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Behind Project ADaPT: Lessons to be Replicated

By A.R. Othman, Department of Mechanical Engineering, Universiti Teknologi PETRONAS, Seri Iskandar, Perak

From years of exposure in research and technology development carried out in universities, under the capacities of researcher and administrator, I have observed how research inventions fail to grow into successful commercial applications. Many good fundamental research projects have successfully been completed, but sadly, they usually do not survive the 'valley of death' of the commercialisation process. With so much invested by governments and universities alike, hardly any research outcome has generated the commercial impact hoped for.

I have spent years reflecting and analysing the mechanics of successful and less successful research projects at universities, of which, for 15 years, I was leading some projects of my own. I have discovered that, regardless of the nature, scope and discipline of the project, there are several key factors that determine its commercialisation success. Indeed, it is a major challenge to align research outcomes at universities to fulfil industrial needs. Some authors state that there is a conceptual approach to mitigating the valley of death through design. It is about "..... finding a balance between (technical) feasibility, (user) desirability, and (business) viability".

Let us connect this concept with an actual successful case so as to learn from the experience.

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/chief editor's note

Greetings!

In this edition of TECHIES, we are happy to bring to the fore three interesting write-ups that represent the diversity in the world of technology. We first take a look at a successfully executed local project – in the hope that the (positive) lessons learned can be put to good use in future initiatives. We next look at what can be done to improve forest management. Last (but not least!) we indulge a little on smart toilets and the potential they bring to give better comfort to users.

Advanced Diagnostic and Prognostic Technology (ADaPT) is a continuous monitoring and failure prediction system dedicated for use in oil and gas plants. The success of ADaPT was mainly due to the innovative changes carried out in the working culture of the team behind ADaPT, as well as the approach strategies used. The balance between technical feasibility, user desirability, and business viability was well maintained. As a result, the 'Valley of Death' between research and commercial application was successfully avoided. From ADaPT, five lessons can be replicated to increase the chances for success in other technology development projects.

Forests are the Earth's lungs. Sustainable utilisation and management of forest resources are partially enabled by the resistograph, a mechanical resistance measurement device. The resistograph is used in the inspection of the health of a tree or its readiness for cutting. However, the high cost to acquire the device limits its usage. At the moment, it is a challenge for local experts to develop a resistograph at a lower price.

The smart toilet concept has the potential to improve cleanliness and the comfort of toilet users. Smart toilets are equipped with sensors that continuously monitor the number of users and their movement in the toilet premises. The data is then streamed to an automated monitoring system, whereby, an intelligent prediction system will appropriately construct an efficient cleaning schedule.

Happy reading!

Datin Ts. Dr. Zuraidah Mohd. Zain

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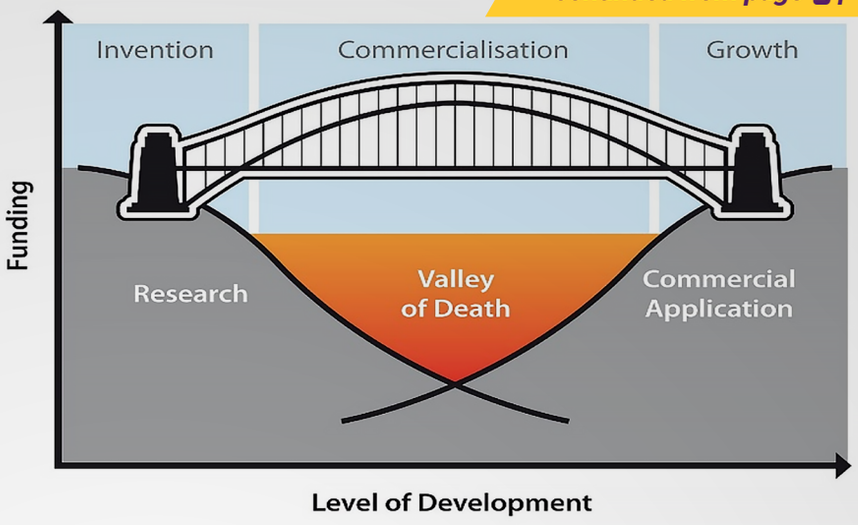
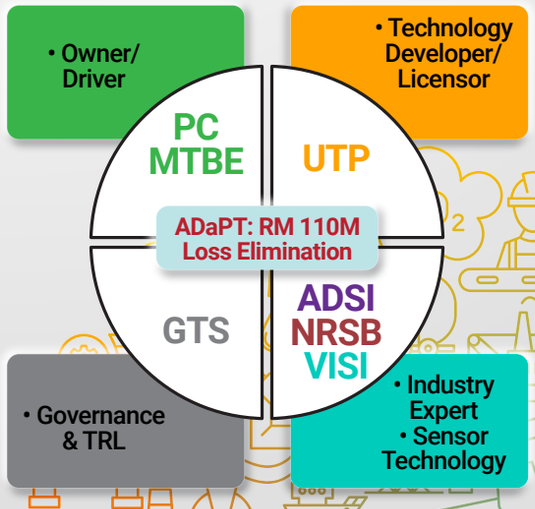


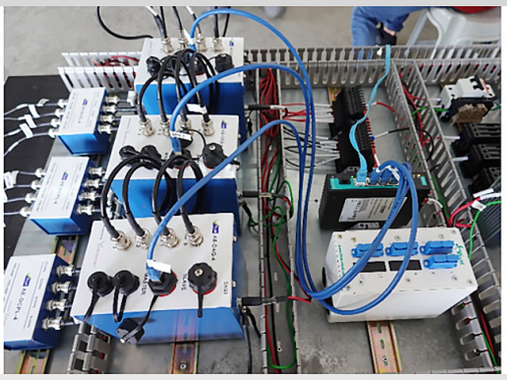
Project ADaPT

From the projects that I have been directly involved in, a few stand out. One of them is ADaPT (Advanced Diagnostic and Prognostic Technology) - a project that started in 2018/2019 involving PETRONAS GTS, PC MTBE and UTP. The goal was to develop a continuous monitoring and failure prediction system to be deployed in oil and gas processing plants. The technology developed under project ADaPT has reached Technology Readiness Level (TRL) 7 – the highest TRL in PETRONAS.

ADaPT offers real time monitoring and prediction of mechanical damage, combining AE sensors with bespoke data acquisition systems and integrated data filtering algorithms. It performs analytics for the interpretation of induced waveform signals from field environments. The correlation between AE signal characteristics and crack initiation and growth, coupled with Polynomial Chaos Expansion (PCE) probabilistic algorithm, provide a digital twin methodology for damage prediction at site. The probability of equipment failure based on machine learning of thermal stress and creep damage patterns enables the detection of early signs of mechanical damage, hence predicting an asset's remaining life expectancy, which in turn will avoid unplanned plant shutdowns. The rest of this article looks at ADaPT's execution, viewed through the lens of project framework to better understand, and if possible, to learn from its successful journey.

Collaboration framework with partners




Instrumentation for AE sensors, cabling, DAQ controller and data storage

Lesson 1: Collaborative framework - team relationship and trust

ADaPT used a technical collaboration framework with partners comprising UTP (technology developer), the plant owner and user, GTS (governance authority), and several industry experts in different disciplines.

The facilities and resources of the project were willingly shared between each partner. Expertise and specific roles were consolidated under the brand name of ADaPT. The most talented individuals from their respective participating organisations were selected - engineers, researchers, project managers, and programmers. The focal points of all team members were appropriately aligned so that, as a result, there was only one common target to work for.

Lesson 2: Alignment with business demands and research competencies

In the O&G industry, critical equipment operates at high temperature and pressure, resulting in the formation of cracks. Hence, continuous monitoring of equipment performance is very much needed to eliminate unnecessary plant shutdowns. As such, research in AE sensors, signal processing and statistical analysis of crack initiation and propagation, including wave propagation study, creep material testing and fatigue tests, were executed. Subsequently, AE signal processing, statistical algorithm, instrumentation, and FE-FFS computational routines for system deployment and site installation were aptly integrated.

Lesson 3: Challenging the status-quo

ADaPT is unique in that it defies the typical project management work process. To start with, a substantial amount of money was allocated to fund the project. To add, team members (who had been freed from their regular job responsibilities) from all partner organisations worked harmoniously with one another, minimising bureaucracy and administrative paperwork. There was mutual support from academic and technical counterparts around the globe, including from UK, Australia, USA, and of course Malaysia. This had essentially redefined conventional mechanisms and work processes, which ensured the project to be completed within a short period of time.

Lesson 4: Readiness vs. opportunities

The resultant ADaPT technology was officially launched in February 2020, which was less than 20 months from start to completion, including a successful pilot deployment. To-date, the technology has successfully provided value to a number of operation plants, with more than RM250m in cost avoidance of maintenance and operation, opportunity and production gain, as well as safeguarding plant turnaround duration.
It is estimated that more than USD 200m can be generated through the replication of the technology at 30 O&G facilities around the world. The success of ADaPT prolongs the life expectancy of critical assets and avoid unplanned plant shutdowns due to the mechanical damages.
Nonetheless, it must be stated that the technology will not last long. Its typical lifespan is only between 3-5 years, hence, the team must be ready to re-innovate or to look for other improvement opportunities.

Lesson 5: Client penetration and visibility

If the solution provided to clients can solve their problems and help in their work, then, confidence in the value of the technology will increase. If the solution offered can accommodate complexities while maintaining operational simplicity, clients will trust the solution provider and will ask for more in the future. It is important to note that regardless of the troubles that may be experienced along the way, the trust that has been built should never be misjudged or taken for granted in order to ensure the sustainability of work collaboration between all vested parties.

ADaPT has shown that step changes in working cultures and approach strategies can be redefined in order to achieve success at various levels. Through step changes, challenges can be anticipated, and failures eliminated. We hope that our experience in ADaPT will assist in the replication of other technologies at universities and research institutions, and this will eventually help to successfully bridge through the 'valley of death'.

By Ts. Jacqueline Joseph, Fakulti Perladangan dan Agroteknologi - Universiti Teknologi MARA Cawangan Sabah

Teknologi Alat *Resistograph:* Ke arah Pengurusan Hutan Lebih Mampan

Alat *resistograph* digunakan untuk mengukur dan menilai kepadatan kayu pada dirian pokok. Pada mulanya, ia bertujuan memeriksa kecacatan atau kerosakan dalaman pokok. Data yang dihasilkan alat *resistograph* membantu menentukan rawatan silvikultur yang sesuai ke atas dirian pokok terlibat. Sesetengah serangan kulat berpotensi mengakibatkan pokok tumbang atau mati. Ini menyebabkan kerugian dari aspek sumber hutan yang boleh digunakan manusia. Alat *resistograph* juga boleh membantu pemilihan dirian pokok yang sesuai untuk dituai dan diproses menjadi produk kayu. Sebahagian produk kayu adalah kayu gergajian, venir, dan produk panel (papan lapis, papan partikel, papan serpai dan papan gentian). Penebangan pokok secara terpilih menyumbang kepada pengurusan sumber hutan secara lebih mampan. Pokok hanya dituai selepas mencapai tahap kematangan dan kepadatan kayu yang diperlukan.

Penggunaan alat *resistograph* adalah kaedah praktikal yang memudahkan inventori penilaian dan penentuan kepadatan kayu pada dirian pokok, terutamanya pokok-pokok di hutan. Kebanyakan kaedah lain yang digunakan untuk menilai kepadatan kayu agak membebankan kerana melibatkan tenaga buruh yang ramai, mengambil masa yang panjang dan kos yang tinggi. Apatah lagi jika sampel kayu perlu diambil untuk tujuan pemprosesan di makmal yang menggunakan kaedah isi padu bagi mendapatkan nilai kepadatan kayu yang lebih tepat. Kaedah konvensional biasanya melibatkan penebangan dirian pokok *(destructive felling)*. Ini sudah tentu menimbulkan isu kontroversi terhadap pemulihaaran ekologi hutan, walaupun tujuan utama adalah untuk penyelidikan. Oleh itu, tidak hairanlah semakin ramai ahli *arborist* menggunakan alat *resistograph* kerana data kepadatan kayu boleh diperolehi tanpa merosakkan dirian pokok.

Rajah 1: Lubang kecil (diameter = 3 mm) pada pokok selepas digerudi menggunakan alat *resistograph.*

Sebelum memulakan penggerudian, diameter dirian pokok perlu diukur menggunakan pita pengukur diameter. Langkah ini bertujuan menentukan kedalaman penggerudian *(drilling depth)* yang diperlukan.

Alat *resistograph* menggunakan mata gerudi berdiameter 3 mm (Rajah 1). Saiz mata gerudi ini adalah terlalu kecil untuk mengakibatkan kerosakan terhadap pokok. Lapisan kulit kayu yang baharu akan terbentuk dalam masa yang singkat untuk menutupi lubang yang disebabkan oleh mata gerudi.

Alat *resistograph* mengukur rintangan penggerudian *(drilling resistance)* untuk menentukan kekuatan dan kepadatan kayu. Nilai bacaan rintangan penggerudian yang tinggi menunjukkan pokok tersebut memiliki kayu yang padat dan boleh dikategorikan sebagai pokok kayu keras. Nilai bacaan yang tinggi juga boleh terhasil jika berlaku ralat dalam pengukuran yang

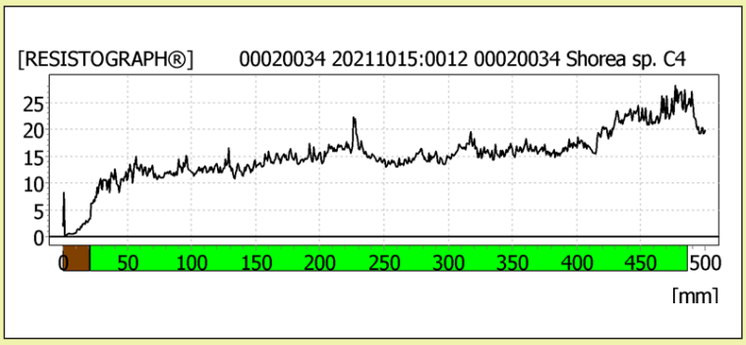
disebabkan daya geseran yang melampau di antara mata gerudi dan struktur pokok. Ralat ini lebih mudah terhasil jika pengukuran melibatkan pokok yang berdiameter besar. Sebaliknya, nilai bacaan yang rendah menunjukkan dirian pokok tersebut mempunyai kepadatan kayu yang agak rendah dan dikategorikan sebagai pokok kayu lembut.

Satu unit bateri alat resistograph yang dicas penuh boleh membekalkan tenaga elektrik untuk menggerudi sebanyak 100-200 lubang pada pokok. Jumlah lubang bergantung kepada kepadatan kayu pada dirian pokok.

Mata gerudi perlu diganti setiap kali selesai operasi penggerudian lubang yang ke-100. Ini penting untuk mengelakkan mata gerudi menjadi tumpul. Kualiti dan resolusi bacaan alat *resistograph* akan menurun jika mata gerudi telah tumpul. Ketepatan tafsiran data juga akan berkurangan.

Drilling operator bertanggungjawab menggerudi pokok (Rajah 2). Beliau perlu mengekalkan kestabilan posisi

Rajah 2: Penggerudian pada dirian pokok menggunakan alat *resistograph.*



Rajah 3: Contoh data untuk pokok *Shorea spp.* yang dihasilkan alat *resistograph* menunjukkan rintangan dipengaruhi oleh kedalaman penggerudian.

alat *resistograph* untuk mengelakkan pergerakan yang boleh mengakibatkan mata gerudi patah. Ketepatan data juga mungkin dipengaruhi pergerakan yang tidak disengajakan oleh *drilling operator.* Setiap kali selesai operasi menggerudi, mata gerudi perlu diperiksa dan dibersihkan serta merta agar tiada cebisan kayu yang melekat. Ketepatan ukuran kepadatan kayu juga turut dipengaruhi oleh kewujudan resin, bahan-bahan ekstraktif dan lembapan di dalam pokok.

Data operasi penggerudian boleh disimpan di dalam telefon pintar atau di dalam alat *resistograph*. Saiz storan dalaman data di dalam alat adalah terhad, dan dari itu migrasi data ke storan luaran adalah perlu. Perisian khas *resistograph* seperti DECOM Scientific Data biasanya digunakan untuk pemprosesan dan analisis. Rajah 3 menunjukkan rintangan meningkat mengikut kedalaman penggerudian. Ini boleh ditafsirkan seperti berikut: kepadatan dirian pokok adalah lebih tinggi di bahagian teras berbanding bahagian berhampiran kulit. Paksi kedalaman berwarna coklat menunjukkan kepadatan bahagian kulit kayu yang mempunyai ketebalan sekitar 20 mm adalah lebih rendah berbanding bahagian dalam pokok. Paksi kedalaman berwarna hijau pula mewakili bahagian dalam pokok. Data ini memberi petunjuk bahawa tiada pereputan atau kerosakan anatomi wujud di dalam batang pokok ini. Maksudnya, pokok tersebut berada dalam keadaan baik dan stabil.

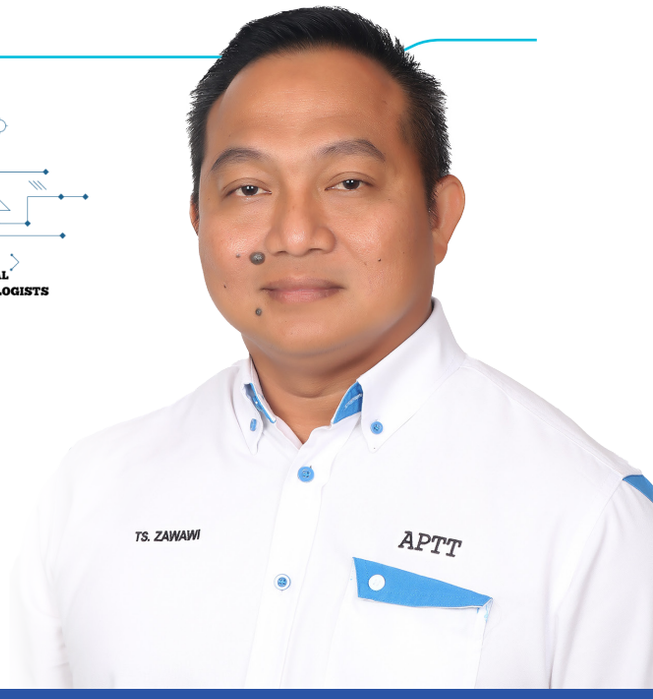
Interpretasi maklumat daripada data penggerudian perlu dilakukan oleh individu yang mempunyai ilmu tentang anatomi pokok atau dendrologi.

Bateri dan mata gerudi alat resistograph memerlukan penjagaan yang teliti. Bateri perlu dicas setiap bulan walaupun tidak digunakan. Stok mata gerudi yang baharu pula mempunyai risiko untuk berkarat walaupun disimpan di dalam bekas yang kedap udara. Bahan pengering seperti gel silika perlu diletakkan di dalam bekas yang mengandungi stok mata gerudi untuk menyerap lembapan dan mengelakkan mata gerudi daripada berkarat.

Kesimpulannya, penggunaan alat *resistograph* perlu diberikan perhatian dan dipertimbangkan untuk diintegrasikan sepenuhnya di dalam operasi pengurusan hutan. Kepakaran dalam menggunakan alat resistograph dan kemahiran mentafsir data untuk menentukan keadaan anatomi pokok juga perlu ditekankan bagi menghasilkan diagnosis yang tepat. Keupayaan teknikal seperti penghasilan alat *resistograph* yang mempunyai mata gerudi yang lebih panjang juga perlu diusahakan. Jika alat resistograph boleh dihasilkan oleh syarikat tempatan, harga alat ini mungkin boleh diturunkan. Harga yang lebih rendah akan menggalakkan pengunaan alat *resistograph*, seterusnya menyumbang kepada pengurusan sumber hutan secara lebih mampan.

An Interview:
Ts. Ahmad Zawawi

Chairman of the Sarawak Association of Professional Technicians and Technologists (APTT)



Interviewer: Thank you for joining us in this interview. Can you briefly introduce yourself?

Ts. Ahmad Zawawi: My name is Ahmad Zawawi bin Kasmin. I am currently the chairperson of the Sarawak Association of Professional Technicians and Technologists (APTT) based in Kuching. The objective of the association is to acknowledge technologists and technicians in Sarawak. We aim to become a one-stop centre for members registered under MBOT within Sarawak (or are Sarawakians) regarding concerns and advice on career advancement as technologists or technicians. We fully support MBOT and are committed to provide our best in related activities in Sarawak. We currently have 160 members who are mostly registered as official members.

Interviewer: Sarawak has been making strides in technology development over the years. How do you view technology development in Sarawak?

Ts. Ahmad Zawawi: As we know, Sarawak is the largest state in Malaysia, hence, significant progress in technology development has been established over the years. This proves that the state government recognises the importance of technology and innovation to drive economic growth. The Sarawak government has been looking into embarking on the digital economy sector. In my opinion, this effort will open up endless opportunities and will ultimately improve the quality of life of the Sarawak people.

The Sarawak government has also been proactively promoting technology development and innovation. Several policies, programmes and incentives have been implemented to attract investors in the technology sector to support research and development activities. Currently, the government shows interest in the education sector through the development of skill centres such as CENTEXS (Centre of Technical Excellence), focusing on skill development using the latest technology for students, specifically those who are not able to pursue higher learning. CENTEXS is a platform for individuals to further their education to be Professional Technicians. Undoubtedly, UNIMAS and i-CATS University College also provide this skill learning. i-CATS is one of the oldest skill centres in Sarawak to endorse technical skill learning. In my opinion, in terms of technology development, Sarawak has improved on its essential infrastructure, which includes high-speed internet connectivity. The Sarawak Multimedia Authority (SMA) has been set up to look into policies and the planning of infrastructure for telecommunication. To add, there is the Sarawak Digital Economy Corporation Berhad that looks into matters relating to the latest technology. These establishments mainly focus on providing Internet connectivity to all parts of the state to make sure that both urban and rural citizens are not denied proper Internet connectivity. We intend to get more than 1000 connectivity towers all over the state.

Interviewer: As we know, APTT is an active association that recognises industry professionals in Sarawak. With that being said, what is your opinion on talent development?

Ts. Ahmad Zawawi: Talent development is a fundamental aspect to achieve progress in any region. APTT contributes significantly in several ways. For example, APTT recognises professionals in the technology and engineering sectors. It also boosts the confidence of professionals by encouraging them to continue to grow in their respective fields. We encourage technologists and technicians to register with MBOT as it is important to be recognised as professionals. Most importantly, being registered with MBOT helps individuals within this field to get the acknowledgement and recognition they deserve. To add, APTT works together with state government agencies to promote methods to upskill and reskill the people of Sarawak – from undergraduates who are not yet employed to working adults who need to improve their careers. Providing funding from the state government is a way to upskill or reskill

since this is a very important part of our talent development.

Interviewer: What do you think are the unique characteristics that make MBOT different from other professional bodies?

Ts. Ahmad Zawawi: MBOT sees the potential of technology and recognises the people within it. MBOT also recognises those having qualifications from other fields. However, it uses the individual's original degree field to differentiate between becoming a Ts. or a Tc. To add, it recognises individuals without a bachelor degree through the diploma or certificate obtained by the individual. Along with that, MBOT acknowledges individuals based on their expertise and experience. This shows that MBOT takes into account all experiences and expertise obtained in the past 3 years to decide if the individual qualifies to be a professional in the field. For example, individuals with a certificate in electrical engineering can be certified professionals in IT. Those with IT specialty can be recognised in green technology based on their experience. This makes MBOT different from the others. MBOT is very committed to improve the development of its members. It provides numerous training programmes through webinars at least once a month, with weekly training sessions too. Webinar sessions are open to the public, of which those attending are not necessarily in the particular field, hence giving opportunity to individuals from other fields to gain knowledge in the many fields available. Most importantly, the training is free and conducted by MBOT directly, which makes every ringgit spent as a member to be well worth it.

Interviewer: Can you share the latest on infrastructure development and the energy industry?

Ts. Ahmad Zawawi: Looking into infrastructure development, Sarawak currently has actively invested in road infrastructure. In the years leading to 2018, the government started the **Pan Borneo Highway** - a significant infrastructure project that became the starting point of many huge development programmes in Sarawak. The original single-carriageway is now doubled in width, with the length of 753 kilometres from Telok Melano to Miri. This is the new backbone of Sarawak. The economy is predicted to perform well – thanks to the Pan Borneo Highway that connects many areas, providing easy and comfortable means of transportation. The highway opens a path of support towards economic activities from which many businesses benefit. We can see numerous development of houses and shop lots even before the full completion of the project.

Besides that, for the past twelve years, I have been involved in **Projek Bekalan Elektrik Luar Bandar**, that supplies electricity to rural areas. To-date, almost all rural areas have electricity supply. However, due to natural factors such as being separated by rivers in the deep jungle, some areas are still without electricity. This is where our service comes in handy. As we are technologists, we need to think of alternatives to overcome the issue. Supplying electricity to no-electricity rural areas can be done through solar hybrid systems or micro hydro. I am personally involved in the project, which supplies electricity free of charge. Although it may not be a full-blown power supply, it provides enough electricity to power up lamps, televisions and radios.

The latest infrastructure change Sarawak is going through is a newly improved public transport system in urban areas through the Sarawak Metro. The government aims to modernise and decarbonise Sarawak's public transportation. The backbone of the project is to introduce hydrogen-powered autonomous rapid transit (ART) vehicles supported by hydrogen power feeder buses. Inshallah, by August 2023, the prototype of ART will be in Kuching for the Proof of Concept (POC).

"Along the same lines, we have our Sarawak Energy hydro project, which is designed to provide surplus energy supply. We export the surplus electricity to Indonesia, especially Kalimantan, since it is our neighbour. We also export to Sabah. There are many other interesting developments happening in Sarawak as we speak."

In terms of talent, we are still at the beginning of the journey. Similar to MRT or LRT, we will surely need experts from out of Sarawak. However, the beauty of this is to be able to provide a means of transportation and have an exchange of knowledge between locals and experts from outside.

Along the same lines, we have our Sarawak Energy hydro project, which is designed to provide surplus energy supply. We export the surplus electricity to Indonesia, especially Kalimantan, since it is our neighbour. We also export to Sabah. There are many other interesting developments happening in Sarawak as we speak.

Interviewer: What are your expectations of MBOT?

Ts. Ahmad Zawawi: I have high expectations of MBOT, especially for those registered as technologists and technicians under MBOT. We hope MBOT can maintain, sustain and advance its professional standards and quality to be recognised globally, and to faithfully abide by its code of ethics. I would like to suggest that, apart from technology-related webinars that are frequently organised by MBOT, why not have a series of webinars on professional ethics and code of conduct once or twice a year so as to consistently remind our members of the importance of ethical conduct. In doing so, responsibility and professionalism can be upheld. We somehow need to get in touch with the fundamentals of being responsible in every aspect. We are governed by our ethics and professionalism, therefore, every part of our work must always be safe to the public. Furthermore, we hope MBOT maintains a robust accreditation process to recognise qualified technologists. MBOT might want to improve the requirements to become a professional from time to time to make sure that the recipients of the title are truly qualified. We also expect MBOT to offer continuous professional development programmes, as it always has. MBOT is expected to advocate these interests while representing concerns relevant to the authorities. This may involve collaboration with government agencies, the industry, and stakeholders in order to shape policies and initiatives that support the growth of the technology and engineering sector in Malaysia.

Interviewer: We have come to the end of the interview. Thank you very much for your thoughtful insights.

By Ts. Amar Lokman, MRANTI Corporation Sdn Bhd

Smart Toilet:
Cleaner and More Comfortable

Smart toilets have the potential to solve toilet cleanliness issues. Cleanliness of a toilet is closely related to the number of users. The development of the smart toilet utilises advanced technology, especially the Internet of Things (IoT). Smart homes, smart cities and healthcare services use IoT to optimise many aspects of life, such as energy consumption. For the smart toilet, energy consumption is not its paramount purpose. Rather, comfort of users is the main concern. A local newspaper once reported that tourists like to visit Malaysia, but they wish our public toilets were cleaner. Thus, retrofitting existing toilets to become smart ones should be explored. In this article, the design of smart toilets, conducted at the Multimedia University's Faculty of Computing, Informatics and Vaccination Centre, is described.

Figure 1 shows the system design of a smart toilet, which mainly consists of data acquisition and analytical modules. Humidity, temperature, and infrared sensors are located at specific locations. Data from the sensors are transmitted to clouds and local databases using MQTT and HTTP network protocols. Members of the maintenance team can access and monitor the condition of the smart toilet from their smart phones or personal computers. Intervention actions can be executed based on the real-time conditions of the toilet.

The position of the sensor is subjected to the type and location of the toilet bowl. Figure 2 shows the coverage of a sensor. Adjustment to the position of the sensor is required to ensure proper detection of the toilet user's movement. In certain cases, the sensor is installed at an angle. Choosing an appropriate position of the sensor is one of the challenges of a good smart toilet design.

The toilet's cleaning schedule can be optimised based on the number of users at specific hours. Different floors in a building may have different frequency distribution of users, as shown in Figure 3. More frequent cleaning should be scheduled during peak hours - the logic being, the more users of the toilet, the dirtier and less comfortable the toilet would be.

An intelligent prediction system can be developed based on the frequency of toilet use. Depending on the prediction approach, the number of toilet users can be forecasted

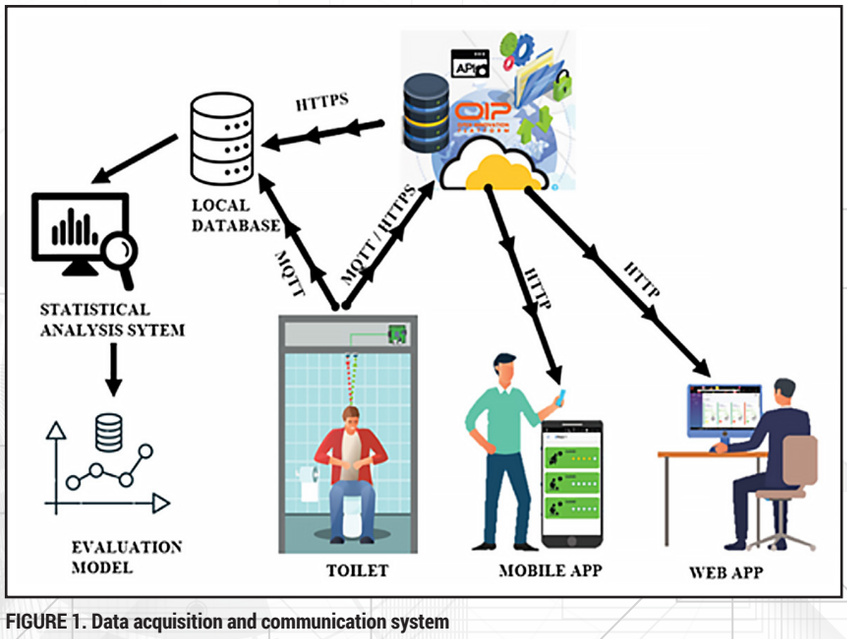


FIGURE 1. Data acquisition and communication system

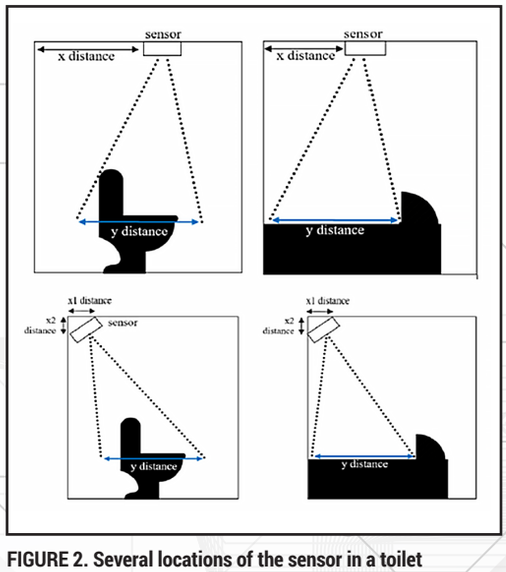


FIGURE 2. Several locations of the sensor in a toilet

The toilet's cleaning schedule can be optimised based on the number of users at specific hours. Different floors in a building may have different frequency distribution of users..'

with reasonable accuracy. Figure 4 shows the comparison between actual data and predicted data of the number of toilet users. From the analysis of this data, a good cleaning schedule and preventive maintenance plan can be constructed. Subsequently, the cleanliness of the toilet can be improved.

In summary, the use of smart toilets has many advantages that must be explored appropriately. The technology to overcome common issues related to public toilets is in existence and hence must be taken advantage of to the fullest.

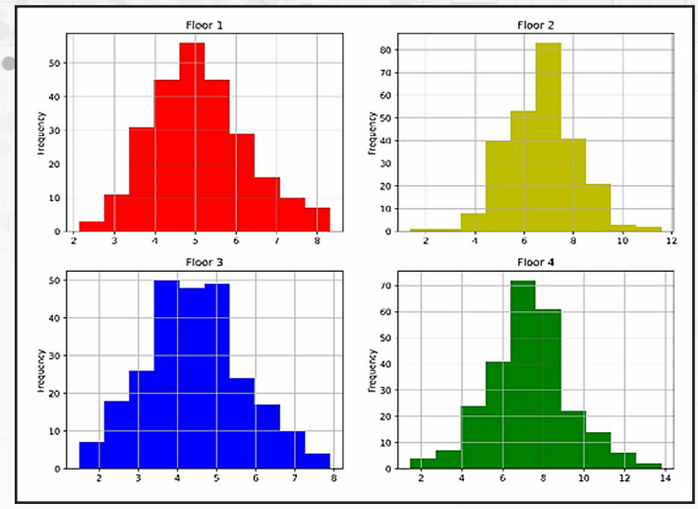


FIGURE 3. Number of users according to time for toilets at different locations.

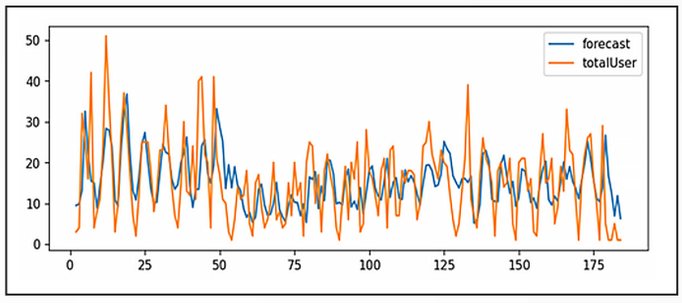


FIGURE 4. Actual and forecasted number of a toilet users.

Types of MBOT CPD ACTIVITIES

ELIGIBLE FOR CPD POINTS

A1 Formal and Informal Education

A2 Congress/ Conference/ Seminar/ Symposium (Local / International)

A3 Fellowships/ Attachment/ Study Tour (including practical and skills courses)

A4 Committee or Project Member

A5 Technology and Technical Related Meetings

A6 Technical Paper Presentation at Official Function/ Seminar/ Meetings (Presenter/ Speakers)

A7 Publication Of Articles in Journal/ Chapters in Book / Technical Reports

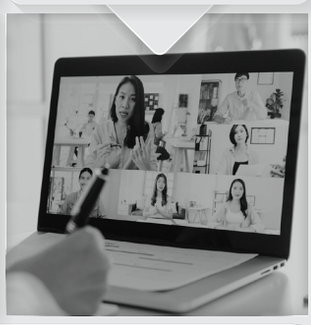
A8 Appointed as MBOT's Assessors
- Professional Assessor Panel
- Accreditation Assessor Panel
- Accreditation visits

B1 Contribution for Technology and Technical Aspects Development

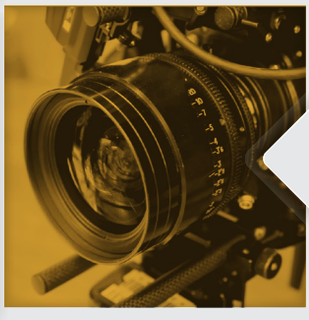
B2 Online Platform Related to Technical and Technology

B3 Mentoring/ Coaching/ Judges/ Consultation Related to Profession

D1 Hands-On/ Special Project & R&D Activities Related in Technical & Technology



D2 CSR Program and Relevant Voluntary Work



D3 Soft-Skills Related to Leadership and Management, Interpersonal Skills and Professional Conduct

/mbot news

Telecommunication & Broadcasting Professional Technologist Conference 2023

The Telecommunication & Broadcasting Professional Technologist Conference took place on 15th July 2023. It was a highly collaborative event involving several prominent organisations in the field of Telecommunications and Broadcasting Technology, MBOT Technology & Technical Working Group (TTWG), Medialab Alliance Sdn Bhd, and UniKL British Malaysia Institute.

YBhg. Datuk Ts. Ir. Dr. Siti Hamisah Tapsir, the President of MBOT, was present at the conference to deliver a welcoming speech and officiate the programme. The conference featured a distinguished keynote speaker, YBrs. Ir. Ts. Azizi A Hadi, who serves as the Chief Information Technology Officer of Telekom Malaysia. With his expertise and experience in the telecommunications industry, he delivered a keynote address that provided valuable insights and perspectives.

The conference theme was 'Empowering the Technologist Profession & Digital Technology', highlighting the focus on empowering professionals in the technology sector and leveraging digital advancements to drive progress and innovation.

Approximately a hundred MBOT professional technologists and telecommunication practitioners from various sectors and organisations attended the event. The conference served as an excellent platform for knowledge-sharing, networking, and collaboration in the rapidly evolving field of telecommunication and broadcasting technology.

/mbot registration

43,279	8,797	20,022	2,480
Graduate Technologists	Qualified Technicians	Professional Technologists	Certified Technicians

74,578 Total MBOT Registrants (As of July 2023)

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