schedules and extending building lifespans. Furthermore, AI powers virtual reality and augmented reality (VR/AR) applications, which offer interactive experiences for education and public engagement. With the integration of AI, heritage conservation becomes more proactive,data-driven and sustainable.

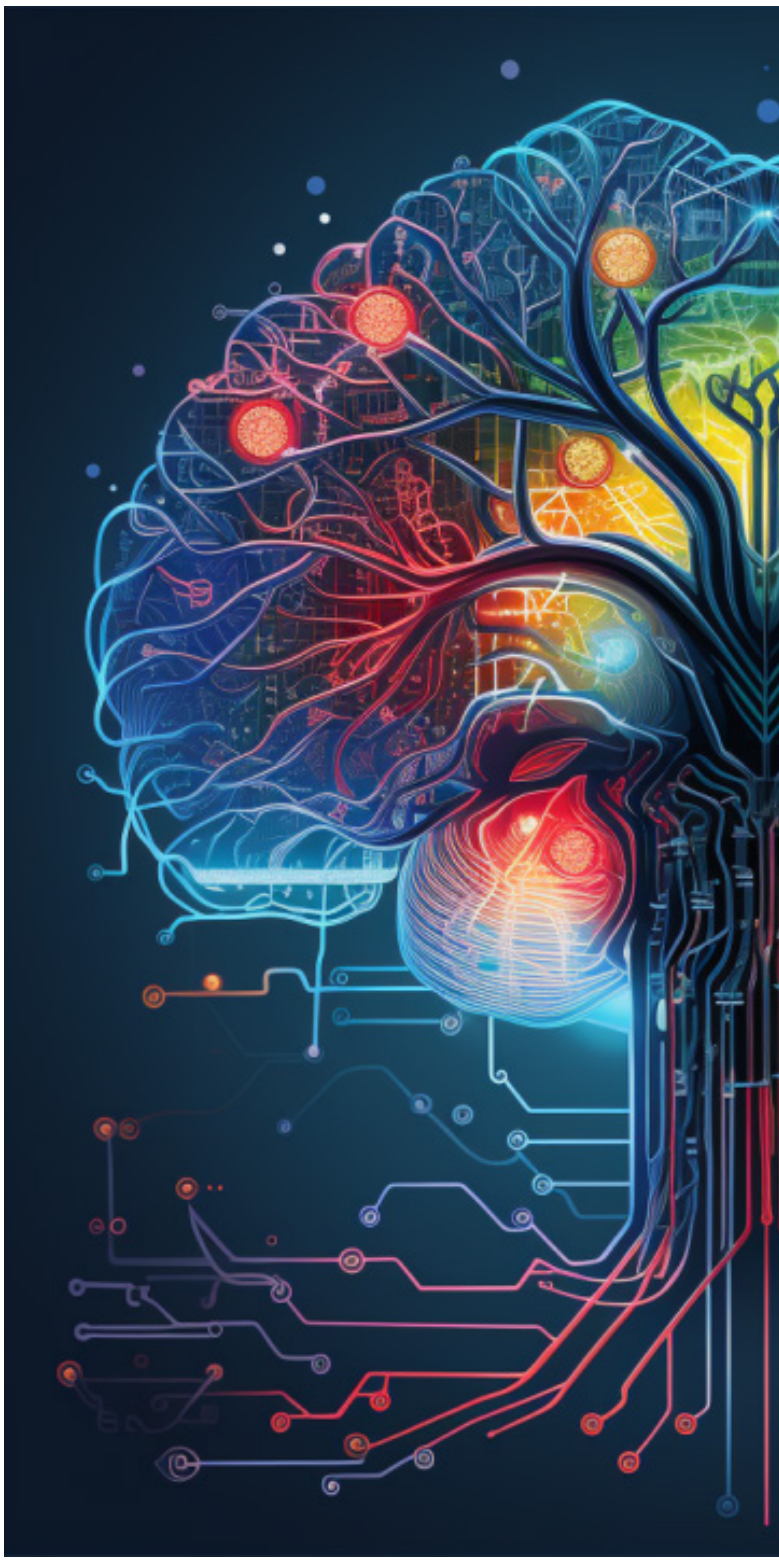
2.0 AI in Today's Heritage Conservation Practices

Climate change, urbanisation, pollution and inadequate maintenance all pose persistent threats to heritage structures. Traditional conservation procedures, while beneficial in many ways, frequently fail to meet the scale, complexity and precision required for long-term preservation (Spinozzi & Mazzanti, 2018). This is where AI becomes a key technology in modern conservation practice. The Need for AI in today's heritage conservation practices might include of the followings:

i. Complexity of Data Management:
Heritage protection necessitates the collecting of substantial data about building structures, materials and their surroundings. AI technologies, particularly those that employ machine learning and big data analytics, enable professionals to process and evaluate data from a wide range of sources, including historical records, 3D scans and sensor readings. AI also enables real-time monitoring of building health and the early detection of problems that are not immediately obvious (Patti, 2020).

ii. Predictive Maintenance and Restoration:
By examining historical data on material behavior and environmental exposure, artificial intelligence may anticipate the future deterioration of cultural sites (Garcia, Müller & Buchecker, 2021). This skill enables professionals like Building Surveyors to solve issues like material degradation, structural instability and environmental implications before they worsen (Ramos et. al., 2018). This predictive maintenance enables more accurate and sustainable conservation practices, optimizes resources, and increases the lifespan of structures.

iii. Accuracy and thoroughness:
AI improves documentation and recovery. AI-powered 3D scanning technology, for example, creates highly detailed digital models of heritage monuments, which aids in historical recording and preservation (Buratti,Conte & Rossi, 2021). AI can also help select the best restoration materials and processes, ensuring that heritage buildings' structural integrity and aesthetic value are preserved (Ranaldi & Zanzotto, 2021).



2.1 AI Tools and Materials in Heritage Building Conservation

AI is being utilised more and more in heritage conservation to improve restoration and documentation procedures (Ghaith & Hutson, 2024; Sandu, 2022; Li, 2021). The primary instruments utilised consist of:

i. **3D Scan and LiDAR:**
By evaluating 3D models created from scans, AI automates damage identification and forecasts deterioration.

ii. **Drones and Sensors:**
AI-driven environmental drones and sensors gather and evaluate data to keep an eye on building conditions and identify problems early on, such leaks or cracks

iii. **Predictive modelling:**
AI makes predictions about future structural damage and optimises maintenance plans based on past data.

iv. **Non-Destructive Testing (NDT):**
AI, infrared thermography and ground penetrating radar (GPR) enable thorough inside inspection without causing structural damage.

v. **Public Engagement:**
Virtual Reality (VR) and Augmented Reality (AR) apps driven by AI provide virtual tours that bring historical landmarks back to life for educational objectives.

By leveraging AI, surveyors gain a deeper understanding of structural integrity, ensure accurate data-driven restoration and improve the preservation of heritage buildings.

2.2 Examples of Successful AI Projects for Heritage Conservation

Several well-known projects throughout the world have successfully used AI technology to conserve cultural heritage, demonstrating its potential to transform this industry.

i. **Restoration of Notre-Dame Cathedral:**
After a fire in 2019, AI and 3D modelling helped restore Notre-Dame Cathedral in Paris. Using AI-driven analysis, specialists may generate detailed digital reproductions of damaged structures. This technique enables exact restoration planning, including AI-driven material analysis to ensure that the appropriate materials are used in the reconstruction (Bloch, 2013).

ii. **Cyprus Digital Heritage Project:**
AI technology is being employed in Cyprus for a project dubbed "European Digital Heritage." The project focuses on creating detailed digital records of numerous cultural heritage locations using AI-powered photogrammetry and LiDAR. This digital model serves as a resource for future restoration work and offers immersive virtual tours for public education. This AI model can also predict the effects of environmental changes on buildings, which aids in the development of long-term conservation policies (Anastasovitis et. al., 2024).

iii. **Venice Flood Protection System:**
Venice, a city that is especially vulnerable to sea level rise and flooding, has implemented an AI-powered monitoring system to protect its heritage sites. This artificial intelligence system monitors environmental data like as tide motions, weather conditions, and building pressure levels, allowing real-time intervention to avert flood damage to the city's heritage structures (Trevisani et. al., 2022)

3.0 Barriers to using AI in Heritage Conservation

Despite its enormous promise, various impediments exist to the broad use of AI in heritage conservation, including technical, financial, and cultural challenges. (Ghaith & Hutson, 2024; Van & Duy, 2024).

i. Cost of Implementation:
Implementation expenses for AI technology like as 3D scanners, complex monitoring systems and machine learning models are generally significant. Many heritage conservation initiatives have limited finances, making it challenging to use advanced AI technologies. Additionally, educating conservation experts to use AI techniques can be time-consuming and costly.

ii. Lack of Expertise:
Traditionally, heritage conservation relied on manual skills, historical knowledge and manual methods. The incorporation of AI necessitates new skill sets in data science, programming and digital modelling, which may not be available in the conservation workforce. To achieve successful deployment, AI professionals must collaborate with conservation experts.

iii. Data Availability and Quality:
For AI to work properly, it requires a vast volume of high-quality data. In many cases, historical information about heritage structures is limited, erroneous or conflicting. The lack of consistent and complete data may hinder the effectiveness of AI technologies, particularly predictive modelling and automated recovery.

iv. Ethical Considerations:
The employment of AI in heritage conservation poses ethical concerns about authenticity and human participation in the restoration process. Some critics claim that an overreliance on AI may result in judgments being made by machines rather than human experts, thereby jeopardizing the historical integrity of conservation efforts. Balancing technological innovation with traditional conservation practices is critical to preserving cultural authenticity.

4.0 Drivers of AI Adoption in Heritage Conservation

Despite the hurdles, several factors are driving the expanding usage of AI technology in heritage preservation (Yurtsever, 2023; Pavlidis, 2023; Gaber, Youssef & Fathalla, 2023; Das, Maringanti & Dash, 2022; Galeazzi, 2017).

i. Efficiency:
The complexities of historical conservation projects necessitate the use of extremely efficient data management, analysis and restoration software. AI offers solutions for automating time-consuming operations including documenting building conditions, doing structural evaluations and identifying potential hazards. This efficiency enables professionals to focus on more important decision-making processes.

ii. Environmental Risks:
Climate change and environmental deterioration are hastening the demise of heritage structures around the world. AI predictive skills provide a proactive approach to tackling these concerns, allowing for early intervention and preventative maintenance. This is especially crucial for heritage assets in sensitive places, such as coastal or metropolitan areas prone to extreme weather occurrences.

iii. Public participation:
Artificial intelligence technologies, particularly those deployed in virtual and augmented reality, can assist raise public awareness and participation with cultural heritage. By providing immersive digital experiences, AI can make heritage conservation more accessible to the general population, raising awareness of the necessity of protecting these monuments for future generations.

iv. Interdisciplinary Collaboration:
The use of AI in heritage conservation fosters collaboration among several professions, such as surveying, computer science, architecture, archaeology and engineering. This interdisciplinary approach generates novel solutions that combine the benefits of traditional conservation practices with modern technology.

5.0 Conclusion

AI has the ability to change the landscape of heritage building conservation by improving documentation, monitoring and repair. Despite hurdles such as high costs, a lack of quality data and ethical problems, the use of AI in this industry will continue to expand, particularly as the demand for efficiency and effectiveness grows. AI may be a useful tool in ensuring thatthe world's cultural heritage is maintained and valued for future generations, especially when surveyors, computer scientists and cultural experts work together.

References and Bibliography

1. Anastasovitis, E., Georgiou, G., Matinopoulou, E., Nikolopoulos, S., Kompatsiaris, I., & Roumeliotis, M. (2024). Enhanced Inclusion through Advanced Immersion in Cultural Heritage: A Holistic Framework in Virtual Museology. Electronics, 13(7), 1396.
2. Bloch, R. H. (2013). Restoration from Notre-Dame de Paris to Gaston Paris.In Manufacturing Middle Ages (pp. 279-297). Brill.
3. Buratti, G., Conte, S., & Rossi, M. (2021). Artificial intelligency, big data and cultural heritage. In Representation Challenges. Augmented Reality and Artificial Intelligence in Cultural Heritage and Innovative Design Domain (pp. 29-34). Franco Angeli.
4. Das, B. R., Maringanti, H. B., & Dash, N. S. (2022). Role of artificial intelligence in preservation of culture and heritage. In Digitalization Of Culture through Technology (pp. 92-97). Routledge.
5. Gaber, J. A., Youssef, S. M., & Fathalla, K. M. (2023). The role of artificial intelligence and machine learning in preserving cultural heritage and art works via virtual restoration.ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 10, 185-190.
6. Galeazzi, F. (2017). 3D recording, documentation and management of cultural heritage.
7. Garcia, X., Müller, S., & Buchecker, M. (2021). Valuation of ecosystem services to assess river restoration projects. River restoration: political, social, and economic perspectives, 210-232.
8. Ghaith, K., & Hutson, J. (2024). A qualitative study on the integration of artificial intelligence in cultural heritage conservation. Metaverse, 5(2).
9. Ghaith, K., & Hutson, J. (2024). A qualitative study on the integration of artificial intelligence in cultural heritage conservation. Metaverse, 5(2).
10. Li, J. (2021, April). Application of artificial intelligence in cultural heritage protection. In Journal of Physics: Conference Series (Vol. 1881, No. 3, p. 032007). IOP Publishing.
11. Patti, I. (2020, November). Standard Cataloguing of Augmented Objects for a Design Museum. In IOP Conference Series: Materials Science and Engineering (Vol. 949, No. 1, p. 012054). IOP Publishing.
12. Pavlidis, G. (2023). From digital recording to advanced AI applications in archaeology and cultural heritage. In "And in Length of Days Understanding"(Job 12: 12) Essays on Archaeology in the Eastern Mediterranean and Beyond in Honor of Thomas E. Levy (pp. 1627-1656). Cham: Springer International Publishing.
13. Ramos, L. F., Masciotta, M. G., Morais, M. J., Azenha, M., Ferreira, T., Pereira, E. B., & Lourenço, P. B. (2018). HeritageCARE: Preventive conservation of built cultural heritage in the South-West Europe. In Innovative built heritage models (pp. 135-148). CRC Press.
14. Ranaldi, L., & Zanzotto, F. M. (2021). Discover AI knowledge to preserve Cultural Heritage.
15. Sandu, A. K. (2022). AI-Powered Predictive Maintenance for Industrial IoT Systems. Digitalization & Sustainability Review, 2(1), 1-14.
16. Spinozzi, P., & Mazzanti, M. (2018). Cultures of sustainability and wellbeing. Taylor & Francis.
17. Trevisani, S., Fabbri, P., & Omodeo, P. D. (2022). Groundwater in the Venetian area. In Advances in Chemical Pollution, Environmental Management and Protection (Vol. 8, No. 1, pp. 161-188). Elsevier.
18. Van, M. N., & Duy, K. H. (2024). Prioritizing barriers to the conservation of cultural heritage buildings in adaptation to urbanization and climate change. Journal of Cleaner Production, 143529.
19. Yurtsever, A. (2023). Documentation of cultural heritage with technology: Evaluation through some architectural documentation examples and brief looking at AI (Artificial Intelligence). Cultural Heritage and Science, 4(1), 31-39.

26th International Surveyors' Congress (ISC)

Event: The 26th International Surveyors Congress (ISC)
Date: 6-7 June 2024
Location: Berjaya Times Square Hotel, Kuala Lumpur.

The 26th International Surveyors Congress (ISC) took place on 6-7 June 2024 at the Berjaya Times Square Hotel, Kuala Lumpur. The event began with a welcoming address by Organising Chairman Sr Dr.Ahmad Sanusi bin Che Cob and was inaugurated by YB Nik Nazmi bin Nik Ahmad, Minister of Natural Resources and Environmental Sustainability.

Trends & Innovations for The Profession,"

Under the theme "Navigating the Future: Trends & Innovations for The Profession," the congress addressed key topics like sustainability, environmental impact, social responsibility, governance (ESG),climate change, and digital advancements in real estate and smart cities. The discussions focused on building sustainable business models for SMEs, integrating technology and AI into surveying, and enhancing governance with ethical AI use.

The event featured 20 technical papers covering new trends, technologies, and methods that are transforming the construction industry, such as sustainable construction practices, Building Information Modelling (BIM), smart buildings, and renewable energy integration. The Congress aimedto keep professionals in surveying and related fields updated on innovations to improve efficiency andresilience in the built environment.

Supported by 16 professional organisations and multiple sponsors, the 26th ISC brought together 366 participants, including national and international professionals. It highlighted RISM's role in the industry and facilitated valuable discussions and knowledge sharing within the surveying sector.

RISM 63rd ANNUAL GENERAL MEETING

DATE : 7 June 2024
TIME : 3.00 PM
VENUE : MANHATTAN II, BERJAYA TIMES SQUARE HOTEL, KUALA LUMPUR

The 63rd Annual General Meeting of RISM was held on 7 June 2024, Friday at Manhattan II, Berjaya Times Square Hotel, Kuala Lumpur.

The meeting was chaired by the RISM President, Sr Haji Adzman Shah bin Mohd Ariffin. Key agenda items included the appointment of internal auditors, the handing over of the chain of office to the President of the 2024/2025 session, an address by the newly appointed President, the announcement of the General Council members for the 2024/2025 session, the presentation of Certificates of Appreciation to outgoing Councillors of the 2023/2024 session, and the presentation of Membership Diplomas to newly elected members of the 2023/2024 session.

63rd Anniversary Dinner

The 63rd Anniversary Dinner was held on 8 June 2024 at the Manhattan Ballroom, Berjaya Times Square Hotel, Kuala Lumpur and was graced by Sr Hazri bin Hassan, Director General of the Department of Survey and Mapping Malaysia. Altogether there were 69 tables.

Excellence Awards were presented at this prestigious dinner for the following categories: RISM Exemplary Leadership Award, RISM Young Surveyor of the Year Award, RISM Lifetime Achievement Award and Tokoh Juruukur Malaysia Award. As well as the presentations of Excellence Awards to surveyors and related industry players, a donation was made to the Yayasan Raja Muda Selangor, a foundation assisting under-privileged children.

The ceremony included the presentation of 9 trophies across 6 categories as part of the Excellence Awards, which honored achievements in:

- RISM Exemplary Leadership
- RISM Young Surveyor of the Year
- RISM Lifetime Achievement
- Tokoh Juruukur Malaysia Award

Additionally, the event featured the presentation of a mock cheque to Yayasan Raja Muda Selangor, alongside the recognition of surveyors and industry contributors.

RISM EXCELLENCE AWARDS 2024

RISM Excellence Awards are presented to deserving individuals/organisation who have demonstrated excellence leadership in property and construction industry. The RISM Excellence Awards are intended to be in the premier awards recognising the efforts of individuals and organisations who/which attained outstanding achievements in the property and construction industry.

Tokoh Juruukur Malaysia

Recipient: PPSr Kwan Hock Hai

PPSr Kwan Hock Hai started as a committee member of the RISM QS Division in the early nineties. He served as RISM Treasurer General twice, and once as Secretary General and was the QS Divisional Chair in 1998. He was elected the President of RISM in 2019. On the international front, he is active in the Pacific Association of Quantity Surveyors. He represented RISM to 24 PAQS Congresses all over the Asia Pacific region. He was the Secretary General in PAQS for the session 2003 and received the PAQS Service Excellence Award in 2007. The International Cost Engineering Council (ICEC) presented him a similar service award in 2012. He was elected Chairman of PAQS for the session 2019 – 2021. He was appointed to the Board of Quantity Surveyors Malaysia for 6 consecutive terms from 2003 until 2017. During his tenure, he was Chairman of the International Affairs Committee. Later, as Chairman of the Acts and Regulation Committee, he was instrumental in getting the amended QS Act approved in Parliament and gazetted in 2015.

Tokoh Juruukur Malaysia

Recipient: YBhg. Dato' Dr. Rahah Ismail

YBhg. Dato' Dr. Rahah Ismail received the ISM diploma in 1984 and became a fellow of the ISM in 2005. She had participated at various levels, including Council (session 2000/2001), Division (2004/2005, 2018/2019, 2019/2019), and also as the Chair for Special Task Force 2018/219, Editor to the Property Surveyor Bulletin 2018/2019, 2019/2020, and Chair of the RISM Excellence Award 2020-2022. Dato' was also very involved in the Board of Valuers, Appraisers, Estate Agents, and Property Managers (BOVEAP). She became a member of the board from 2005 to 2010, and later on, in 2015, she became a member of the executive council of the board. At the same time, she was also the chair of the Registration and Examination Committee, the chair of the Valuation Practice Committee, and the chair of the Complaints Investigating Committee of the Board. In 2016–2017, she became the President of BOVEAP. She was also the President of the ASEAN Valuers Association, Malaysian Chapter, 2016–2017.

Lifetime Achievement Award

Recipient: YBhg. Datuk Sr Chua Soon Ping

YBhg. Datuk Sr Chua has been actively involved in the professional institutions, he is the Fellow of RISM and Fellow of RICS. He held presidency in various associations i.e. Sabah Housing and Real estate Developers Association (SHAREDA) and Sabah Teochew Association. He was the deputy President for The Federation of Chinese Association Sabah, FIABCI and the United Sabah Chinese Communities Associations of Kota Kinabalu. Datuk Sr Chua is the founder of the "Property Developer Course" in collaboration with SHAREDA and Tunku Abdul Rahman University of Management and Technology in 2022

Lifetime Achievement Award

Recipient: Sr Ahmad Suhaimi Abdul Majid

Sr Ahmad Suhaimi Abdul Majid had served in various sector of the construction industry and has played key roles in all aspects of operations with responsibilities in project management, tendering, financial evaluation, negotiation of contractual arrangement, construction planning and construction claims work. These projects cover a wide range of activities including general construction, water engineering, educational institution, hospitals, road & infrastructure works, petrochemical plant and housing development. The contractual arrangement ranges from small contract to large turnkey and privatisation projects with projects experiences worth more than RM1 Billion. Sr Ahmad Suhaimi also served the nation in professional and academic sector as an external examiner for QS Degree course at Taylor's University and UTAR, also Chairman of RICS accreditation team for RICS approved courses for various universities in Malaysia, Hong Kong & Australia. He was also member of the RICS Asia, Examination & Accreditation Board and a member of RICS ASEAN QS Professional Group. In RISM he has served in various capacities as a member of sub-committees, Treasurer of QS division, Chairman of QS Division, Treasurer General of RISM and as Council Member of RISM since 2016. He was also an Associate Professor Industry for University Malaya from 2021 to 2024.

Lifetime Achievement Award

Recipient: Adjunct Professor YBHg. Datuk Sr Haji Johari bin Wahab

Adjunct Professor YBhg. Datuk Sr Haji Johari bin Wahab was appointed as a Board Member of the Land Surveyors Board Malaysia on November 15, 2022, by the Minister of Natural Resources and Environmental Sustainability. His appointment underscores his standing and expertise within the surveying community. Datuk Sr Haji Johari has been serving as an Independent Non-Executive Director at Puncak Niaga Holdings Berhad since February 10, 2020. Datuk Sr Haji Johari's professional affiliations are extensive and varied including as an active member of the Association of Authorised Land Surveyors Malaysia (PEJUTA), he has held positions such as Chairman and Vice Chairman of the Geomatics & Land Surveying Division. Datuk has also held the position as President of the Association of Competent Utility Mappers Malaysia (UMAP MALAYSIA) for the 2021/2023 session. Datuk Sr Haji Johari's appointment as Professor Adjunct at Universiti Teknologi Malaysia last year underscores his esteemed status and commitment to nurturing the next generation of surveyors and geospatial professionals. In academia, Datuk Sr Haji Johari has also contributed significantly as a member of the Board of Studies at the School of Computing, Universiti Utara Malaysia. He has been involved in the development of the Masters of Science (Geomatics for Disaster Risk Reduction – GeoDRR) program.

Young Surveyor Of The Year

Recipient: Sr Max Sylver Sintia

Sr Max was accepted as a Member of the Royal Institution of Surveyors Malaysia (RISM) in 2012. He is also a Member of the Malaysian Institute of Property and Facility Managers and the Association of Valuers, Property Managers, Estate Agents and Property Consultants in the Private Sector Malaysia. At the RISM Sabah Branch, Sr Max has served as a Committee Member of the Property Surveying Division, Chair of the Property Surveying Division and Branch Deputy Chairman before being elected as the Branch Chairman for the session of 2023/2024. At RISM council level, Sr Max serves as the General Council Member for the session of 2023/2024. He was also the Committee Member of the RISM Excellent Awards Committee 2022/2023.

His involvement in the Royal Institution of Surveyors Malaysia include:-

1. Organising Committee of the 4th - 8th Sabah International Surveyors' Congress.
2. Panelist for Sabah International Property Exhibition (PROPEX) 2022.
3. Organising Committee for various seminars, courses, workshops and various career guidance talk to promote surveyors' profession to students as well as Sabah Branch representative to various courtesy visits to government departments conducted by RISM Sabah Branch.

Exemplary Leadership Awards

The criteria's for the selection of Nominees is as below:

1. The Principals/Management have been active in RISM in the last 5 years holding positions in General Council or Division or branch.
2. They have given significant sponsorship for events organised by RISM.
3. They have encouraged their staff to become RISM members.
4. The firm has been operating for at least 5 years and is reputable.

The Recipients:

- AJ SURVEYORS (M) SDN. BHD
- BASAR & HARUN SDN
- K&P COVE CONSULTANCY SDN. BHD
- SAVILLS (MALAYSIA) SDN. BHD

MEMBERS ELECTED TO THE CLASS OF FELLOW SESSION 2023/2024

Building Surveying Division
Sr Dr. Syamilah Bt Yacob
Sr Lim Swee Meng

Geomatics & Land Surveying Division
Sr Teoh Boon Siong
Sr Che Zamrey Bin Mohd Hashim

Property Surveying Division
Sr Kholim Bin Sahray
Sr Loo Choo Wei
Sr Chandra Mohan A/L Krishnan
Sr Lee Wen Tat
Sr Nithiyaini Jewa
Sr Mohd Arif Bin Mat Hassan
Sr Ng Weng Yew
Sr Ahmad Faisal Bin Ahmad Shayuti
Assoc. Prof. Sr Dr. Ts. Noorsidi Aizuddin Mat Noor

Quantity Surveying Division
Sr Ong Siew Chin
Sr Chen Seong Wai
Sr Goh Pei See
Sr Mohd Farid Omar
Sr Azury Binti Kamaruddin
Sr Azwan Mohd Hashim
Sr Ts. Mohd Shamir Bin Zaini
Sr Mohd Syazwan Bin Samsudin
Sr Muhamad Hafizuddin Bin Idris
Assc. Prof. Sr Dr. Sarajul Fikri Mohamed
Sr Suzieanah Binti Harun

Surveyors making a difference: SSR Orang Asli Outreach Programme, Organised by RISM Quantity Surveying Division

RISM proudly celebrated the success of its SSR Orang Asli Outreach Programme at Royal Belum, held from 4th to 6th July 2024. The initiative highlighted how surveyors contribute to Malaysia's sustainable development goals, emphasizing the importance of meeting current needs without compromising future resources. RISM's focus was on fostering a healthy environment through ecological principles and resource efficiency.

Event Objectives:

- Raise awareness of sustainable development and water resource management.
- Learn best practices in managing lakes and rivers.
- Promote sustainable project management practices.

Key Activities:

- Conducted the inaugural meeting of the Quantity Surveying (QS) Division for Session2024/2025.
- Released 40 bags of fish seeds into Tasik Royal Belum, officiated by the RISM President.
- Donated essential items to 48 Orang Asli families in Kg Klewang.
- Planted 40 Mempelam Madu trees in the village.
- Installed 3 park benches in Kg Klewang.
- Implemented 3 QS Division Carbon Capture Practices, including feeding Ikan Kelah at Sg Ruok Sanctuary.

This outreach effort reinforced RISM's commitment to sustainable development and community support.

RISM MONTHLY GOLF MEDAL 2024/2025

Organised by

SPORTS AND SOCIAL COMMITTEE

27 JULY 2024 |
BANGI GOLF RESORT, BANGI, SELANGOR

> The RISM Golf Monthly Medal for July 2024 took place at the Bangi Golf Club Resort, offering members a day of friendly competition and camaraderie. The sunny weather and mild temperatures created ideal conditions, while the course's well-maintained greens and fairways added to the experience. The event saw the participation of 13 RISM members and 3 non-members, with no special guests in attendance.

The July tournament was deemed a success, showcasing exceptional sportsmanship among participants and a vibrant sense of community. Appreciation goes to the volunteers and Bangi Golf Resort staff for their contributions. Preparations are already in progress for the upcoming event, promising an even more thrilling experience.

Congratulation to all winners!

Results Men's Singles

Winner:	Mohd Zul Helmi Ramle Score: 41
1st Runner-up:	Sr Sharun Kasim Score: 39
2nd Runner-up:	Muhiddin Score: 38

2024/2025 SIGNING MEMORANDUM OF UNDERSTANDING BETWEEN RISM AND MAPMA

ORGANISED BY : BUILDING SURVEYING DIVISION
DATE : 30TH JULY 2024
LOCATION : HOTEL SUNWAY PUTRA, KUALA LUMPUR

The MOU signing ceremony between the Royal Institution of Surveyors Malaysia (RISM) and the Malaysian Assets and Project Management Association (MAPMA) took place on 30th July 2024 at Hotel Sunway Putra, Kuala Lumpur. The event formalised a strategic collaboration between the two organisations, aiming to enhance member activities and institutional initiatives.

Key participants included YBrs Sr Dr. Ahmad Sanusi Che Cob, President of RISM, and YBhg. Dato' Ir. Roslan bin Ismail, President of MAPMA, who jointly signed the MOU. The ceremony included speeches outlining goals, achievements, and expectations, followed by a photo session and networking opportunities for attendees.

The event was well-organised, with a positive and collaborative atmosphere. It served as a platform to strengthen relationships and explore future joint initiatives. Recommendations include regular follow-up meetings and maintaining open communication to ensure the MOU's objectives are achieved. The ceremony successfully laid the foundation for a productive partnership between RISM and MAPMA.

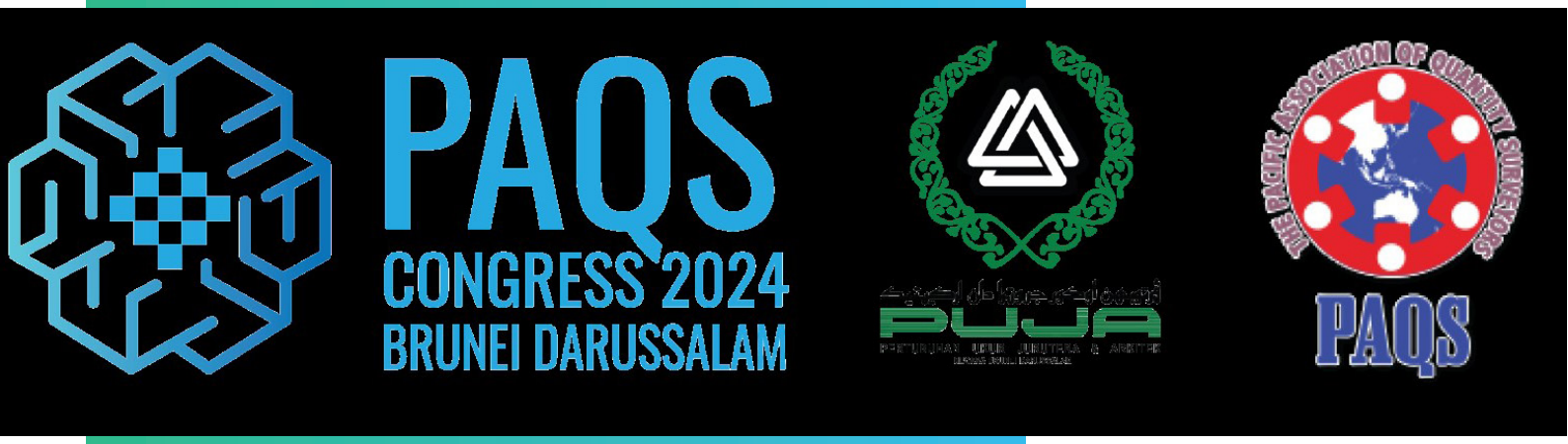
Overview of PAQS Congress 2024 Bandar Seri Begawan, Brunei

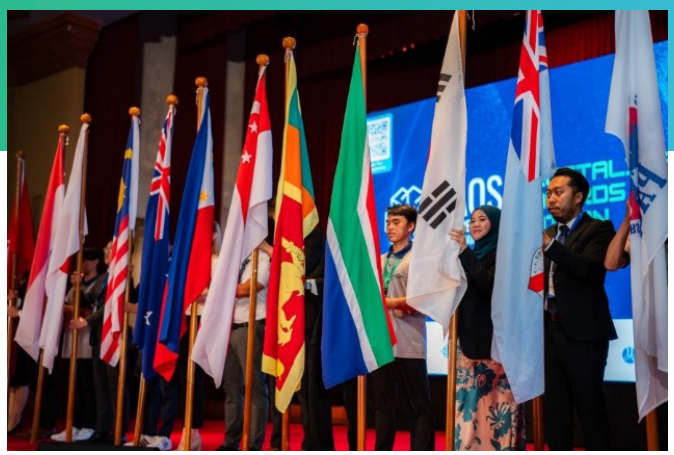
Organised By : Quantity Surveying Division

Event : The Pacific Association Quantity Surveyors (PAQS) Congress 2024

Date : 23 to 27 August 2024.

Location : The Rizqun International Hotel, Abdul Razak Complex, Bandar Seri Begawan





The Pacific Association Quantity Surveyors (PAQS) Congress 2024 was held at The Rizqun International Hotel, Abdul Razak Complex, Bandar Seri Begawan from 23 to 27 August 2024.

The pre-congress sessions commenced from 23 to 25 August 2024, followed by the main congress from 26 to 27 August 2024.

For the pre-congress sessions that spans 3 days from 23 to 25 August 2024, a two-day Young QS Programme, PAQS Committee Meetings, PAQS Golf, PAQS Board Meeting, and President's Dinner were held.

For the main congress held from 26 to 27 August 2024, there were 5 keynote speeches, and 26 papers presented throughout the concurrent sessions. For spouses and accompanying persons who were not joining the main congress, they had the opportunity to participate in the 2-day Spouse Programme to explore Temburong and Canopy Tower Visit on Day 1 and a tour to Mangrove River Safari and Proboscis Tour on Day 2. To wrap up the PAQS Congress 2024, all delegates were invited to join the Gala Dinner where it was a PAQS tradition to have every PAQS country member to stage a performance of their choice.

PAQS Gala Dinner

27 August 2024

The Rizqun International Hotel, Abdul Razak Complex, Bandar Seri Begawan

This is the pinnacle of the PAQS Congress 2024. Apart from sumptuous meal, the delegates were enjoying themselves with the country performances. There were also numbers of awards presentation to the winners. We would like to congratulate the winners and their accolades from Malaysia as follows:-

We would like to congratulate Sr Aminudin Yahiya for winning the PAQS 2024 Golf Tournament.

PAQS Medal 2024:
Sr Kwan Hock Hai

PAQS Service Excellence Award 2024:
Sr Ahmad Suhaimi Abdul Majid
Sr Quek Jin Keat

PAQS Academic Excellence Award 2024:
Sr Dr. Noushad Ali Naseem Ameer Ali

PAQS Best Research Paper 2024:
Sr Dr. Fara Diva Mustapa

The RISM and Malaysia Contingent at the Gala Dinner

The RISM and Malaysia Contingent at the Gala Dinner

Recipient of PAQS Medal 2024, Sr Kwan Hock Hai

Recipient of PAQS Service Excellence Award 2024, Sr Quek Jin Keat

Recipient of PAQS Service Excellence Award 2024, Sr Ahmad Suhaimi Abdul Majid (Received on behalf of by Sr Nazir Muhamad Nor, Vice President (QS) of RISM)

Recipient of PAQS Academic Excellence Award 2024, Sr Dr. Noushad Ali Naseem Ameer Ali

Recipient of Best Research Paper 2024, Sr Dr. Fara Diva Mustapa (Received on behalf of by Sr Wan Ainon Zuraiha, Deputy President of RISM)

Winner of PAQS 2024 Golf Tournament

Technical Visit to TOPCON Corporation, Tokyo

Organised By: Geomatics and Land Surveying Division

> Located at 75-1, Hasunuma-cho, Itabashi- ku, Tokyo 174- 8580

The technical visit to TOPCON CORPORATION, located at 75-1, Hasunuma-cho, Itabashi- ku, Tokyo 174- 8580, provided invaluable insights and knowledge to the delegates from the Geomatics and Land Surveying Division (GLS) Division and JUPEM regarding the latest advancements in agriculture and construction technologies. During the visit, delegates were introduced to innovative precision farming tools, drones, and remote sensing technologies, which are poised to significantly enhance productivity and sustainability within these sectors. TOPCON emphasized its commitment to shortening project timelines through the implementation of ICT in construction, effectively reducing operational steps and minimising repetitive tasks.

Additionally, TOPCON announced the establishment of a training center in Shah Alam, Malaysia, designed to equip local professionals with the advanced skills necessary to leverage these technologies effectively. This visit underscored the potential for strengthening bilateral relations between Malaysia and Japan, particularly in the realm of sustainable technology collaboration. Currently, the Geomatics and Land Surveying Division (GLS) Division and Jabatan Ukur Pemetaan Malaysia (JUPEM) are actively pursuing follow-up discussions with TOPCON to explore mutually beneficial partnerships that will enhance capabilities and foster innovation among all parties involved.

8TH SABAH INTERNATIONAL SURVEYORS CONGRESS

& 40th Annual Dinner

Organised by : Sabah Branch
Date : 16-17 October 2024
Location : Magellan Sutera Harbour, Kota Kinabalu Sabah

"AI and Land Governance"

Kota Kinabalu, Sabah – The 8th Sabah International Surveyors Congress (8SISC) was held on 16-17 October 2024 at the Magellan Sutera Harbour, with a theme on "AI and Land Governance." Organised by the Royal Institution of Surveyors Malaysia (Sabah Branch) in collaboration with the ASEAN Federation of Land Surveying and Geomatics (AFlag), the event featured Sr Ts Allen Chin as the Organising Chair.

The congress brought together 335 participants, with 31 expert papers covering geomatics and land surveying, property surveying, and quantity surveying in line with the congress theme. Among the speakers, five hailed from AFlag, with additional support from eight moderators and six representatives each from Kolej Teknologi Yayasan Sabah and Politeknik Kota Kinabalu. An exhibition showcased products and services from 18 exhibitors, reflecting the industry's innovation in surveying.

Chief Minister Datuk Seri Panglima Haji Hajiji Bin Haji Noor, through a speech delivered by State Finance Minister Datuk Seri Masidi Manjun, encouraged surveyors to leverage AI and machine learning to support Sabah's land governance initiatives. He highlighted the potential of generative AI to assist with sustainable housing policies, urban planning, and land use optimization. Furthermore, he urged both the government and private sector to adopt AI-powered tools for monitoring land use patterns, detecting illegal activities, and assessing environmental impacts in real time.

"The integration of AI into various sectors, including land governance, presents unprecedented opportunities and challenges to embed sustainable practices into our land governance strategies," he stated.

The congress successfully concluded on 17 October 2024, followed by the 40th Annual Dinner and Installation also held at the Magellan Sutera Resort. The event saw a turnout of 62 tables, bringing participants together to celebrate achievements in the industry.

EXCELLENCE IN ACHIEVEMENT AWARDS 2024:

Celebrating Our Members

RICS SOUTHEAST ASIA AWARDS 2024

The RICS Southeast Asia Awards 2024 celebrate remarkable achievements and innovation in the built environment sector, recognising projects and individuals that demonstrate excellence in land, real estate, construction, and infrastructure. These awards underscore the critical role of industry professionals in driving projects that positively impact communities and inspire future progress.
This year, RICS commemorates four RISM members and fellows, corporate valuation team and agency team whose exceptional work and dedication have set new benchmarks in their respective fields, celebrating their leadership and contributions to the industry. The successful teams and individuals of this year's Awards were announced and celebrated at a formal ceremony held at Singapore Marriott Tang Plaza Hotel on 23 October 2024.

LIFETIME ACHIEVEMENT AWARD

PPSr Dr. Ong See Lian

Renowned for his visionary leadership and extensive contributions to the surveying and construction industries, PPSr Dr. Ong See Lian has been honoured with the prestigious Lifetime Achievement Award. As the Director and Strategic Advisor at Turner & Townsend in Kuala Lumpur, Dr. Ong's career spans over five decades of groundbreaking work in both public and private sectors. Formerly the Senior Partner at Davis Langdon & Seah / JUBM, Dr. Ong's influence includes serving as President of the Royal Institution of Surveyors Malaysia (RISM) from 2003 to 2004 and Chairman of the Pacific Association of Quantity Surveyors (PAQS) from 2003 to 2005.

Notably, Dr. Ong made history as the first non-British passport holder to serve as the 130th Global President of the Royal Institution of Chartered Surveyors (RICS) from 2011 to 2012. He also chaired the Standard Setting Committee of the International Construction Measurement Standard (ICMS), overseeing the publication of ICMS-1 and ICMS-2. His countless accolades, including the "Surveyor of the Year" by RISM, "PAQS Gold Medal" by PAQS, "Most Prominent Player in the Construction Industry" by CIDB Malaysia, CIDB Fellowship, Gold Award by Board of QS Malaysia, and the "David Bucknall Award" by RICS, underscore his unwavering commitment to elevating the profession.

WINNERS - PROPERTY PROFESSIONAL OF THE YEAR

Datuk Sr Paul Khong Poh Yew, Savills (Malaysia) Sdn. Bhd.

The Group Managing Director of Savills (Malaysia) Sdn. Bhd., Datuk Sr Paul Khong, has been recognized as the Property Professional of the Year. A distinguished Chartered Surveyor, Registered Valuer, and Licensed Auctioneer, Datuk Paul's expertise spans 30 years in corporate agency and valuations. His leadership has facilitated corporate exercises for major IPOs and RTOs, influencing submissions to securities commissions across Malaysia, Singapore, and Hong Kong. His professional repertoire boasts over RM10 billion in sales transactions and more than 800 published articles in major media outlets.

WINNERS - VALUATION TEAM OF THE YEAR

Savills Malaysia Group - Corporate Valuation Team

Celebrated for their exceptional proficiency, the Corporate Valuation Team at Savills Malaysia, led by Datuk Sr Paul Khong and Marcus Chia, has been awarded Valuation Team of the Year. With a legacy spanning over three decades, their team includes 10 Registered Valuers among a robust staff of 250 professionals, operating in Johor, Penang, and beyond as part of Savills' global network. The team's impressive portfolio encompasses iconic projects such as the TRX Exchange 106, the Petronas Twin Towers, and Merdeka 118. Their collective expertise has driven valuations exceeding RM200 billion for IPOs, REITs, mergers, and more.

HIGHLY COMMENDED - CONSTRUCTION PROFESSIONAL OF THE YEAR

Sr Chong Wai Kien
ACTUS Construction Claims & Disputes

Sr Chong Wai Kien's relentless dedication and strategic insight have earned him the title of Construction Professional of the Year. A standout in the industry, Wai Kien's meticulous project management skills recently facilitated the successful resolution of a significant national project dispute, circumventing costly legal battles and saving both parties around RM40 million. His leadership ensured timely project delivery, marking a substantial benefit for the public and setting a benchmark for excellence in project execution.

HIGHLY COMMENDED - PROPERTY PROFESSIONAL OF THE YEAR

Datuk Sr Firdaus Bin Musa
Firdaus Associates Property Professional Sdn Bhd

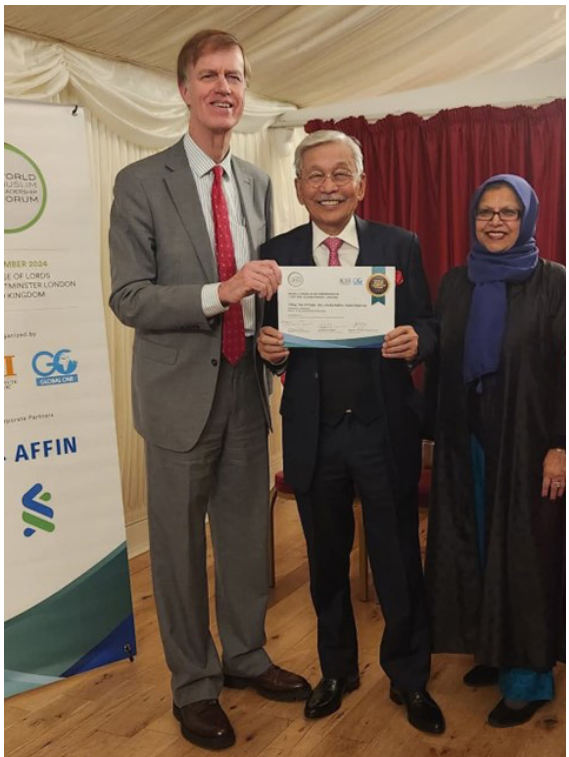
Founder and Executive Chairman of Firdaus Associates Group Holdings, Datuk Sr Firdaus Musa's transformative vision has propelled his consultancy from a modest beginning in 1998 to a leading establishment with a workforce of 800. Armed with an honors degree from Kingston University, London, and numerous professional accreditations, Datuk Firdaus' influence extends to roles in FIABCI, PEPS, and BOVAEP. His profound impact on industry policies and education, paired with his DPSM and AMP honours, highlights his dedication to both business excellence and community service.

HIGHLY COMMENDED – AGENCY TEAM OF THE YEAR

Under the expert leadership of Sr Teh Young Khean, a distinguished member of RISM, Knight Frank Malaysia adeptly managed a Stay Vs Go project for a major global financial company occupying approximately 150,000 sq ft in KL Sentral. Acting as the exclusive Tenant Representative, the team capitalized on market sentiment, sustainability insights, landlord relationships, and the client's brand reputation to achieve significant cost savings of around RM13 million over two 3-year tenancy periods. Additionally, they negotiated favourable terms for lease flexibility and secured an extra 50,000 sq ft to support approximately 1,000 employees. This effort highlights Teh's commitment to client needs and excellence in the real estate industry.

WORLD MUSLIM ENTREPRENEUR LIFETIME ACHIEVEMENT AWARD

Tan Sri Dato' Sr (Dr) Abdul Rahim Abdul Rahman
Rahim & Co Executive Chairman Leadership



Rahim & Co Executive Chairman, Tan Sri Dato' Sr (Dr) Abdul Rahim Abdul Rahman, receiving the 2024 World Muslim Entrepreneur Lifetime Achievement Award at the World Muslim Leadership Forum in the UK. The award recognises his contributions to business excellence and leadership. The forum, held at the University of London, focused on "Muslim Leadership in Challenging Times – Fostering Inclusivity and Sustainability." We are proud of your achievement.

Congratulations to Tan Sri Rahim on being awarded this prestigious award at The House of Lords in London. We are proud of your achievement.

RISM Pickleball Tournament 2024

Organised By:
Sports and Social Committee

The RISM Pickleball Tournament 2024, held on 26 October 2024 at SACC Mall, brought together members of the Royal Institution of Surveyors Malaysia (RISM) for a day of competitive fun and camaraderie. Organised by the Sports & Social Committee, the tournament showcased the spirit of unity and fitness among members across divisions.

The half day event drew 24 teams comprising RISM members and invited guests. Participants competed in Men's and Mixed Doubles, adhering to the official rules of pickleball in a grouping format to ensure fairness.

The half day event drew 24 teams comprising RISM members and invited guests. Participants competed in Men's and Mixed Doubles, adhering to the official rules of pickleball in a grouping format to ensure fairness.



Recognising Excellence

The tournament celebrated outstanding performances in both categories:

Achievements and Results

Men's Doubles:

Winner: TA Global
Runner-Up: Primakos
Third Place: PREC Team 1

Mixed Doubles:

Winner: PKNS Real Estate Sdn Bhd (Team 3)
Runner-Up: PKNS Real Estate Sdn Bhd (Team 2)
Third Place: Building Surveying Division (Team 2)

Sponsors and Acknowledgments

The success of the event was made possible through the generous support of sponsors, including:

Venue Sponsors:
PKNS Real Estate Sdn Bhd & SACC Mall

Medal Sponsors:
Firdaus & Associates, PA International

Other Sponsors:
Fipper Marketing Sdn Bhd, Cheston International, K&P Cove, Almas Building Control, and Auni Aina.

Their contributions provided essential resources, from venue support to prizes, ensuring a memorable experience for all attendees.

The RISM Pickleball Tournament 2024 proved to be more than just a competition—it was a platform for fostering bonds among members, promoting physical fitness, and engaging in a day of recreational fun. Positive feedback from participants highlights RISM's commitment to creating meaningful events that resonate with its members.

PERTUBUHAN JURUUKUR DIRAJA MALAYSIA
ROYAL INSTITUTION OF SURVEYORS MALAYSIA

PATRON: DYMM Sultan Sharafuddin Idris Shah Al-Haj Ibni Almarhum Sultan Salahuddin Abdul Aziz Shah Al-Haj D.K., D.M.N, D.K. (Terengganu)., D.K. (Kelantan)., D.K. (Perak)., D.K. (Perlis)., D.K. (Negeri Sembilan)., D.K. (Kedah)., D.K. (Johor)., D.K. (Pahang)., S.P.M.S., S.S.I.S., S.P.M.J.

OFFICE BEARERS AND GENERAL COUNCIL MEMBERS FOR SESSION 2024/2025

PRESIDENT

Sr Dr. AHMAD SANUSI BIN CHE COB

IMMEDIATE PAST PRESIDENT

PP Sr HJ. ADZMAN SHAH HJ. MOHD ARIFFIN

DEPUTY PRESIDENT

Sr WAN AINON ZURAIHA KHALID

HON. SECRETARY GENERAL

Sr CHOY YUE KWONG

HON. TREASURER GENERAL

Sr STEVEN PANG CHING CHOOI

VICE PRESIDENT (GLS)

Sr Dr. MOHD YUNUS MOHD YUSOFF

VICE PRESIDENT (QS)

Sr NAZIR MUHAMAD NOR

VICE PRESIDENT (PS)

PROF. (I) Sr MOHD KHAIRUDIN ABD HALIM

VICE PRESIDENT (BS)

Sr Dr. SYAMILAH YACOB

Sr BONG LEE HONG

Sr ROBERT TSEU CHEN CHEE

Sr NEOH WEN WAN

Sr TAN PEI LING

Sr HJ. FADZULLAH SUHAIMI ABD GHAFAR

PROFESSIONAL BOARDS 2024/2025

DATUK Sr MOHD AMRAN MOHD MAJID

Sr ABDUL RAZAK YUSAK

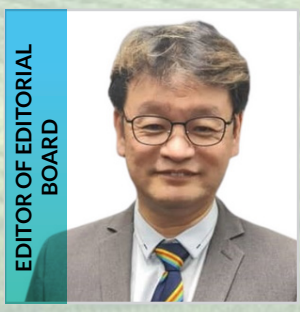
DATO' Sr HAZRI HASSAN

COUNCILLORS 2024/2025

Sr ASOKUMAR PONNAN

ASSOC. PROF. Sr Dr. SAIPOL BARI ABD. KARIM

PP Sr TANGGA PERAGASAM



Sr KHOO SUI LAI

CHAIR OF GLOBALISATION, LIAISON & PROMOTION COMMITTEE

PP Sr DAINNA BAHARUDDIN

CHAIR OF ESG INITIATIVES COMMITEE

Sr LOGISVARRAN MUNIANDY

CHAIR OF MEMBERSHIP REVIEW & PORTAL COMMITTEE

Sr SARAH SHAHARUDDIN

CHAIR OF SPORTS & SOCIAL COMMITTEE

Sr RICHARD OOI HOO ONG

CHAIR OF MEMORANDUM COMMITEE

Sr HJ. JAILANI JASMANI

CHAIR OF CONSTITUTIONAL REVIEW COMMITTEE

DATUK Sr PAUL KHONG

CHAIR OF INFORMATION TECHNOLOGY & LIBRARY COMMITTEE

Sr SULAIMAN AKHMADY MOHD SAHEH

CHAIR OF UNIVERSITIES' PARTNERING COMMITTEE & YOUNG SURVEYORS' GROUP

ASSOC. PROF. Sr Dr. ADI IRFAN CHE ANI

CHAIR OF YOUNG ACHIEVERS' AWARD ORGANISING COMMITTEE

ASSOC. PROF. Sr Ts. Dr. MOHD FADZIL MAT YASIN

WEB 3.0 IN THE CONSTRUCTION INDUSTRY: THE FUTURE OF BUILDING

The construction industry stands on the brink of a revolutionary change with the advent of Web 3.0 technologies. This new era of the internet, characterised by decentralised networks and artificial intelligence, promises to transform the way we build, manage, and maintain structures. Web 3.0, also known as the Semantic Web, is the next phase of the internet's evolution, enabling machines to understand and interpret data in a human-like manner. In the construction sector, this means an unprecedented level of data analysis and automation, leading to more efficient project management, design, and execution.

1.0 ARTIFICIAL INTELLIGENCE

One of the most significant impacts of Web 3.0 is the integration of AI into construction processes. AI algorithms can analyze vast amounts of data from various sources, such as material suppliers, weather forecasts, and construction schedules, to optimise project workflows and reduce delays. Moreover, AI can assist in predictive maintenance, ensuring that buildings are serviced proactively, thus extending their lifespan and reducing costs.

2.0 DIGITAL TWINS

The potential of Web 3.0 in construction extends to the use of digital twins, virtual replicas of physical buildings that can be used for simulation and analysis. These digital models enable architects and engineers to test various scenarios and make data-driven decisions before any actual construction begins, saving time and resources.

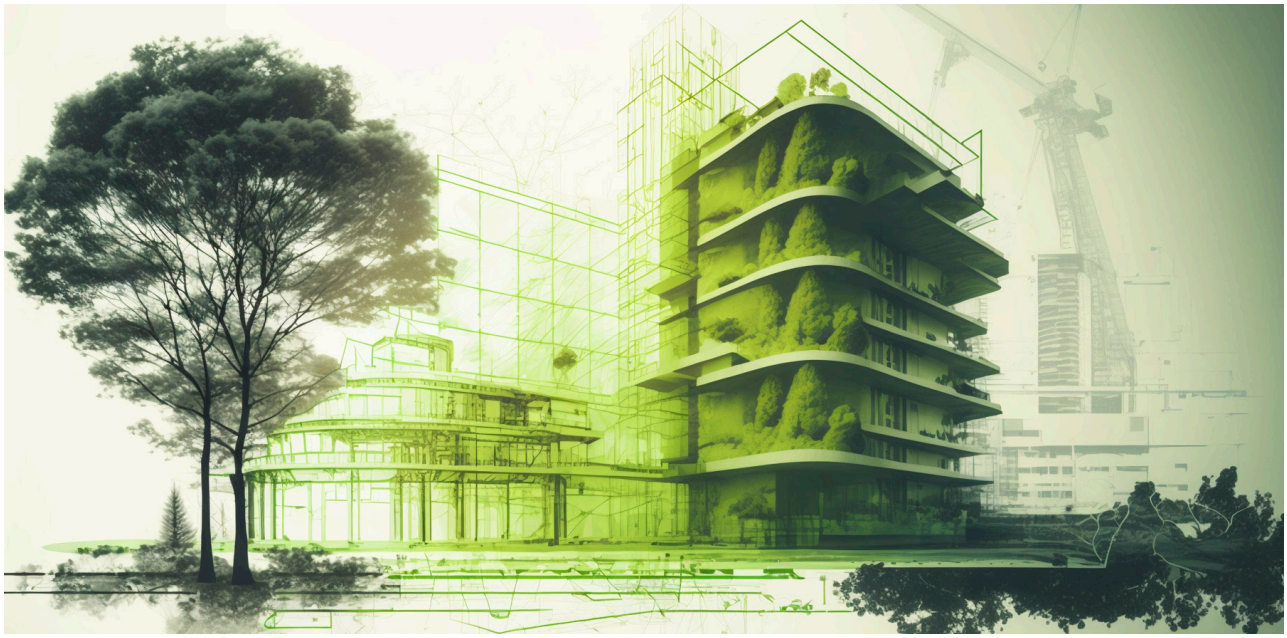
3.0 BLOCKCHAIN

Blockchain technology, a cornerstone of Web 3.0, offers another layer of innovation. By creating immutable records of transactions and documentation, blockchain enhances transparency and accountability among all stakeholders involved in a construction project. This is particularly beneficial in an industry where complex projects often involve multiple contractors and suppliers, making the tracking of responsibilities and progress challenging. The use of smart contracts on blockchain platforms can automate payment processes and enforce contract terms, reducing the likelihood of disputes and streamlining administrative tasks. Furthermore, blockchain's secure nature makes it an ideal solution for combating fraud and ensuring the integrity of the construction supply chain.

4.0 SUSTAINABLE CONSTRUCTION

In addition to these technological advancements, Web 3.0 paves the way for more sustainable construction practices. With better data analysis and resource management, projects can minimise waste and optimise the use of materials, contributing to greener building methods and adherence to environmental regulations.

As we look to the future, Web 3.0 will play a pivotal role in shaping the construction industry. Companies that embrace these technologies will likely see improved efficiency, reduced costs, and enhanced competitiveness. The construction landscape is set to evolve, and Web 3.0 is the catalyst for this transformation



5.0 CONCLUSION

The construction industry has always been a cornerstone of human progress, and with Web 3.0, it is poised to reach new heights of innovation and efficiency. The buildings of tomorrow will not just be structures; they will be intelligent systems, interconnected and responsive, build for a new age of the internet. The question is not if, but when, and how quickly the industry will adapt to harness the full potential of Web 3.0. The future of construction is here, and it is digital.

This article is provided by Building Cost Information Services Malaysia (BCISM).

RISM NEW MEMBERS

BS DIVISION

September 2023 to Aug 2024

Fellow

Sr Syamilah Bt Yacob
Jabatan Kerja Raya Malaysia

Sr Lim Swee Meng
Insight Building Services and Consultancy

Member

Sr Mohammad Hilmi Bin Nadzri
Infra Kirana Sdn Bhd

Graduate

Allistair Ricky Pudang
Bumirim Sdn Bhd

Benedict Abol Ramba Anak Jawan
Doland (M) Sdn. Bhd.

Mohd Fauzi Bin Sukat
Universiti Putra Malaysia (UPM)

Nurnadia Syakireen Binti Mohamed Rosli
RCK Property Management (M) Sdn Bhd

Ahmad Faiz Fauzi Bin Zulkifli
Jabatan Kesihatan Negeri (JKN) Negeri Sembilan

Farah Nabilah Zaulkarnain
Ranhill Syarikat Air Johor

Liong Kok Kit
UEM Sunrise Berhad

Mohd Hilal Bin Osman
Mitrajaya Holdings Berhad

Muhammad Amir Asyraf Bin Azmi
Binari Construction Sdn.Bhd.

Muhammad Izwan Bin Mohd Salleh
Jabatan Kesihatan Negeri (JKN) Negeri Sembilan

Nur Shazleen Natasha Binti Jamaluddin
Gamuda land

Nurul Hidayah Binti Harun
Majlis Perbandaran Kuala Kangsar

Siti Nurnasuhar Mohd Nasir
M.A.W. Global Sdn. Bhd.

Abdul Haliim Abu Bakar
Top House Group Sdn. Bhd.

Mohd Haikal Bin Ismail
Selaman Sdn Bhd

Muhammad Aashif Bin Kamarudin
Woh hup Malaysia Sdn.Bhd.

Muhammad Aiman Rasul Bin Mohd Norazdee
Henry Butcher Malaysia (Mont Kiara) Sdn Bhd

Muhammad Najmi Bin Zulkifli
Perbadanan PR1MA Malaysia

Nur Firzanah 'Alyea Bt Norazam
Sunissa Sdn Bhd

Siti Nur Fai'zun Binti Husain
ViTrox Technologies Sdn. Bhd.

Fernandez Cornelius William
WTW Property Services (Sabah) Sdn Bhd

Khairul Bariah Binti Harun
Global Facilities Management

Lim Keat Hee
Public Bank

Muhammad Hakim Bin Mohd Kamal Arifin
P-CON Building Surveyors Sdn Bhd

Muhammad Ikmal Ariff Bin Azmee
SCM International Property Management Sdn Bhd

Norhaizat Hazreen Bin Hmzah
Zecon Medicare Sdn Bhd

Nurshafarina Binti Jasme
Dongnam Sdn. Bhd.

Azril Yusri Bin Md Yuaup
KLCC Projeks Sdn Bhd

Nurul Amirah Binti Khairuddin

Batrisyia Rowena Binti Ahmad Bakri
Binaindah Makmur (M) Sdn Bhd

Che Muslim Md Nor
Mercury Plus Enterprise

Muhammad Nur Ariff Bin Zamhari
MNAZ Home Inspection

Muhamad Nur Syafiq Bin Mokhtar
Environmental Science (M) Sdn. Bhd.

Salasiah Binti Putit
Sarawak Metro Sdn Bhd

Azlan Bin Abdul Aziz
Jabatan Kerja Raya Negeri Perak

Frederick Nulai Anak Ganing
K&P COVE Consultancy Sdn Bhd

Farrazatul Ainnur Syuhada M. Razali
Gamuda Land

Farah Nieza Natasha Binti Zainal Adnan
CAFAM Sdn Bhd

Nurina Afiqah Binti Mohd Noor
Belati Engineering Sdn. Bhd.

Aminatul Natasha Binti Abdul Razak
Kondoservis Management Sdn Bhd

Mohd Norazman Bin Abdul Kholid

Muhammad Syafiq Fahmi
BS Expert Sdn Bhd

Mohd Farezee Bin Abd Razak
Dewan Bandaraya Kuala Lumpur (DBKL)

Faryzuan Bin Ahmad
Posh & Core Property Management

Mohd Faisol Bin Abu Bakar
CBRE WTW Property Services Sdn Bhd

Aznor Eisya Diana Binti Abdullah

Muhamad Faizam Bin Masri
Badan Pengurusan Bersama I-Soho I-City

Mohd Azizul Hakim Md Zailan
Majlis Bandaraya Subang Jaya

Nur Yuhanis Binti Kamarulzaman
Arissa Engineering Sdn Bhd

Nurul Farahanna Binti Aziz
Malaysian Communications and Multimedia Commission

Ting Siew Jing
George Town World Heritage Incorporated

Aimi Syamimi Binti Azman
Medivest Sdn Bhd

Mohd Hazril Bin Mohd Napi
CIDB Malaysia

Nur Anith Nadirah Aina Binti Ibrahim
HYtechEmpire Consultant Sdn.Bhd.

Nur Syazwani Binti Azman
PKN Building Solutions Sdn Bhd

Ahmad Akmal Bin Ahmad Dahlan
Majlis Bandaraya Subang Jaya

Azharizal Bin Ab Rahman
Majlis Perbandaran Kuala Selangor

Faiz Muhaimi B. Ramli
Ampero (M) Sdn. Bhd.

Khairul Azrin Bin Jalaludin
Skyworld Development Berhad

Mohammad Zul Amka Bin Zamri
TEMOKIN Development Sdn Bhd

Muhamad Izzat Bin Rosli
KCJ Engineering Sdn Bhd

Muhammad Faiq Bin Azman
IM Global Property Consultants Sdn Bhd

Nur Azean Binti Abdul Rahim
Ruma Inspection Services

Nur Izzah Binti Azizan
Henry Butcher Malaysia

Nur Syahidaton Umairah Binti Ton Zalani
Ove Arup & Partners Ireland Ltd t/a Arup

Nurul Afiqah Binti Mohammad Batni
WCT Construction Sdn. Bhd.

Ruzilawati Binti Moh Hussin
Jabatan Kerja Raya

Sharmila Binti Ahmad
Platinum Victory Holdings Sdn. Bhd.

Syamerin Bin Rukinin
Ehsan Property Inspection Enterprise

Probationer

Mohammad Affendy Bin Omardin
Universiti Malaysia Pahang

Muhammad Arkam Bin Che Munaaim
Mega Jati Academy Sdn Bhd

Ahmad Firdaus Bin Abd Latif
IJM Construction Sdn Bhd

Rabeah Binti Md Zin
Jabatan Pendidikan Politeknik & Kolej Komuniti

Zaimah Binti Zainal Abidin
UiTM Seri Iskandar

Andrew Ng Zhi Chong
CBRE WTW Real Estate Sdn Bhd

Mohd Sazalie Bin Ramlee
AECOM Perunding Sdn Bhd

Akram Syahmi Bin Azmi
Politeknik Mara

Azman Bin Mat Yasin
Spirit AeroSystems Malaysia Sdn Bhd

Student

Siti Masitah Binti Abdul Manan@ Zahari

Sarah Binti Lateng

Ahmad Danial Bin Ahmad Subri

Koh Jie Ling

Nur Emiesha Binti Rosli

Aisyah Wahidah Wahid

Cecilia Yii Wen Ya

Chai Tze Yi

Chai Xi Chen Roxanne

Chiang Yun Qi

Fatin Farahiyah Binti Zamren

Fatin Nur Auni Binti Zamri

Khairin Husna Binti Zahari

Lee Kai Wen

Lee Zien

Leong Wei Qin

Mabel Lay Qer Zhi

Mohamad Aieman Bin Daud

Mohammad Afiq Fiqrie Bin Jasri

Noorzulaikha Binti Salimun

Norsharizah Binti Mohd.Rohaisham

Nur Afini Binti Hamat

Nurul Adiba Binti Sohaimi

Pua Sze Xue

Queennie Julian

Teo Jia Ning

Tey Min Li

Voon Poh Yun

Yip Man Lin

Wong Wee Yuan

Muhammad Furqaan Bin Mohd Rashid

Neoh Jia Qin

Chew Li Jie

Chang Kah Thean

Gan Chee Yeow

Ong Jung Yu

Aliah Irdiena Binti Abdul Halim

Tan Hou An

Muhammad Faiz Fakhruddin Bin Shihabuddin

Eddy Sia Yong Jie

Wong Siow Earn

Putri Anis Nadiya Binti Muzir

Gan Chin Yu

Kanagaraj A/L Radzakrisnan

Lee Ming Chun

Muhammad Farhan Iman Bin Asri

Muhammad Farid Aidil Bin Suzuki @ Aslam

Muhammad Naufal Bin Suhaimi

Syaza Syaimaa Syazwani Binti Zaidi

Avy Rosabel Misek Yakim

Hong Fatt Chung

Muhammad Nasruddin Bin Mohd Hayat

Noor Natasha Binti Shahri

Nurul Amirah Binti Alim

Niu Yuanzun

Mohamad Izzul Ismat Bin Amran

Nurul Balqis Natasha Binti Mohd Zaini

Amirul Hakim Bin Amirudin

Nor Rohman Bin Mohtar

Goh Tse Dorn

Haziq Fahmi Bin Farid

Juhaohan

Muhamad Shahril Bin Mohamad Azani

GLS DIVISION

Sep 2023 to Aug 2024

Fellow

Sr Teoh Boon Siong
XYZ Survey Services Sdn Bhd

Sr Che Zamrey Bin Mohd Hashim
Ukur Dimensi Sdn Bhd

Member

Sr Ahmad Afifi Bin Nordin
Ukur Dimensi Sdn Bhd

Sr Ahmad Fitri Bin Baharuddin
Kemas CSJJ Survey Sdn Bhd

Sr Amirul Hakim Bin Kamaruddin

Sr Azmi Bin Yusoff
Delima Geomatik (M) Sdn Bhd

Sr Choong Hon Kit
Jurukur Tempatan SDN BHD

Sr Heng Kuan Aui
Juruukur Usaha Sdn Bhd

Sr Ismaizzuddin Ismadi Bin Abdullah
Topcon Positioning Asia (Malaysia) Sdn. Bhd.

Sr Mat Nizam Bin Uti
UITM Sri Iskandar Perak

Sr Mohamad Asrul Bin Mustafar
UiTM Cawangan Perlis

Sr Mohamad Faris Bin Alias
University Malaysia Kelantan Jeli Campus

Sr Mohammad Haffizuddin Bin Zakaria
Perunding Ukur Zakaria

Sr Mohammad Nur Hashif Bin Misran
UTEC Survey Asia Pte Limited

Sr Mohd Azfarulhisyam Bin Ahamad Kamil
AZF Ukur Consultant

Sr Mohd Buraidah Bin Che Mohamed
Pejabat Tanah Dan Jajahan Kota Bharu

Sr Mohd Fuad Alfisyairie Bin Safien
SSC Survey Consultant

Sr Mohd Rozaimi Bin Salleh
Mah Sing Group Berhad

Sr Mohd Syuib Bin Umar
UiTM Kampus Arau

Sr Muhamad Firdaus Bin Ibrahim
Roslan Ukur Sdn Bhd

Sr Muhammad Abdul Hakim Bin Muhamad
UiTM Shah Alam

Sr Muhammad Adli Bin Abdul Jamil
Perunding Ukur Maha Sdn Bhd

Sr Muhammad Aiman Bin Safi'n
JUPEM WPKL

Sr Muhammad Asyraf Bin Abu Hasan
Ukur Sepakat

Sr Muhammad Idham B Mahd Mayedi
AA Geomatics and Survey Consultant

Sr Muhammad Safwan Bin Ahmad
Jurukur Khoo

Sr Muhammad Safwan Bin Zakaria
Amanah Berjasa Geomatique (M) Sdn Bhd

Sr Muhammad Wafiy Adli Bin Ramli
Universiti Sains Malaysia

Sr Nik Ahmad Aiman Bin Nik Hisham
Jurukur Nik Hisham & Tung Sdn Bhd

Sr Noor Hidayu Binti Mohd Sahaid
AA Geomatics and Survey Consultant

Sr Nur Hazlina Binti Mohd Hussain
HA Tech Resources

Sr Ronald Foo Yen Seng
Radian Geomatics PLT

Sr Samuel Tan Thian Meng
Suruhanjaya Perkhidmatan Awam Negeri Sabah

Sr Shahira A'in Binti Noor Azmi
University College of AgroSciences Malaysia

Sr Siti Wan Syahidah Binti Wan Ahmad
Lembaga Jurukur Tanah

Sr Wan Mohammad Zaeri Bin Wan Zainudin
Jupem Terengganu

Sr Wan Mohd Haffiz Bin Wan Deraman

ENZ Geodata Survey Sdn Bhd

Sr Wan Nur Farah Edlin Binti Wan Abdul Rahman
Jurukur Sentral

Sr Zol Hazwan Bin Hasanuddin
JUPEM KL

Sr Azlan Benjamin
Perunding Geomatik Sdn. Bhd.

Sr Bazli Bin Badrul Hisham
Jurukur Perunding Services Sdn. Bhd.

Sr Faizman Bin Badayamin
Jurukur Khoo & Mas

Sr Farah Farhanah Binti Hamim
AJ Surveyors (M) Sdn Bhd

Sr Kavitha A/P Seras @ Jeyaraj
Geohub Sussol Services

Sr Kenndy Cartar Bin Keriah
Jabatan Tanah Dan Ukur Sabah

Sr Kuik Teing Shen
Jurukur Kencana

Sr Mahathir Bin Kusnan
Jurukur Jasa Jaya Sdn Bhd

Sr Mohamad Fhais Bin Mohd Ali
Otimo Energy Sdn Bhd

Sr Mohamad Nur Najmi Bin Mohd Najmuddin
East Coast Surveyors (M) Sdn. Bhd.

Sr Mohamad Syamil Amri Bin Wahab
AJ Surveyors (M) Sdn Bhd

Sr Mohd Azizulhafeez Bin Mohd Rafiei
Axis Survey Consultants Sdn.Bhd.

Sr Mohd Fauzee Bin Mohamad
Gabungan Strategik Sdn Bhd

Sr Mohd Hasmikhan Bin Idris
TAC Mapping Sdn Bhd

Sr Mohd Razlan Bin Ghazali
SMEC (M) Sdn Bhd

Sr Mohd Syukri Bin Masri
Jurukur Perkasa Sdn Bhd

Sr Muhammad Afiq Bin Rosli
Jurukur Khoo & Mas

Sr Muhammad Bin Sulaiman
JUPEM KL

Sr Muhammad Fakhrul Arif Bin Hasan
Jurukur Teras Sdn. Bhd.

Sr Muhammad Firdaus Bin Aminuddin
Politeknik Sultan Haji Ahmad Syah

Sr Muhammad Kamalnoah Bin Kamarudin
Projek Lebuhraya Usahasama Berhad

Sr Muhammad Zaki Bin Nordin
Ukur Sepakat

Sr Munirah Binti Gerdi
Perunding Geomatik Sdn Bhd

Sr Norhedayah Binti Usup
Perunding Geomatik Sdn Bhd

Sr Nur Syasyahirah Binti Mohd Asri
Jurukur Shahful Sharif

Sr Nurul Fariza Binti Ahmad Yacob
Jurukur Hashim Perantau

Sr Quek Yong Wah
Antaragrafik Psc Sdn Bhd

Sr Sofia Abena Anak Bayang @ Junggok
Perunding Geomatik Sdn Bhd

Sr Teoh Joshua
XYZ Survey Services Sdn Bhd

Sr Norfazila Bt Kasim
Jabatan Kerja Raya Sabah

Sr Abdul Rashid Bin Abdul Rahim
ACD Global Mapping

Sr Afifah Bt Abdul Wahab
Juruukur Abadi Utara Sdn.Bhd

Sr Ahmad Aizuddin Bin Tuah
Alam Flora Sdn Bhd

Sr Ahmad Izzaidy Bin Yuhana
Pelaburan Hartanah Berhad

Sr Angelina Deidre
Sabah Lands and Surveys Department

Sr Awang Aswari Bin Awang Mustaffa
Jurukon Malaysia

Sr Hazida Bt Hamzah
JUPEM KL

Sr Jamil Faisal Bin Yusoff
JUPEM KL

Sr Lucia Binti Duakim
Jabatan Kerja Raya

Sr Luqman Bin Samsudin
Jurukur Samsudin Hassan

Sr Mohd Aizat Bin Mohd Amran
Jurukur Wan Ariffin

Sr Mohd Azwan Bin Abbas
UiTM Shah Alam

Sr Muhamad Asyraf Bin Zamari
Jurukur Khoo & Mas

Sr Muhammad Faeezwan Bin Omar
Sapura Geosciences Sdn. Bhd.

Sr Muhammad Izuddin Bin Muhammad Daud
Sabar Ukur Consultants Sdn Bhd

Sr Muhammad Radhi Bin Abdul Rahman
Perunding Ukur Ridhwan

Sr Muhammed Amizan Bin Amzah
Polaris Geoland Survey & Consultant Sdn Bhd

Sr Mustaqiimah Muhamad
Politeknik Tuanku Sultanah Bahiyah

Sr Norazrul Bin Berawi
Sumerich Resources Sdn. Bhd.

Sr Nur Nazeha Bt Ramli
Amanah Berjasa Geomatique (M) Sdn Bhd

Sr Nur Syamsinar Fadhilah Binti Mohamad Jaya
Politeknik Sultan Mizan Zainal Abidin

Sr Nurul Amalina Binti Hamzah
AA Geomatics and Survey Consultant

Sr Nurul Atiqah Binti Suhaime
Syarikat Jurukur Konsultant

Sr Siti Hajar Binti Nayan
Juruukur Mutiara

Sr Siti Mazirah Binti Madzin
Jurukur Teras Sdn Bhd

Sr Siti Munirah Binti Mazlan
JUPEM KL

Sr Syaza Kautsar Binti Mohamad Halim
NZ Survey Consultant

Sr Syed Haziq Bin Syed Muhammad Jasin
Construction Development (M) Sdn. Bhd.

Sr Thuaibatul Aslamiah Binti Mastor
JUPEM KL

Sr Wan Mohd Faiz Bin Wan Abd Rahman
Faiz Survey Consultant (M) Sdn Bhd

Sr Yong Chien Zheng
University of Otago

Sr Zakiah Binti Abdullah
Jurukur Khoo

Sr Amiera Binti Aminudin
Jurukur Iltizam

Sr Wan Mohd Hakimin Bin Wan Shafie
Politeknik Kuching Sarawak

Sr Nur Rabiatuadawiyah Binti Baharul Azidi
Rezq Utilities Sdn. Bhd.

Sr Ahmad Fuad Bin Ab Kadir
Aa Geomatics and Survey Consultant

Sr Muhammad Zulqif Bin Mahamad Jainalabidin
Perbadanan Kemajuan Negeri Selangor (PKNS)

Sr Zulhulaipah Bin Salamat
WCE Maju Sdn Bhd

Sr Leow Hui Xian
Jurukur Makmur

Sr Norazrina Binti Md Ramlan
JUPEM KL

Sr Norliza Binti A.Patah
JUPEM KL

Sr Ahmad Zuhdi Bin Ismail
Jurukur Tanahmas Sdn Bhd

Sr Mohd Azlan Bin Ismail
Westports Malaysia Sdn. Bhd.

Sr Roznirini Binti Rozali
Syarikat Ayob Bin Saud

Sr Muhammad Izwan Bin Abd Razak
East Coast Surveyors (M) Sdn Bhd

Sr Mohammad Khairul Bin Hasbol
Ocean Might Sdn. Bhd.

Sr Muhammad Afiq Bin Md Abd Rashid
Gamuda Engineering Sdn. Bhd.

Sr Mohd.Hazwan Bin Md.Darus
Subsea 7 Crewing Services Pte Ltd

Sr Ngoh Wan Zing
Jurukur Jitu Runding

Sr Vivian Tan Fui Vun
Jabatan Tanah Dan Ukur

Sr Julia Cheong May Ling
Resources Surveys Services

Sr Abza Binti Khalid
Politeknik Merlimau

Sr Azzillahwati Binti Bonimin
Jurukur Jitu Runding

Sr Hii King Kwong
Bormap Surveys Sdn Bhd

Sr Ku Nor Afiza Asnida Binti Ku Mansor
Ocean Hydro Sdn. Bhd.

Sr Mardyana Binti Abdul Halim
Pejabat Ukur Daerah Pulau Pinang

Sr Mohamad Sufi Bin Mohamad Pisol
Koridor Utiliti Selangor Sdn Bhd

Sr Mohd Saflan Bin Zainol Abidin
Ukur Dimensi

Sr Mohd Syamsul Bahari Bin Daud
Ssangyong-Hyundai Joint Venture

Sr Muhamad Sadiq Bin Abdul Jabar
Strato Solutions Sdn Bhd

Sr Ngu Heng Tai, Raymond
Jabatan Premier Sarawak

Sr Nurzaitie Aflah Binti Abdullah
SHT Engineering Sdn. Bhd

Sr Ponisah Anak Sabod
Jabatan Kerja raya Sarawak

Sr Elga Elain
Jabatan Tanah Dan Ukur

Sr Fatin Amalina Bt Mohd Tarmizi
Juruukur Tarmizi

Sr Leonard Takom
Jabatan Kerja Raya Sabah

Sr Low Lip Hwa
Ukur Sekitar Sdn Bhd

Sr Mahfuz Fikri Bin Marzuki
Geomatics Survey Consultants

Sr Mohamad Jahidi Bin Osman
UTM-JPNJ

Sr Mohamad Rafli Bin Rosli
JUPEM Kota Bharu, Kelantan

Sr Mohd Syazwan Affif Bin Sulaiman
Geomatics Survey Consultants

Sr Muhamad Arif Bin Rosdi
Wira Ukur Consultant

Sr Muhammad Abdul Hadi Bin Razali
Juruukur Wahdah

Sr Noor Shila Binti Ismail
Pejabat Daerah Dan Tanah Kuala Selangor

Sr Nora Malawit
Jabatan Tanah Dan Ukur Sabah

Sr Odell Anak Andrew
Fugro Malaysia Marine Sdn Bhd

Sr Tiffenny Chen
Jabatan Tanah Dan Ukur Sabah

Sr Willie Anak Lagan
Sarawak Energy Berhad

Sr Zaharudin Bin Pawi
Jurukon Malaysia

Graduate

Akmal Jauhari Bin Jalal
Jalal Johari Consultants Sdn Bhd

Caley Jousie Amin
Jabatan Tanah dan Ukur Sabah

Emir Asyrawi Bin Rosdy
SR Survey Consultant

Nora Binti Malawit
Jabatan Tanah dan Ukur Kota Kinabalu, Sabah

Zulfikry Bin Wahap
Jurukur Wahap

Khairuddin Nurfitri
S.O. Survey Consultants

Mohamad Najwan Bin Mohd Hisham
Syarikat Abdul Wahab

Muhammad Amir Irfan Dzulkefli
Syarikat Mahyuddin Dan Siew Sdn Bhd

Muhammad Baihaqi Bin Azhari
Pejabat Pengarah Tanah dan Galian

Muhammad Shakiran Basri Bin Sabri
Juruukur Sutera

Muhammad Syazwan Bin Mohd Mazlan
Jurukur Teras Sdn Bhd

Nicholas Goh Kyai Earn
Jurukur Makmur

Noorsyamimie Anies Binti Sukree
Perunding Ukur Rahman Hamid

Nur Syahirah Binti Patamma
Juruukur Robert Cheng & Associates

Nurul Syahirah Binti Robia
Juruukur Abadi Utara Sdn Bhd

Putra Nafis Aiman Bin Mohd Azahar
Perunding Ukur Iman Sdn. Bhd.

Shafika Ahlam Bt Mohamed Taufik
Juruukur Abadi Utara Sdn Bhd

Tan Tai Wei
Jurukur Makmur

Amir Abdillah Bin Mohd Razali
Syarikat Ayob bin Saud

Ammar Muhsin Bin Saharuddin
Jurukur Generasi

Durrani Azman Bin Sukman
Jurukur Metra

Ezam Bin Abdullah
Sekara Prima Sdn Bhd

Khairun Nas Bin Mulyani
Jurukur Salehan

Kurniawan Putra Bin Shahrom
MH Malawati Enterprise

Lau Jett Xiang
Jurukur Bakti Sdn. Bhd.

Mohd Nor 'Aid Bin Jemangin @ Jemain
SR Survey Consultant

Muhamad Adzrai Bin Azhari
Jurukur Bandardesa Sdn Bhd

Muhamad Ridzuan Bin Hassim
Jurukur Tempatan Sdn Bhd

Muhammad Amirul Firdaus Bin Mahmud
Sahabat Ukur Consultants

Muhammad Haziq Haikal Bin Omar
Ukur Sepakat

Nur Afiqah Binti Alias
Inaco Bina Sdn Bhd

Nur Aiesyah Binti Sulaini
Jurukur Putra (Timur)

Nurul Naziera Binti Kassim
Lembaga Jurukur Tanah

Siti Nurulain Binti Sha'aban
MH Malawati Enterprise

Wan Ahmad Syamil Bin Wan Sagar
Jurukur Budiman

Yasmin Athirah Binti Azizan
Jurukur Generasi

Khairul Nizam Bin Mohamad Kamal
Infra Survey Consultants

Muhammad Abdul Rahman Bin Mohd Said
Jurukur Mokhtar Kassim Sdn Bhd

Nurul Nabilah Mohd Norezan
Geodetic Global Science & Technology Sdn Bhd

Lydy Yvonne Yacob
Juruukur Robert Cheng & Associates

Mohamad Aiman Asyraaf Bin Che Zamrey
Ukur Dimensi Sdn. Bhd.

Ahmad Muslim bin Ali
Kementerian Pendidikan

Joseph Bin Dipal
Juruukur Lee Survey & Associate

Abdul Rahman Ansari Bin Rosli
Jurukur Kristal

Muhamad Azizi Bin Daud
Jurukur Daud Bohani

Wan Arif Bin Wan Bakar
Jurukur MKD

Nur Neesya Binti Mohamad Sahar
Jurukur Khoo & Mas

Chee Thong Chua
Mesra Ukur Sdn Bhd

Chen Chee Bui
Ukurancang Perunding Sdn Bhd

Juliette Easter Sikodol
Jabatan Kerja Raya Sabah

Lizahafifi Binti Mohd Tamin
Pejabat Daerah Tanah Mualim

Mohammad Aizat Bin Zulkifli
Jurukur Rahman

Mohd Zharif Syafiq Bin Ramlan
Jdinar Geomatics Sdn.Bhd

Muhammad Syarif Bin Ahamad Kamil
AZF Ukur Consultant

Nur Alya Nasuha Binti Azizan
Jurukur Khoo & Mas

Ahmad Aiman Bin Ridzwan
Jurukur T&T

Chua Li Min
Tambatan Marin Sdn Bhd

Jazlina Binti Muhammad
Politeknik Sultan Sallahuddin Abdul Aziz Syah

Lau Bik Sing
LS Survey Consultant Sdn. Bhd.

Mathew Pengiran Bayan
Kemas CSJJ Survey Sdn Bhd

Mohammad Shahrul Nizam Bin Zaid
Vista Infinity Development Sdn Bhd

Noramira Binti Monir
JKR Sarawak

Nur Athirah Bt Azni
Politeknik Kuching Sarawak

Nur Faizah Binti Abdul Nasir
Jurukur Bandardesa Sdn Bhd

Rosazlan Bin Mohamad
IJM Construction Sdn Bhd

Shahril Bin Mohamad Sahar
Perbadanan Aset Kereta api

Syed Asfan Ghazir Bin Syed Abdul Aziz
JGC (Malaysia) Sdn. Bhd.

Toh Ming Liang
Blessed Earth Survey Services

Probationer

Cheng Chee Lim
LLC Infra Sdn Bhd

Mohd Azwan Bin Wil
Tenaga Nasional Berhad

Muhamad Nur Akmal Bin Sirun
T7 Kemuncak Sdn Bhd

Student

Ahmad Rashdan Bin Ahmad Roshdi

Khalid Bin Mahktar

Elizabeth Yusthyna Binti Colony

Fahmi Syazwan Bin Syafie

Izzabel Conrad

Muhammad Fakri Bin Mohammad Sahrien

Nurul Izzati Binti Che Azib

Siti Aisyah Binti Mahdzir

Muhammad Amirul Danial Bin Mohd Adzmi

Muhammad Daniel

Quinne Tang Shin Lin

Adeline Ivy Anak Kassim

Muhammad Harris Amir Bin Mohd Hanifa

Nurul Arina Binti Abd Malek

Nurul Farihah Binti Damit

Rosazlan Bin Mohamad

Nur Radhia Binti Ahmad Nazari

Chua Wei Jie

Zulhaqim Zulkefli

Riethvieen Logisvarran

Nur Arisya Huwaida

Akmal Nizam Bin Zuhairon

Chew Kok Choon

Aerick Bin Malawit

Mathew Pengiran Bayan

Mohd. Hazlan Bin Hasim

Akmal Azri Bin Hisham

Muhammad Aizat Bin Sukardi

Wan Muhammad Irman Bin Wan Rojas

Muhammad Adam Bin Zairul Anuar

PS DIVISION

Sep 2023 to Aug 2024

Fellow

Sr Chandra Mohan A/L Krishnan
One Asia Property Consultant (PG) Sdn. Bhd.

Sr Kholim Bin Sahray
UiTM Shah Alam

Sr Lee Wen Tat
Raine & Horne International Zaki + Partners Sdn Bhd

Sr Nithiyaini Jewa
Rahim & Co

Sr Mohd Arif B. Mat Hassan
National Institute of Valuation (Inspen)

Sr Noorsidi Aizuddin Mat Noor
Universiti Teknologi Malaysia

Sr Ng Weng Yew
Metro Rec Sdn Bhd

Sr Ahmad Faisal Bin Ahmad Shayuti
KLCC (Holdings) Sdn. Bhd.

Sr Loo Choo Wei
PA International Property Consultants Sdn Bhd

Member

Sr Farha Binti M. Saad
Proharta Consultancy Sdn Bhd

Sr Goey Poh Hwa
Sinland Real Estate Sdn Bhd

Sr Jeffrey Pui Zen Thung
C H Williams Talhar & Wong

Sr Mohd Ibni I'zzan bin Adnan
Azmi & Co (Melaka) Sdn Bhd

Sr Mohd Izudin Bin Nordin
Jabatan Penilaian Dan Perkhidmatan Harta

Sr Mohd Khairul Mohd Yunos
Ziyad Property Consultants Sdn Bhd

Sr Noriha Binti Harun
Azmi & Co (Pahang) Sdn Bhd

Sr Ooi Siong Gim
Solid Real Estate Consultants Sdn Bhd

Sr Ahmad Faizal Bin Ismail
Majlis Bandarya Petaling Jaya

Sr Ahmad Nur Azrul Bin Che Rezali
Perbadanan Kemajuan Negeri Pahang

Sr Ahmad Syukri Bin Abdullah
Kumpulan Perangsang Selangor Berhad

Sr Christopher Heng Yong Wei
Saradise live the Sarawak dream

Sr D Dahryna Binti Mohd Yunos
Petroliam Nasional Berhad (Petronas)

Sr Eric Husly Hului Hafveat
Klcc (Holdings) Sdn Bhd

Sr Goh Zhong Ming
Real Estate JS Valuers Property Consultants (Perak) Sdn. Bhd.

Sr Jazreeni Binti Jaafar
Knight Frank

Sr Kamarul Afizah Binti Muhammad Ariffin
Majlis Bandaraya Petaling Jaya

Sr Khadijah 'Ariyah Binti Hanafi
Majlis Bandaraya Petaling Jaya

Sr Khairol Anuar Bin Rosman
Institut Penilaian Negara

Sr Mazlin Binti Wahid
Pelaburan Hartanah Berhad

Sr Mohamad Afendy B Izahar
Jabatan Penilaian Dan Pengurusan Harta

Sr Mohd Nazry Bin Zakaria
Jabatan Penilaian Dan Pengurusan Harta (MBPJ),

Sr Mohd Rizal Bin Hashim
Majlis Daerah Cameron Highlands

Sr Mohd Shakimi Bin Dato Haji Md Yusoff
Azilah Properties

Sr Mohd Zulfadli Bin Burhan
Majlis Bandaraya Petaling Jaya

Sr Muhammad Nazhif Bin Radzuan
Petroliam Nasional Berhad (Petronas)

Sr Nurul Shafiqah Binti Ahmad
City Value and Consultants Sdn Bhd

Sr Roslan Bin Hassan
Perbadanan Pembangunan Pulau Pinang

Sr Siti Norasyikin Bt Abd. Rahman
Knight Frank Property Asset Management Pte Ltc

Sr Wilson Rangga Anthony Jiram
Universiti Malaysia Sarawak

Sr Wong Chie Kheng
Zerin Properties Corporate Values

Sr Wong Jin Nee
Wong Jin Nee & Teo

Sr Yap Yu-Jin
JS Valuers Property Consultants (Perak) Sdn.Bhd

Sr Jamaluddin Bin Harun
RISDA

Sr Chan Yin Chen
CID Realtors Sdn Bhd

Sr Lui Pey Jiuan
Oregeon Property Consultancy Sdn Bhd

Sr Siti Zamilah Binti Abd Hamid
UTM Space Kuala Lumpur

Sr Sharifah Nurul Akhilah Bt Syed Mustorpha
Oregeon Property Consultancy (Penang) Sdn Bhd

Sr Nurul Syakima Binti Mohd Yusoff
University Teknologi Malaysia

Sr Chang Jiah Jung
Knight Frank

Sr Thanabalan A/L Muthu
Jordan Lee & Jaafar (M'cca) Sdn. Bhd.

Sr Nurul Nabihah Binti Zainal Abidin
Im Global Property Consultants Sdn. Bhd.

Sr Mohd Khairul Bin A.Khalid
JB Jurunilai Bersekutu (Selangor) Sdn Bhd

Sr Sivaggami A/P Raman
Dreamlike Development Sdn Bhd

Sr Diana Binti Abd Latiff
Dewan Bandaraya Kuala Lumpur

Sr Yap Ying Li
Jones Lang Wootton

Sr Ahmad Fawwaz Bin Ahmad Saleh
Irhamy & Co

Sr Lee Joo Aun
JS Valuers Property Consultants Sdn. Bhd., KL

Sr Ahmad Faizal Bin Nordin
Petroliam Nasional Berhad (Petronas)

Sr Abby Mae Joe
Dewan Bandaraya Kota Kinabalu

Sr Yap Khee Heong
CBRE WTW Valuation & Advisory Sdn Bhd

Sr Muhammad Alif Bin Ismail
Azmi & Co (Bangi) Sdn Bhd

Sr Rizali Hadi Bin Dzulkifli
Transasia Property Consultancy Sdn Bhd

Sr Rashidah Binti Isnin
JB Jurunilai Bersekutu Sdn. Bhd.

Sr Mohamad Razali Bin Mohamad Salleh
JB Jurunilai Bersekutu Sdn. Bhd.

Sr Ng Zheng Hong
City Valuers and Consultants Sdn Bhd

Sr Abdullah Abdul Rahman
Petronas Gas Berhad

Sr Nor Syazana Binti Nor Sukri
Petronas Gas Berhad

Sr Zainuddin Bin Muhamad
DBKL

Sr Fadzilah Binti Ahmad
DBKL

Sr Haw Yin Han
Henry Butcher Malaysia (Muar) Sdn Bhd

Sr Lee Loong Yee
Zerin Properties Corporate Values

Sr Lee Sot Chen
SCL Real Estate Service

Sr Lim Soon Mun @ Albert
Sime Darby Property Berhad

Sr Masraimi Bin Mahyiddin
TD Aziz Sdn Bhd

Sr Muhammad Syakir Bin Mohd Wazir
Artfield Properties

Sr Syed Azzim Bin Sheik Ali
ExaStrata Solutions Sdn Bhd

Sr Tham Kuen Wei

Prof. Sr Dr. Tham Kuen Wei
MV Valuers & Estate Agents

Sr Terence Rajiv A/L Francis
Khong & Jaafar Sdn Bhd

Sr Al Fazli Bin Mohd Salleh
WTW Property Services (Sabah) Sdn Bhd

Sr Jennifer Wong Shau Yun
Laurelcap (Sabah) Sdn Bhd

Sr Ahmad Tajjudin Rozman
International College Imperia

Sr Fariq Anwar Bin Abd Rahman
Jabatan Penilaian Dan Perkhidmatan Harta Seberang Perai

Sr Kalthum Binti Mohd Ghazalli
JB Jurunilai Bersekutu Sdn Bhd

Sr Mohammad Hafiz Abdul Hamid
Raine & Horne

Sr Wong Siew Lan
Jasaland Property Consultants (KL) Sdn Bhd

Graduate

Angeline Goh Moong Er
HSR Property Management Sdn Bhd

Anwar Faris Bin Rosman
IM Global Property Consultants Sdn Bhd

Chuah Ren Hong
GS Realty Sdn Bhd

Gan Li Xin
Raine & Horne International Zaki + Partners Sdn Bhd

Lim Yen Yee
Laurelcap (SEL) Sdn Bhd

Lim Yong Rui
Savills (Johor) Sdn Bhd

Megat Mohd Hazwan Bin Yahya
Raine, Horne & Zaki Property Management Sdn Bhd

Nurul Asmaa' Binti Musa
Universiti Teknologi Malaysia (UTM)

Tham Wai Si
Chartwell Itac International Sdn Bhd

Nur Adlina Binti Che Hasnu
Cbre Wtw Valuation & Advisory Sdn Bhd

Ahmad Fadzli Bin Che Mohd Hashim
TH Properties Sdn Bhd

Ameer Danish bin Ahamad Jamil
IM Global Property Consultants Sdn Bhd

Goh Hui Ting
E Trend Realty Sdn Bhd

See Ker Li
Cbre Wtw Valuation & Advisory Sdn Bhd

Ahmad Luqman Hakim Bin Ahmad Azhar Shah
Cbre Wtw Valuation & Advisory Sdn Bhd

Cherlyn Liaw Jye Yiing
Taylor Hobbs Chartered Surveyors

Lum Chean Jeeng
Dutama Properties

Muhammad Zhahril Bin Zaki
Raine & Horne International Zaki + Partners Sdn Bhd

Norfarizan Binti Mohamad
Invenio Ptl Property and Facilities Management Sdn Bhd

Ong Ghee Cheang
Cbre Wtw Valuation & Advisory Sdn Bhd

Ting Sing Ting
Taylor Hobbs

Low Siu Kuan
Knight Frank

Nurzawani Binti Abdul Latiff
Cbre Wtw Valuation & Advisory Sdn Bhd

Alvin Tan Chee Yau
BT Properties

Ameera Juliyana Binti Jalal
Cheston International

Kee Yoke Yew
Solid Real Estate Consultants

Mohamad Farudin Bin Abd Rahman
Jabatan penilaian dan perkhidmatan Harta Seremban

Mursyidah Binti Ramli
Ecoworld Creating Tomorrow & Beyond

Nor Fasehah Binti Ibrahim
Invenio Potential

Nurul Amira Binti Ibrahim
UEM Group

Ratna A/P Ragawan
Khong & Jaafar Sdn Bhd

Rumaisa Binti Zulkifli
Cbre Wtw Valuation & Advisory Sdn Bhd

Probationer

Az. Rizan Randy Fendy Bin Jonathan
Real Estate Negotiator
EUM Realty Sdn. Bhd.

Chin Wai Leong
Fairview Valley Sdn Bhd

Hee Ping Zhi
Vigor Properties Sdn Bhd

Lee Sook Fong
IQI Realty Sdn Bhd

Lim Kam Choy
Ann Joo Management Services Sdn Bhd

Najihah Syahira Binti Zulkarnail
SA Property Management Sdn Bhd

Ngan Shiky
Genting Berhad

Pung Po Bao
CBRE WTW Real Estate Sdn Bhd

Sow Xin Xuan
Toyota Tsusho (Malaysia) Sdn Bhd

Tan Wei Shin @ Chin Wei Shin

Teh Yong Chin
Serata Kota Sdn Bhd

Tew Eu Jian
Knight World Realty (M) Sdn Bhd

Wei Aik Ng
NI Property Management Sdn. Bhd.

Dato'Yong Moon Goon

Chong Ji Sheng
PMC Facilities & Real Estate Sdn Bhd

Nur Hafizah Mohd Sidek
Invenio Potential

Sum Wai Ming
FBS Realty

Khor Yun Keat
Anchor Empire Properties

Galvin Lee Kuan Sian
IQI Realty Sdn Bhd

Fadzreen Shahira Binti Rusli
IQI Realty Sdn Bhd

Loi Li Ping
FBS Realty

Chan Iou Cheng
Ong Housing Agencies

Lim Chia Wea
Simon Realty

Mohd Nizam Bin Awang
Pelaburan Hartanah Berhad

Lau Yong Sern
Jabil Sdn. Bhd.

Lee Zhe En
DI Mahkamah Tinggi Malaya di Kuala Lumpur

Lee Jian Jun
IQI Realty Sdn Bhd

Mohd Zulfadly Bin Abd Majid
MMC Corporation Berhad

Wong Hoe Luen
TSW Labs Sdn Bhd

Esther Liew Ai Peng
St. Mary's Cathedral

Foong Wing Keong
Fastwood Properties Sdn Bhd

Loo Chang Soon
Professional Engineer with Practising Certificate

Ong Yee Thing
Kiat Hin Electrical

Alwi Bin Abdul Aziz
Kondoservis Management Sdn Bhd

Lim Li Wen

Kevin Ton Khing Bing
Azmi & Co (Sarawak) Sdn Bhd

Chan Hong Guan
IPG Century Sdn Bhd

Henry Chen Poh Luong
Public Bank

Lim Zhe Kang
IQI Realty Sdn Bhd

Wong E Zung
Capital R Berhad

Lee Yee Yee
East Design Architect Sdn Bhd

Lo Kah Wah
IPG Realty Sdn Bhd

Mohamad Arif Bin Md Nor
Koperasi Muslimin Malaysia Berhad

Thang Kah Mun
Eco World Development Group Berhad

Yeap Kok Peng
Iskandar Regional Development Authority

Probationary Estate Agent

Wei Leong Chin

Jesslyn Choo Huey Ling
Hartamas Real Estate (Malaysia) Sdn Bhd

Nora Liew Pyit Sha
Interland Properties Sdn Bhd

Chong Chun Jie
HI Realtors Sdn Bhd

Lim Chiun Wei
Foreward Realty Sdn Bhd

Clare Ng Siew Hong
KTS L&S Services Sdn Bhd

Mohammad Firdaus Bin Iskandar
Firdaus & Associates Holdings Sdn Bhd

Yap Chee Yong
Ecoworld Creating Tomorrow & Beyond

Siti Nurul Ain Binti Noor Habre
DSA Global Empire

Khoo Mun Hui
Real Estate Negotiator

Alvin Isaac
Keisha Marine Services Sdn Bhd

Tan Wai Hong
IPG Realty Sdn Bhd

Tiew Kah Hi
IPG Realty Sdn Bhd

Tan Soo Ping
IPG Realty Sdn Bhd

Goh Yen Peng
PropNex Realty Sdn Bhd

Chua Pei Ern
PMG Management Sdn Bhd

Leong An Ni
IPG Realty Sdn Bhd

Izaan Johaan Bin Sallih
AI Group Enterprise

Yong Dee Peng
SHM Development Sdn Bhd

Muhammad Azamuddin Bin Lokmanal Hakim
DSA Global Empire

Chong Kok Ton
IQI Realty Sdn Bhd

Sia Zheng Han
Guyub (M) Sdn. Bhd.

Lim Aun Ying
IQI Realty Sdn Bhd

Student

Muhamad Amir Zulfaqar Bin Zulkernain

Choo YiXi

Yong Huey-Yeng

Aliah Maisarah Binti Jalani

Aidan Chong

Wan Nur Afiqah Binti Wan Mohd Fauzi

Kau Qi Xuan

Yoon Kang Ying

QS DIVISION

Sep 2023 to Aug 2024

Fellow

Sr Chen Seong Wai
JRK Group

Sr Goh Pei See
Wing Tai Malaysia property Management Sdn Bhd

Sr Ong Siew Chin
Unitech QS Consultancy Sdn. Bhd.

Sr Mohd Farid Omar
JUBJ Shd. Bhd.

Sr Azury Binti Kamaruddin
Project Lintasan Kota Holding Sdn Bhd

Sr Azwan Mohd Hashim
Jabatan Kerja Raya Malaysia

Sr Mohd Shamir B. Zaini
Jabatan Kerja Raya Selangor

Sr Mohd Syazwan Bin Samsudin
Kwasa Land Sdn.Bhd.

Sr Muhamad Hafizuddin B. Idris
ARH Juruukur Berhad Sdn Bhd

Sr Sarajul Fikri Mohamed
Universiti Teknologi Malaysia

Sr Suzieanah Binti Harun
Jabatan Kerja Raya

Member

Sr Ee Poh Ling
Jabatan Bekalan Air Luar Bandar Sarawak

Sr Kasibah Binti Abdul Manan
Perunding Jati

Sr Liew Chee Leong
Unitech QS Consultancy (KL) Sdn Bhd

Sr Ng Kia Hng
Vescope Sdn Bhd

Sr Noor Hashura Binti Mohd Hashim
Unit Kerjasama Awam Swasta (UKAS)

Pusat Pentadbiran Kerajaan Persekutuan

Sr Syamimi Liyana Binti Amat Rais
Universiti Teknologi Mara

Sr Tan Koe Yi
QST Consult

Sr Wong Kim Loon
Unitech QS Consultancy (KL) Sdn Bhd

Sr Alpian Bin Maik
MOQS Consultants Sdn Bhd

Sr Amirah Bt Hasan
Zul-QS Consult

Sr Azman Bin Mohd Ihsan
Pengurusan Aset Air Berhad

Sr Cheok Rui Peng
AQS Services Sdn Bhd

Sr Gan Siew Yen
TQS Konsult

Sr Ho Shue Wen
JUBC Sdn Bhd

Sr Ku Mohammad Asyraf Bin Ku Azir
Universiti Teknologi Mara

Sr Lu Chun Yaw
Swinburne University of technology Sarawak Campus

Sr Muhammad Fadhli Bin Othman
JKR Kampar

Sr Ng Kuan Hin
Kejora Positif

Sr Nor Asiah Abdullah
JKR Malaysia

Sr Nur Hidayati Binti Dahalan
Majlis Perbandaran Sepang

Sr Priscilla Anak Donald
Kontrak Infobena Sdn Bhd

Sr Teng Ching Yee
QST Consult

Sr Anis Mardhiah Binti Mukhtar
Malaysia Airports Holdings Berhad

Sr Guaz Zhi Wee
Perunding Nfl Sdn Bhd

Sr Izyanny Mohd Rashid
KPK Quantity Surveyors (Semenanjung) Sdn Bhd

Sr Sharil Anuar Bin Ahmad
(HK) Ibu Pejabat JKR Pulau Pinang

Sr Farahajlaa Binti Julaihi
Universiti Teknologi Mara

Sr Fateha Halimin
JUBM Sdn Bhd

Sr Mohd Nor Rezza Bin Junaidi
JKR Sarawak

Sr Nazrul Azwa Bin Mohd Azizan
Kay Pride Sdn Bhd

Sr Ng Yee Enn
Unitech QS Consultancy (KL) Sdn Bhd

Sr Nor Azwa Binti Yusof
JUBM Sdn Bhd

Sr Shakirah Bt Azmi
Ranhill Technologies Sdn Bhd

Sr Ding Chu Sheng
University of Technology Sarawak

Sr Koh Mei Yi
Cos Quantity Surveyors Sdn Bhd

Sr Chieng Yew Hoe
Perunding Ukur Bahan Asmy Sdn Bhd

T Sr eng Ee Wee
Transgreen Construction Sdn Bhd

Sr Viviana Hii Jia Ling
KMA Associates

Sr Mohd Faiz B. Arshad
Asri QS Consult

Sr Mohammad Asri Bin Monir
Sarawak Energy

Sr Muhamad Afiq Al- Amin Bin Mohd Kabri
KR Perak

Sr Wan Ahmad Firdus bin Hashim @ Wan Husain
Qatar Deserves the Best

Sr Azhar Ahamad
RK Partnership Sdn Bhd

Sr Siti Aisyah Binti Mohd Razali
WCT Construction Sdn Bhd

Sr Tan Chen Wei
WCT Berhad

Sr Shuhaini Binti Mohamed
JKR Daerah Kuantan

Sr Ahmad Syazwan Ahmad Suhaimi
AS2 Consult Sdn Bhd

Sr Afidah Akmal Binti Johari
Malaysia Airports Holding Berhad

Sr Alexander Ross Tukis
Brilliant LTP Builder Sdn Bhd

Sr Chan Lee Seng
BrillianT LTP Builder Sdn Bhd

Sr Lai Chen Foong
Turner & Townsend Sdn Bhd

Sr Lee Sui Sheng
JUB Padu

Sr Muhamad Hazwan Naqiuddin Bin Hisham
Kristal Padu Konsult Sdn. Bhd.

Sr Muhammad Helmi Bin Yusri Yeo
JQS International Sdn Bhd

Sr Natalie Wong Yoong Vern
CSL QS Consult

Sr Pan Ming Chuan
JKQS Consultancy Sdn Bhd

Sr Yuarlifh Bin Yusof
Majlis Bandaraya Seremban

Sr Abdul Muhaimin Bin Kamarudin
KAS Juruukur Bahan Sdn Bhd

Sr Afrizah Marlis
Secretariat Advisors Malaysia Sdn Bhd

Sr Chew Hui Ting
JUBM Sdn Bhd

Sr Fairiz Miza Bin Yop Zain
UiTM Cawangan Perak

Sr Lew Kai Shen
Sang Qs Consult

Sr Lim Zi Hui
Syarikat Pembenaan Yeoh Tiong Lay Sdn Bhd

Sr Mohamad Tajudin Saidin
UITM Cawangan Perak

Sr Mohd Azrai Bin Azman
Kolej Pengajian Alam Bina

Sr Mohd Ermin Bin Yudi
Perunding NFL Sdn Bhd

Sr Mohd Esham B. Mamat
Universiti Teknologi Mara Cawangan Perak

Sr Muhammad Afiff Bin Mahzan @ Zulkifli
Perunding NFL Sdn Bhd

Sr Nur Syanim Binti Haji Salleh
Huden JB Bergabung

Sr Ong Yee Fei
Perunding Ukur Bahan CGH

Sr Ooi Yin Ji
Gamuda Engineering Sdn Bhd

Sr Sara Ruhaya Binti Abu Bakar
Veritas Contracts Sdn Bhd

Sr See Hongrui
GKG Konsultant Kos

Sr Siti Nurbaya Ismail
Dal HCM Sdn Bhd

Sr Siti Salwa Ashikin Binti Zulkifli
ARH Jurukur Bahan Sdn Bhd

Sr Wong Shi Yee
Universiti Teknologi Sarawak

Sr Zairra Binti Mat Jusoh
UCSI Group

Graduate

Chang Wen Yi
Setia Ecohill 2 Sdn Bhd

Chen Chun Thong
Vincent Tan Associates Sdn Bhd

Chong Vun Nee
Perunding Kos T&K Sdn Bhd

Eilen Chan Sue Jing
Total QS Services

Eleanor Tan Szeying
KQS Consul Sdn Bhd

Fong Kah Yan
Crest Builder Sdn Bhd

Huang Poh Ling
Acre Works Sdn Bhd

Intan Farena Binti Zainoren
Dja Ukur Bahan Sdn Bhd

Izzati Masturah Binti Shikh Anuar
Setia Utama LRT3 Sdn Bhd

Khairunnisa Binti Othman
JKR Bahagian Kapit

Lai Pei Yin
Persatuan Soka Gakkai Malaysia

Magdalen Petrus
University of Technology Sarawak

Mohamad Shaiful Hisham Bin Zulhizam
University of Reading Malaysia

Mohd Ikram Bin Yusuf
DJA Ukur Bahan Sdn Bhd

Mohd Razif Fariq Bin Mohd Radzi
AL Muzill Engineering & Trading

Muhamad Fikri Bin Abdul Jalal
Kl Bund Sdn Bhd (A Subsidiary of Ekovest Berhad)

Muhammad Yusuf Bin Khalid
Building Cost Information Services Malaysia (Bcism Sdn Bhd)

Nabila Syakira Binti Zainuddin
Majlis Agama Islam Wilayah Persekutuan

Noor Hafizurahman Bin Noor Shahriman
PUBM Quantity Surveyors Sdn Bhd

Nor Aizan Binti Saari
Politeknik Kota Kinabalu

Shahida Sapudin
Irkaz Builders Sdn Bhd

Sii Chuan Ung
Yung Hung Transport Sdn Bhd

Suzkertimazura Binti Md. Zaman
Majlis Perbandaran Kemaman

Wan Muhammad Syaheran Bin Wan Zainal Abidin
Perunding Kos T & K Sdn Bhd

Wong Qin Kai
Northcroft Lim Perunding Sdn Bhd

Aariyon Joseph Anak Lanyun
Jurukur Bahan Spl Sdn Bhd

Ahmad Fauzzi Bin Sobri
Markas Angkatan Tentera Malaysia

Chee Cheng Yee
Northcroft Lim Perunding Sdn Bhd

Chok Fui Yin
J.U.B.M. Asia Sdn. Bhd.

Hazuan Bin Hasnan
Pengurusan Lebuhraya Pan Borneo Sarawak

Lau Kar Mun
AQS Services Sdn. Bhd.

Law Bih Wen
Axteria Construction Sdn Bhd

Lee Han Yeen
QST Consult

Lee Tyzz Huan
AQS Services Sdn. Bhd.

Low Aii Yii
Kuantibina Sdn. Bhd.

Md Nurikhbar Bin Jalilah
Pakatan Ukur Bahan Sdn Bhd

Mohammad Nabil Fikri Bin Saaid
Universiti Teknologi Mara

Nina Rabaia Anak Edward
Jabatan Kerja Raya Sarawak

Norshahlelawati Shahrudin
Mtog Engineering Sdn Bhd

Nur Amirah Binti Amir
MMC Gamuda Kvmrt (PDP SSP) Sdn Bhd

Sammuel Ling Kwong Hieng
Jubsar Sdn Bhd

Sargunan A/L Arumugam
Rexcell Bina Sdn Bhd

Tan Chee Keong
Nakano Construction Sdn Bhd

Tan Guo Sheng
Unitech Qs Consultancy (Kl) Sdn Bhd

Tan Jia He
Townsend Sdn Bhd

Tey Zhi Li
Rider Levett Bucknall

Zafira Nadia Binti Maaz
Universiti Teknologi Malaysia

Abdul Raziq Bin Ahmad Safri
Juruukur Bahan MFZ Sdn. Bhd.

Chan Yuin Ching
DK QS Sdn Bhd

Fahim Syahir Bin Abu Bakar
Azm Perunding Ukur Bahan

Faye Dora Moujing
SP Perunding

Koay Ching Ching
Unitech QS Consultancy Sdn Bhd

Maisarah Binti Makmor
Segi University

Mohamed Fazril Bin Roslan
MOQS Consultants Sdn Bhd

Mohd Akmal Afif Bin Yusri
ZA QS Consult

Muhamad Nur Amier Bin Mohammed Safian
Baharuddin Ali & Low Sdn Bhd

Naima Binti Bohri
Perunding Ukur Bahan Lah

Nazirah Binti Nazeri
HAH Associates

Nur Hafizah Binti Hatta
KPK Quantity Surveyors (Semenanjung) Sdn. Bhd.

Nur Shuhada Binti Nasaruddin
Hash Juruukur Bahan

Ooi Ying Yee
YTL Construction Sdn Bhd

Tan Chun Ming
Haily Construction Sdn Bhd

Yap Yong Xin
JKQS Consultancy Sdn Bhd

Yeong Re Seng
JKQS Consultancy Sdn Bhd

Yip Juen Yaw
YCL Consult

Ahmad Aqil Bin Zaidi
Petronas Nasional Berhad

Ahmad Hasadusi bin Abu Bakar
UEM Edgenta

Gan Wen Xin
JKQS Consultancy Sdn Bhd

Kayden Liaw Juin Wuen
Lintas Square

Lam Yin Wai
Metrio Construction Sdn Bhd

Muhammad Syafiq Adha Bin Johari
ER Consult

Rasmen Abd Halun
HHA Associates Sdn Bhd

Razis Bin Yunus Agensi
Penguatkuasaan Maritim Malaysia

Rozali Bin Abdullah
Wawasan Metro Bina Sdn Bhd

Suhaili Binti Suparlan
KAS Juruukur Bahan Sdn Bhd

Tsai Yane Yie
Worldklang Group Development Sdn Bhd

Chai Hui Lin
Unitech QS Consultancy (KL) Sdn Bhd

Yong Yik Zhi
Sunway Berhad

Yap Yi Jern
Turner & Townsend Sdn. Bhd.

Francis Lee Yung Kan
Jabatan Bekalan Air Luar Bandar

Kamarul Aiman Bin M Raymi
Arissa Engineering Sdn Bhd

Chua Jin Wei
Econcos Consultants Sdn Bhd

Siti Nor Fathiyahalwani Binti Yahya
Belkron Trading Sdn Bhd

Woon Zhin Wei
Perunding PCT Sdn. Bhd.

Evie Sendi Ibil
Universiti Teknologi Mara Cawangan Sarawak

Nurul Ainun Jariah Binti Aznan
Platinum Victory Development Sdn Bhd

Chai Tze Qing
Gamuda Land Sdn Bhd

Seh Xin Yu
WT Partnership (M) Sdn Bhd

Ruvithira Renganathan
Indesign Engineerings Sdn Bhd

Mohd Razali Bin Ismail
Pelabuhan Tanjung Pelepas Sdn Bhd

Mashanim Binti Mahazir
Segi University

Anita Binyasing
Dataran PHB Peremba Square

Sze Fan Ching
Maxmas Holding Sdn Bhd

Eric Mclaren Anak Kabric
Baharuddin Ali & Low Sdn Bhd

Fatihah Rasli
UEM Bhd

Iylia Shazmin Binti Naimat
QS Associates

Faris Bin Hyder Ali
Turner & Townsend

Marni Ainin Syahirah Binti Muksain
CR Sea (M) Sdn Bhd

Mohd Ismail Bin Ibrahim
THB Maintenance Sdn Bhd

Jarius Onduk
Jabatan Air Negeri Sabah

Nurul Farhana Binti Azhar
UEM Edgenta

Luqman Hakim Bin Mohd Nor
Quanticos Sdn Bhd

Rosmanieyra Binti Hamzah
Lembaga Kemajuan Kelantan Selatan (Kesedar)

Mohd Khairul Fakhruzzaman B. Alias
Tenaga Nasional Berhad

Jingchien Cheap
Kuantibina Sdn Bhd

Tan Wei Hong
Qsun Quantity Surveyors Sdn Bhd

Afrizah Marlis
Secretariat Advisors Malaysia Sdn Bhd

Ahmad Farid Bin Aziz
Gamuda Engineering Sdn Bhd

Ahmad Ridzuan Bin Basiran
Jabatan Kerja Raya Selangor

Calvin Wong Ping Ket
Perunding Kos Kinabalu

Hanim Sufinaz Binti Md. Sidek
Pembinaan Tetap Teguh Sdn Bhd

Hasnida Binti Arifin
Econcos Consultants Sdn. Bhd.

Hong Cing Cing
PMT Enterprise

Izz Farhan Mohamad Nadzri
Plus Three Solution Sdn Bhd

Japhia Ngui Yong Yun
COS Quantity Surveyors Sdn. Bhd.

John Pan Jun Yiu
Binaan Kos Konsult (BKK)

Kong Lin Ting
QS 98 Consultants Sdn. Bhd.

Lee Poh Yuet
PUBM Quantity Surveyors Sdn Bhd

Massyita Bassirun
FLA Juruukur Bahan Sdn Bhd

Mohd Izat Zulhelmiyansyah Bin Ali
Kinabalu Setia Konsult Sdn Bhd

Mohd Shahrizan Bin Abd Rahman
Petroliam Nasional Berhad (PETRONAS)

Nor Isah Binti Barmawi
Dewan Bandaraya Kuching Utara

Norhafizah Binti Md Nor
EFCT Konsult

Nur Azuin Binti Asari
AMQS Consult

Nur Raidah Binti Razali
Jabatan Pengairan Dan Saliran Malaysia

Nurin Nabilah Binti Izhar Afendy
Advantage QS Sdn Bhd

Ruhi Adila Binti Yatim Ishak
MMC Engineering Sdn. Bhd.

Siti Nurbaya Ismail
DAL HCM Sdn Bhd

Tan Shi Yan
Perunding PCT Sdn. Bhd.

Tan Woon Ting
GKG Konsultant Kos

Thien Ang Ang
Excell QS Associates Sdn. Bhd.

Tu Xin Jie
QS 98 Consultants Sdn. Bhd.

Vijian Sangar A/L Sangar
Tropicana Alma

Afif Azhan Bin Abdul Moeis
Universiti Teknologi MARA

Allan Lau Song Leong
ELP Quantity Surveyors (Sarawak) Sdn Bhd

Amira Khairani Binti Keria
Jabatan Kerja Raya Sarawak

Ben Ng Wan Hua
PKT Quantity Surveying Consultant Sdn Bhd

Choo Junxiong
WCT Building Values

Fatin Farhanah Abd Wahid
Hisniaga Bina Sdn Bhd

Hajar Saripah Shariff
Pengurusan Aset Air Berhad

Haryati Binti Ismail
Jabatan Kejuruteraan Awam

Jacob Woon
MKS CQS Sdn Bhd

Keaschvinni A/P Thiyagarajah
GSIB Engineering Sdn Bhd

Kia Jason
TYC QS Consult

Lim Xin Yi
J.U.B.M. Asia Sdn Bhd

Liyana Syahirah Binti Abd. Rahman
Jabatan Kerja Raya Sarawak

Lok Zhen Teng
ELP Quantity Surveyors Sdn Bhd

Low Yan Yong
IJM Construction Sdn Bhd

Muhammad Faiq Bin Mohd Rashidi
Zhao Yang Geotechnic Sdn Bhd

Muhammad Syafiq Bin Saharil
Juru Ukur Bahan Malaysia (JUBM)

Ng Jia Xuen
Northcroft Lim Perunding Sdn Bhd

Nor Aini Binti Mahyidin
Menawar Resources Sdn Bhd

Nur Izzati Afiqah Binti Che Mansor
WKL Design Sdn Bhd

Nur Raihana Binti Jamadi
Synergy Tech Consult Sdn Bhd

Nur Zaharatulatfal Anuar
Jabatan Kerja Raya Malaysia

Philomena Nabella Anak Ahmad
JKR Bahagian Sibu

Wong Ken Fah
Akas Permai Sdn Bhd

Probationer

Tan Peng Soon
Jabatan Kerja Raya Sarawak

Najib Fahmi Bin Ayob
MZH Consult Sdn Bhd

Tan Min Sheng
GT-Max Construction Sdn Bhd

Yee Ling Chan
Samalaju Engineering Sdn Bhd

Muhammad Aminurddin Bin Kamisan
Edgenta Infrastructure Services Sdn Bhd

Rosazmah Binti Azman
Perunding Ukur Bahan RB Sdn. Bhd.

Mohamad Solehin Bin Abd Rahman
Dwitasik Engineering & Interiors Sdn Bhd

Normazdi Bin Mohd Nor
Opus Consultants

Zahari Bin Abd Raman
Worldwide PMC Sdn Bhd

Nur Syamimi Yusra Binti Alias
Pembinaan Sejati Perkasa Sdn Bhd

Teh Kae Dan
KKB Engineering Berhad

Student

Abegail Julius

Amiruddin Fathurrahman Bin Kamaruddin

Arny Ashiqin

Ayuni Farhana Binti Isa

Batrisyia Qistina Binti Mohd Zakee

Bong Yek Hin

Chai Paul Ine

Dayang Nurhanis Halisya Binti Awang Ekshaan

Elsa Junih Frankie

Ezzah Khaleeda Binti Eddie

Fong Jia Yee

Hazriffuddin Bin Ayup

Jaroesnisha Supang James

Kon Sang Poh

Lucyfer Ferra Tesa Anak Alan

Mahfuz Milzam Bin Misron

Michelle Ryne Thomas

Michelle Steven

Mohamad Izzad Bin Leep

Mohammad Aizat Bin Abdillah

Mohd Fadzil Fikri Bin Basrah

Muhammad Bazli Bin Salahudin

Nelmui Muhari

Nur Asfharina Binti Abdul Hamid

Nur Farzana Binti Atthan

Nur Liyana Natasha Binti Hasli

Nur Syazrina Binti Muhammad Salleh

Nurshyamimy Zafirah Binti Mohammad Safri

Nurul Azyan Izzati Binti Ismail

Nurul Izzati Binti Yakof

Piong Pei Sze

Sarah Binti Lateng

Sharah Sharina Anak Kisun

Sharleney Eliza Binti Iskandar Yusuf

Sherrilyn Anak Anthony

Siti Khairunnisa Binti Abd Rahim

Tan Jing Jie

Teu Chung Seng

Vishmitha A/P Visvanathan

Yii Zhi Yong

Zainun Nadiah Binti Bohri

Abigael Thu Li Ting

Alia Natasha Binti Jaafar

Chai Vui Yang

Cheung Yik Kei

Karen Lee Shi Hui

Lo Yong Khoon

Nur Asfa Najmi Binti Zakaria

Nur Fatnin Zakirah Binti Mohd Zamani

Nuraisha Fina Binti Alfian

Nurul Najwa Aswani Binti Aziz

Paulina Kho Huey Ling

Peggy Hii Ching Yee

Siti Nur Addawiyah Binti Mohd Habib Bullah

Takuya Ivan

Zafirah Binti Mohd Noor

Adelaine Miya Anak Kilee

Aniis Farhanah Binti Zulkhari

Karen Kimberly Nicholas Majimbun

Kiing Yii Xing

Melanie Baling Talek

Nur Hidayah Binti Pauzi

Nurin Syafiqah Binti Shamsul Ariffin

Nursukasih Binti Saimi

Patricia Dinang Anak Patrick

Nur Maisarah Binti Mohd Salehhuddin

Oh Mei Jin

Nuraina Myza Binti Mohd Sofian

Nurul Natasya Binti C Mapur

Hansen Yii Yang Jie

Amy Shakila Binti Adnan

Nur Alia Munirah Binti Muhammad Rizuan

Irdina Najla Binti Hasbi

Shun Chi Kam

Ahmad Faizal Bin Abd Aziz

Amir Imran Bin Ismail

Yap Wei Chien

Nabila Shahira Binti Azrie

Datu Farshad Bin Datu Abdul Rashid

Dayang Nur Emilia

Richard Joel Anak Lanchang

Samuel Sumok Anak Albert Gundie

Sarvain Balagogolan

Cheang Kuang Soon
China Railway Electrification Engineering Group (M) Sdn Bhd

Noraidah Binti Ibrahim
Pengurusan Aset Air Berhad

ACTUS
CONSTRUCTION CLAIMS & DISPUTES

https://actus.expert/

ACTUS specializes in providing bespoke client focused expert services.
The ACTUS team has at its backbone, meticulous construction professionals whom have both practical experience and professional accreditation.
ACTUS provides our services to employers, contractors and specialist sub-contract across SEA and the Middle East

Services :

- Claims
- Dispute Strategy
- Expert Witness
- CIPAA
- Contract Administration
- Expert Determination
- Advocacy
- Mediation
- Training

ACTUS Construction Claims & Disputes

TARUMT
TUNKU ABDUL RAHMAN UNIVERSITY OF MANAGEMENT AND TECHNOLOGY

Postgraduate Admission

Shaping Skylines, Building Careers

ENROLL NOW

Faculty of Built Environment

Doctor of Philosophy in Built Environment (MQA/PA 10786)
Master of Science in Built Environment (MQA/FA 10770)
Master of Architecture (MQA/PA 10785)
Master of Science in Real Estate Development (MQA/PA 14149)
Master of Science in Property and Facilities Management (MQA/FA 14811)
Master of Science in Construction Project Management (MQA/FA 14274)
Master of Science in Construction Contract Management (MQA/PA 14150)

Industry Aligned Curriculum

Full Time/Part Time Study Mode

State of Art Facilities

Supportive Community

2019 SETARA

(6)03-41450123
https://cpsr.tarc.edu.my/

TAR UMT, Jalan Genting Kelang, Setapak, 53300 Kuala Lumpur.

ROYAL INSTITUTION OF SURVEYORS MALAYSIA
Est. 1961

27TH INTERNATIONAL SURVEYORS' CONGRESS

INNOVATE TO ELEVATE: SURVEYORS REINVENTING THE PROFESSION AND INDUSTRY

19 - 20 JUNE 2025 | SIME DARBY CONVENTION CENTRE

REGISTRATION FEES
(EXCLUDING 8% SST)

EARLY BIRD RATE

MEMBER: RM950.00
NON-MEMBER: RM1,050.00
INTERNATIONAL: USD300.00

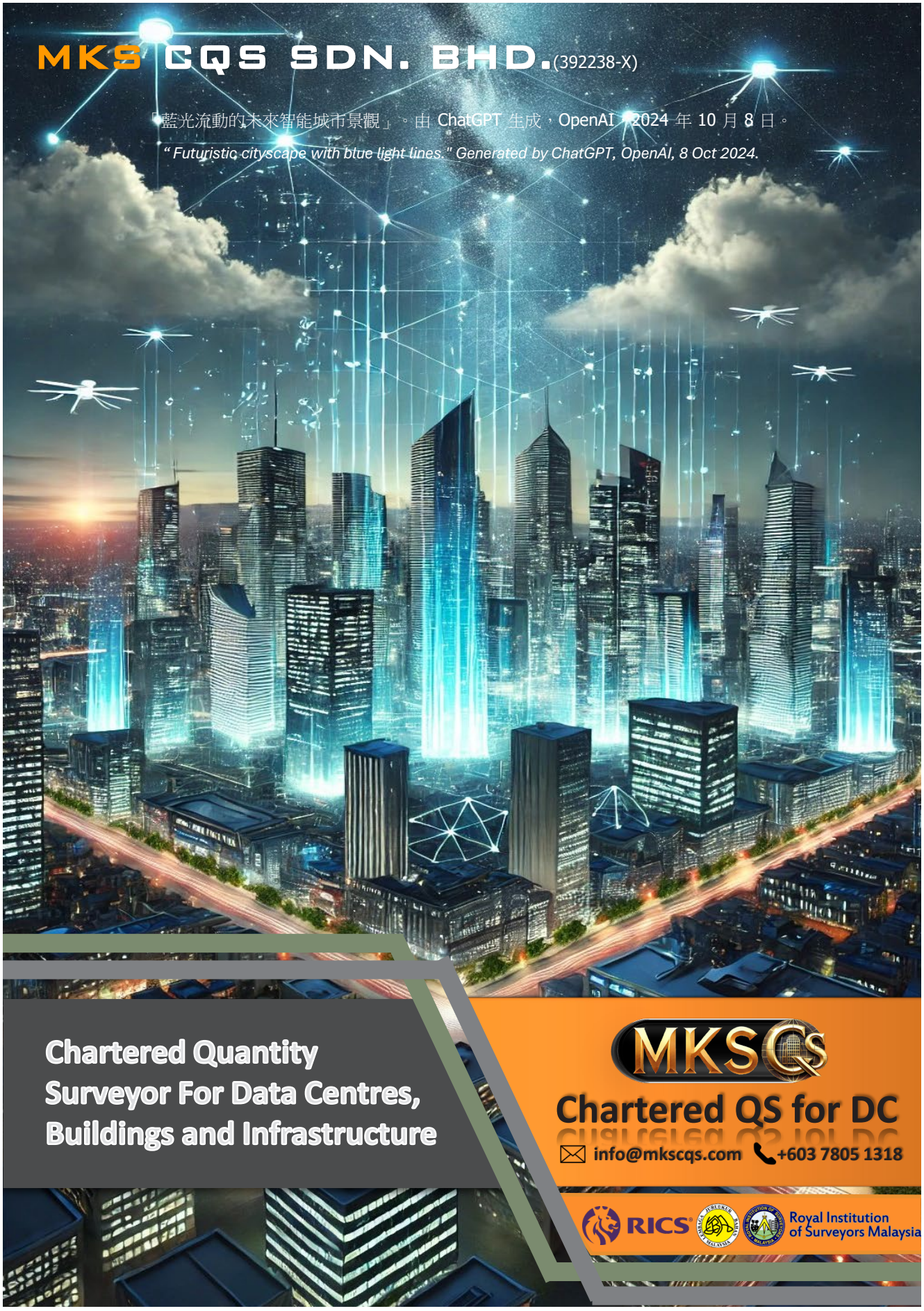
NORMAL RATE
(PAYMENT FROM 1 APRIL 2025)

MEMBER: RM1,200.00
NON-MEMBER: RM1,300.00
INTERNATIONAL: USD400.00

REGISTER HERE

https://shorturl.at/4g8Nk

CPD & CCD HOURS APPLIED FOR
LJT: 4 | BQSM: 8 | BOVEAP: 8 | BS DIVISION: 8 | CIDB: 20
RICS: ACCREDITATION UPON PRESENTATION OF CERTIFICATE OF ATTENDANCE


MKS CQS SDN. BHD.(392238-X)
「藍光流動的未來智能城市景觀」。由 ChatGPT 生成，OpenAI，2024 年 10 月 8 日。
" Futuristic cityscape with blue light lines." Generated by ChatGPT, OpenAI, 8 Oct 2024.
Chartered Quantity Surveyor For Data Centres, Buildings and Infrastructure
MKS QS
Chartered QS for DC
info@mkscqs.com
+603 7805 1318
RICS
Royal Institution of Surveyors Malaysia

EST. 1961

Royal Institution of Surveyors Malaysia

3rd Floor, Bangunan Juruukur
No. 64&66, Jalan 52/4
46200 Petaling Jaya
Selangor Darul Ehsan

Tel: +603 7955 1773 Fax: +603 7955 0253
email: *editor@rism.org.my*
www.rism.org.my