TECHIES

Official Bulletin 16th Edition - KDN: PQ1780/J/187

MBOT LEMBAGA TEKNOLOGIS MALAYSIA MALAYSIA BOARD OF TECHNOLOGISTS

/tech notes

DRIVING THE PROFESSIONS FORWARD

UNDOUBTEDLY, 2022 has been unprecedented and challenging for many as we tried to make sense of the post-pandemic. Reflecting on MBOT's achievements, it has been quite rewarding and enriching. Our heartfelt gratitude to all registered Technologists and Technicians, our partners in industries, higher learning institutions, government agencies and organisations.

MBOT has always been dedicated in carrying out its main function of recognising the professions of Technologist and Technician, especially during post-pandemic when demands for skilled technologists and technicians are at a record high. MBOT has approved 17,396 registrations which brings the total number of registrations to 65,908 in 2022. Meanwhile, the number of programmes accredited by MBOT through the Technology and Technical Accreditation Council (TTAC) in 2022 is 145 programmes which totalled up to 805 academic programmes.

MBOT also continued its initiative to engage with various institutions, industries and organisations in both public and private sectors, to explore strategic cooperation and to disseminate information to all levels. In our quest to uplift the professions of Technologists and Technicians in the country, we will produce strategic papers that will influence policy makers, industries and regulators.

I believe there are huge opportunities to be seized. MBOT will explore wider international initiatives and to continue to contribute in the development and recognition of our local talents. In 2023, MBOT is looking forward to expand effective international partnerships and talent mobility. Thus, the year 2023 is going to be very exciting. We aim to be a full signatory of Seoul Accord which is a multi-lateral multi-recognition agreement for Information and Computing Technology programmes accredited by MBOT.

MBOT hopes to provide conducive and collaborative environment amongst technologists and technicians at various fields and expertise. More programmes and initiatives will be organised to intensify engagements and participation of our valuable members as emerging technologies will become more prevalent in 2023. MBOT will play its part in leveraging on-demand talent particularly in terms of recognition and marketability.

These initiatives will be intensified, especially engagements with Technical and Vocational Education and Training (TVET) institutions through accreditation of technical and skilled programmes in institutions under the Department of Polytechnic Education and Community Colleges, Vocational Colleges and Accredited Centres under the Department Skills Development.

As we welcome year 2023, MBOT would like to introduce new look of Techies whereby it will be published bi-monthly with more solid content and specified theme. We are excited to have your support, commitment and thoughts for the new facelift of Techies.

With this in mind, we promise a lot of interesting perspectives on technologists and technicians. Together we will drive the professions forward!

Thank you.

Prof. Datuk Ts. Ir. Dr.
Siti Hamisah Tapsir, FASc
President of Malaysia Board of Technologists

/what's inside

ISSN 0128-1313

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By Prof. Ts. Ir. Dr. Shahriman Abu Bakar, R. Murali and Ts. Ir. Dr. Z. Razlan,
Centre of Excellence (COE) of Motorsport and Automotive (MOTECH), Universiti Malaysia Perlis (UniMAP)

Sri Perlis Range Extender Electric Vehicle (SP-REEV): Malaysia's Homegrown Affordable Electric Vehicle

The number of motorcycle users with Internal Combustion Engine (ICE) in the world increases over the years. This causes climate change and carbon footprint increment. It was documented that 54 metric tons of CO2 have been emitted in 2020 in Malaysia through the transportation sector. The implementation of electric vehicles (EVs) could eventually reduce the overall carbon footprint in the world. However, issues such as high cost of purchasing, few charging stations, long charging time, and short travelling range still need to be resolved. To partly solve the issues, the Sri Perlis Range Extender Electric Vehicle (SP-REEV) is developed. It is a collaboration between UniMAP, MODENAS and MIMOS under MITI's complex product development and high-value grant. A market survey was conducted and it was found that most people are interested to own sporty and futuristic REEVs. A REEV prototype has been successfully developed, and is capable of running 330km at an estimated price of RM12,000. UniMAP students are involved in the development of the REEV, in line with the quest to stengthen Technical and Vocational Education and Training (TVET). In a nutshell, the SP-REEV is the first Malaysian-built low-cost hybrid motorcycle, and is the only electric retro cafe motorcycle with a range extender feature.

Background and Introduction

The evolution of the internal combustion engine (ICE) motorcycles began in 1885 (Župan, 2017). Since then, the number of motorcycle users in the world has increased alongside technological advancements in ICE. However, this has negatively impacted the environment. It is documented that transportation is the major source of air pollution around the world due to high numbers of vehicles on the road (Arirang News, 2016; NDTV Special Projects, 2018; WION Climate Tracker, 2022). Vehicles introduce toxic materials into the atmosphere and emit several substances as waste products, causing major environmental pollution, which directly leads to climate change and increasing carbon footprint (Table 1).

No	Country	CO_2 Emission (Metric Ton)	Annual Increase (%)
1	MALAYSIA	54	5.66
2	INDONESIA	106	5.74
3	SINGAPORE	6	3.18
4	VIETNAM	36	-
5	THAILAND	68	5.47

Table 1 Annual CO2 Emissions through Transportation in Asia in 2020 (Knoema, 2020).

The implementation of electric vehicles (EVs) could eventually reduce the overall carbon footprint in the world. There are currently more than 31000 registered EVs in Malaysia. However, this covers only 6.2% of the total vehicles registered in 2022 (Veza et al., 2022). The main issue that arises from EVs is the cost of purchasing, which is very high. Figure 1 shows some prices of EVs in the market.

Figure 1 Price Comparison of the Latest Available Electric Motorcycles in the Market.

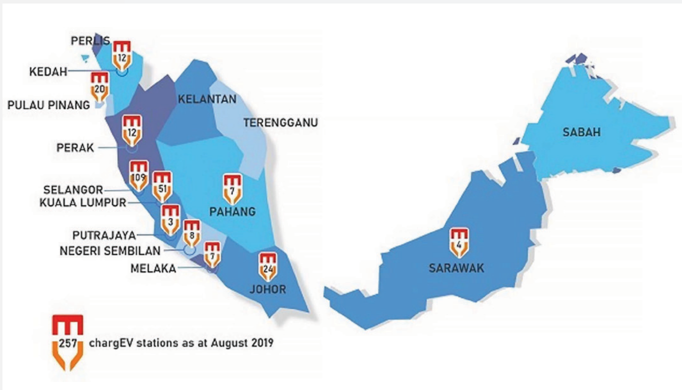

Figure 2 Charging Stations in Malaysia (Chargev, 2020).

Type of Motorcycle	Charging/ Fuelling Time	Travelling Range
EV	20 minutes to 6 hours	100 km
ICE motorcycle	5 minutes	200 km
REEV	No charging required	330 km

Table 2 Comparison of Charging Time and Travelling Range of Different Types of Motorcycles.

Even though the government is moving towards commercialising EVs, few people are buying them, which leads to fewer available charging stations due to lower demand. Figure 2 shows that there are only 257 charging stations in Malaysia in 2020.

As can be seen, the charging time to fully charge the battery of an EV is longer than the standard fueling time of a vehicle with ICE. To add, the maximum travelling range of an EV is very short. For example, an ICE motorcycle can travel up to 200 km while an EV can only travel 100 km, as shown in Table 2. Therefore, an affordable EV that has a longer travelling range is direly needed. In the wake of this situation, the Sri Perlis Range Extender Electric Vehicle (SP-REEV) is invented. It aims to kickstart the use of EVs among Malaysian users, and serves as a step towards having affordable electric motorcycles in the local market.

The Malaysian government established the National Automotive Policy (NAP) in 2020, which incorporates EVs and other energy-efficient vehicles, in line with the aim to reduce carbon footprint and environmental pollution. The SP-REEV directly fulfils NAP2020 objectives, as well as some of the Standard Development Goals (SDG) and Shared Prosperity Vision 2030, as shown in Table 3.

Made possible through the collaboration of Universiti Malaysia Perlis (UniMAP), the National Applied RnD Centre (MIMOS), and MODENAS, and with a grant of RM1.7m awarded by MITI, the SP-REEV project started with a market survey on 950 respondents, shown in Figure 3. It was found that 754 respondents (79%) were interested to buy a motorcycle (Figure 4), and the majority of respondents who wanted to buy an electric motorcycle preferred a sporty and futuristic REEV (Figure 5). The survey also indicated that battery longevity is an important purchasing factor.

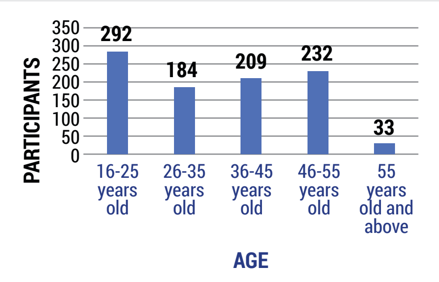

Figure 3 Age Distribution of Respondents.

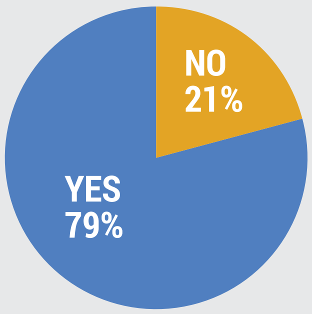

Figure 4 Intention to Buy.

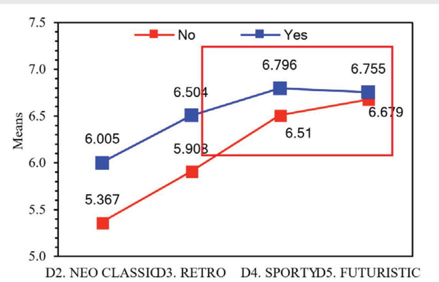

Figure 5 Intention to Buy Distribution (Different Types of REEV).

No	Standard Development Goals (SDG)	Shared Prosperity Vision 2030 – Strategic Thrust 2: Key Economic Growth Activities (KEGA)
1	SDG 4: Quality Education	Kega 3: Fourth Industrial Revolution - (Manufacturing, Supply and Services)
2	SDG 7: Affordable and Clean Energy	Kega 5: ASEAN Hub
3	SDG 8: Decent work and economic growth	Kega 7: Malaysia Commodities 2.0
4	SDG 9: Industry, Innovation and Infrastructure	Kega 8: Transportation, Logistics and Sustainable Mobility (TLSM)
5	SDG 11: Sustainable Cities and Communities	Kega 10: Centres of Excellence
6	SDG 13: Climate Action	Kega 12: Green Economy

Table 3 SDGs and Shared Prosperity Vision 2030 Related to the Invention of the SP-REEV.

SP-REEV Development

Various components of the SP-REEV have thus far been developed and tested.

First, the chassis was simulated to ensure its structural integrity. Vertical bending and torsional analysis showed that the chassis was rigid and of high strength. It was fabricated using steel rods and metal plates that involved material cutting, pipe bending, fitting, joint welding, and machining. All completed parts of the chassis and swing arms such as pipes and brackets were matched on a welding jig and welded together by a welding expert. After the chassis was completely fabricated, loose parts such as the front and rear wheel, suspension system, and handlebar were installed to complete the rolling chassis.

Before installing the components in the REEV, an electrical test bench was built to obtain a replicable and realistic test to accelerate the durability testing of the parts. A battery capacity test was conducted to measure the module storage capacity over energy time, which was at 20 Amp hour via charging and discharging under constant current load.

After that, electrical parts and components were installed on the rolling chassis. Lithium-ion battery provided a 60-volt power to be supplied to the controller. A brushless direct current motor was installed to the chassis with its casing, while a 12-volt 5Ah battery was installed to crank the starter of the generator. This motor controller unit (MCU) was connected to a BLDC that powered the REEV motor. The DC to DC converter functioned as a high-frequency power conversion circuit from 60 volts to 12 volts.

A telemetry controller was then installed to allow for retrieving, storing and sending of vehicle-specific parameters. A stator was used to rotate (crank) the generator to initiate the engine's operation. The stator was installed in the generator section, where it would rotate automatically when the battery power decreased to 30%. A generator with a rated power of 2.3 kW was set to be driven by a stator motor to generate electricity to charge the battery. The charger was located under the seat for ease of maintenance, and had three input wires, namely life (L), neutral (N), and earth (E). A current of 72V and 6A was connected to the battery charging process.

The REEV had 13 body parts produced using a 3D printing machine. The process started by sending a REEV digital 3D file to the 3D printing machine. Stereolithography (SLA) 3D printing (also known as resin 3D printing) is an additive manufacturing process used here. Once the 3D body parts were printed, they were painted. Three layers of paint were applied after sanding and polishing the printed 3D parts. The first layer was a grey undercoat, while the second layer was white or silver, and the last layer was clear paint for durability and more shine. After the painting process was completed, the body parts were installed on the REEV chassis.

Once the REEV functional unit was assembled, a performance test was conducted. The functional prototype bike was mounted on a chassis dynamometer to measure its power. For the maximum speed test, the test bike was driven across a flat and uniformly paved road until it achieved the highest speed. Next, the vehicle was measured on the chassis dynamometer using an ECER40 drive cycle under straight road conditions.

Specification	Description
Overall Dimension	1905mm x 580mm x 1056mm
Maximum weight	180kg
Brake	Front disk brake and rear drum brake
Maximum power of the electric motor	2.2 HP @ 825 rpm
Maximum torque of the electric motor	200 Nm
Maximum Speed	75 km/h
Acceleration (0-50 km/h)	7 seconds
Fuel Efficiency	RM0.06/km

Table 4 SP-REEV Specification.

The REEV has a dimension of 1905mm x 580mm x 1056mm, and a maximum driver and passenger load of 180 kg. It is equipped with a front single brake disk and rear drum brake. It is powered by a direct current brushless hub motor with a maximum of 825 rpm and a rated power of 2.2 horsepower and 200 Nm of torque. The source of current is supplied by a lithium-ion battery with a capacity of 20 Amp hour and a rated voltage of 60 volts. The motorcycle can be equipped with either single or double batteries to extend the travelling range. The REEV has a maximum cruising speed of 75 km/h and can go from 0 to 50 km/h in just 7 seconds. It is also equipped with a 79cc engine with a maximum power output of 2.3 kilowatts and a fuel tank capacity of 3.2 litres that can last up to 100 km. It is worth noting that a standard motorcycle with an internal combustion engine can travel up to 200 km, while the REEV can travel up to 330 km, which is way further and hence, no doubt, is more attractive than the currently available models in the market.

Figure 7 App-based Remote Start and Stop.

Moreover, the SP-REEV is also equipped with an app-based remote start-and-stop, which can start and stop the motorcycle, check real time battery, motor, and genset engine status, as well as fuel level, trip information, and history, as shown in Figure 7. Another advantage of the SP-REEV is that, it costs only RM0.06 per km of travelling.
The SP-REEV has received much attention from various parties, inluding from Malaysia's ninth Prime Minister. To add, project researchers were invited for a live Radio TV Malaysia (RTM) interview to discuss the SP-REEV and how the project aligns with Malaysia's TVET pursuits and aspirations.

Figure 8 Commendations from Malaysia's 9th Prime Minister.

The SP-REEV has thus far received positive feedback from the high officials of the Road Transport Department, and has been widely publicised in the media, including in Malaysia Aktif, Careta, Amanz Network and Funtasticko – all of which have been followed by encouraging feedback from the public.

In addition, various journals and conference papers have been published regarding the SP-REEV. Given the reasonable recommended selling price of RM12,000, a letter of intent has been issued by Fuiji Engineering Japan, who wants to collaborate with UniMAP to commercialise this motorcycle in the ASEAN market.

Concluding Remarks

In conclusion, we have designed, simulated, tested and built the SP-REEV prototype that is capable of running 330km. Its affordable sale price of approximately RM12,000 is poised to solve one of the issues needed to increase the use of EVs in Malaysia. The SP-REEV will hopefully revolutionise and kickstart attentiveness towards EVs among Malaysians. Three intellectual properties (IP) have been filed through this invention. Already, investors from Japan have shown interest to jointly develop and produce EVs in Malaysia and Southeast Asia. Currently, the SP-REEV is the only electric retro cafe motorcycle with a range extender feature. All in all, the SP-REEV holds much potential in the near and far future.

Acknowledgements

The authors would like to acknowledge the support from the Ministry of International Trade and Industry (MITI) in providing a research grant under the high-value-added and complex product development programme. The authors also acknowledge the staff at the Centre of Excellence Automotive and Motorsport and the Faculty of Mechanical Engineering Technology, Universiti Malaysia Perlis, MIMOS Berhad, and Modenas Sdn. Bhd (Malaysia) Research & Development Department for their productive discussions and input to the innovation. Contributions from everyone directly or indirectly to this study are highly appreciated.

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By Ts. Low Hann Sen, Osram Opto Semiconductors (Malaysia) Sdn Bhd

Adaptive Intelligent Forward Lighting - the Future of Automotive Headlamp

Traditional lamps are fast disappearing from static forward lighting and are replaced by LEDs. Traditional lamp headlights in the market rely on heat sinks for thermal management. In contrast, LEDs cool down within the system via free convection from metal core PCBs instead of using dedicated heat sinks. Given the high electrical efficiency of LED light sources and the possibility of using low-cost PCBs, it is possible to develop a cost-optimised forward lighting system.

Figure 1. An example of a complex driving situation at night: traffic, passengers and obstacles must be visible without glaring others.

Automotive forward lighting serves a number of purposes to the vehicle operator as well as other drivers and pedestrians. The lighting provides forward visibility in any condition, and offers adequate peripheral illumination of possible off-road hazards. It is also bright enough to provide driver comfort without distracting oncoming traffic (Figure 1).

In the future, multifunctional intelligent dynamic forward lighting will illuminate the road and communicate with the surrounding environment using dynamic or moving light. Intelligent dynamic forward lighting elevates car safety to another level. It enhances driver visibility while simultaneously reducing glare for other road users. As soon as incoming traffic is detected, the appropriate pixels switch off automatically. Drivers can always drive with high-beam light distribution, while other road users experience this light as low-beam illumination. This is made possible by having an adaptive driving beam (ADB) that uses an integrated camera to identify other vehicles and dynamically screens the eyes of oncoming drivers to prevent glare (Figure 2). The same technique also spots obstacles in the road and illuminates them, further boosting safety.

ADB systems or multi-pixelated single LEDs eliminate dazzling light from oncoming traffic and enable car-to-car communication by projecting warning symbols on the road (Figure 3). Higher resolutions/pixelations, called 'digital light', can also be projected for decorative functions. For example, before the driver enters the vehicle, a personalised welcome message can be displayed in front of the car. These applications, from permanent glare-free high beams to projections of driver track assistance, are possible by using just a single component.

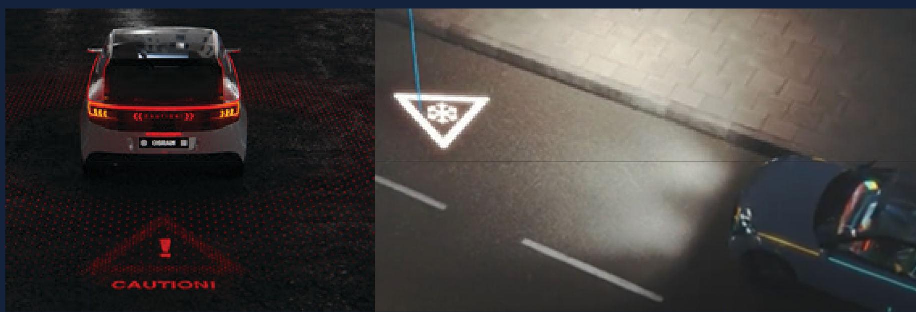


Figure 3. One component can illuminate or fade out defined areas by selective appropriate lighting components. Projections of patterns, symbols or letters are possible so that information can be visualised.

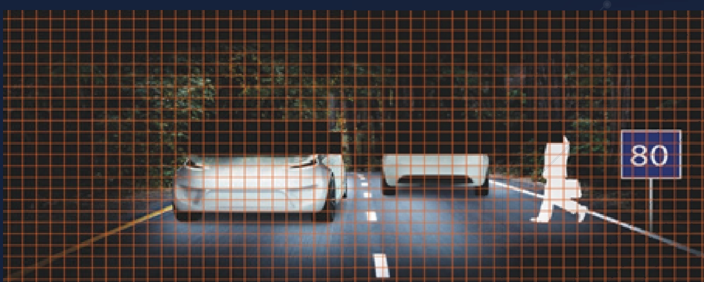
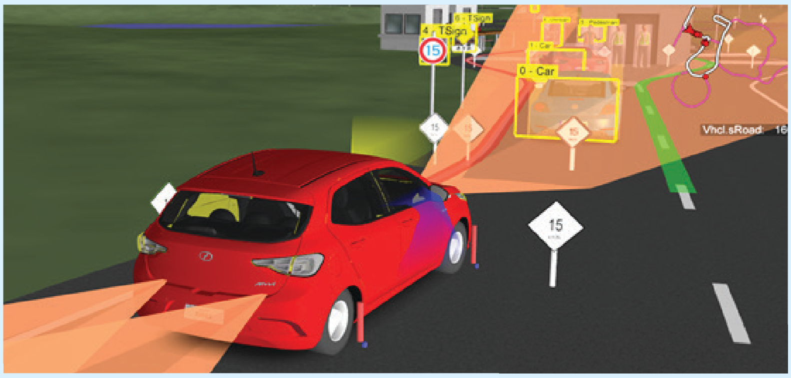


Figure 2. Smart headlights with fine resolution switch on or off depending on traffic situation. The driver does not need to switch between high and low beams. High-pixelated LEDs offer a very smooth light pattern.

Adaptive lighting devices combine two technologies into one: a light emitting chip and individual pixel control electronics are accommodated in the footprint of a RM 0.10 coin. This combination means tens of thousands of individually controllable pixels will bring HD-quality projections onto the road.

The device can fade out areas with unprecedented precision while other areas shine in full light. This technology opens the door to new fields of application beyond classic lighting. Depending on the application, customers can combine several adaptive lighting devices with each other or other conventional LEDs, paving the way to exciting automotive lighting systems in the future.

By Ts. Ir. Dr. Vimal Rau Aparow, Cheok Jun Hong, Lee Kah Onn, Prof. Dr. Hishamuddin Jamaluddin (University of Nottingham Malaysia), Dato' Ts. Ir. Dr. Khairil Anwar and Ts. Zulhaidi Mohd Jawi (Malaysian Institute of Road Safety Research - MIROS)



Virtual Safety Testing for Autonomous Vehicle in Malaysia

Autonomous vehicles (AV) have become a key solution to overcoming adverse traffic conditions. This upcoming technology is capable of decreasing traffic congestions and road accidents. The Malaysian government has established the National Automotive Policy (NAP) 2020 to accelerate the use of AVs in the country. Throughout the years, several initiatives have been deployed, such as the development of the Guideline for Public Road Trials of Autonomous Vehicles. The Guideline is used to conduct physical testing of AVs on designated public roads, for, testing is required to investigate the capability of the vehicle in Malaysian road and traffic environment.

Development of AV Testing in Malaysia

The Malaysian government is very serious about adopting AV technology as a part of the automotive development of the country. The National Automotive Policy 2020 highlights a digital industrial transformation in the automotive industry between 2020 and 2030. This policy encourages the automotive industry to focus more on the development and deployment of autonomous vehicles (AV) in Malaysia.

Along the same lines, the Malaysian Intelligent System (ITS) Blueprint was published in 2019 to emphasise collaboration and integration in the development of ITS in Malaysia, especially in the area of AV. The blueprint states the need for governmental inter-agency collaboration to implement different action plans under different ministries and government agencies to ensure progress in the ITS.

Recently, the Ministry of Transport, with support from Futurise Sdn Bhd and the Malaysian Automotive, Robotics & IoT Institute (MARii) published a document entitled, "Guidelines for Public Road Trials of Autonomous Vehicle" – to be used as a guide to plan and conduct physical trials of AVs on designated Malaysian public roads. The Guideline sets out pertinent information on AV trial routes, application process, safety and technical requirements, and rules governing the conduct of such trials. Several locations have been selected as designated roads for testing purposes – namely Cyberjaya and Putrajaya - under the purview of Majlis Perbandaran Sepang (MPSepang), known as Route A (Cyberjaya), Route A (Putrajaya), Route B (Cyberjaya) and Route B (Putrajaya).

Figures 1-4 show the designated roads for public trials of AVs in Malaysia.

Fig. 1. Route A (Cyberjaya).

Fig. 2. Route B (Cyberjaya).

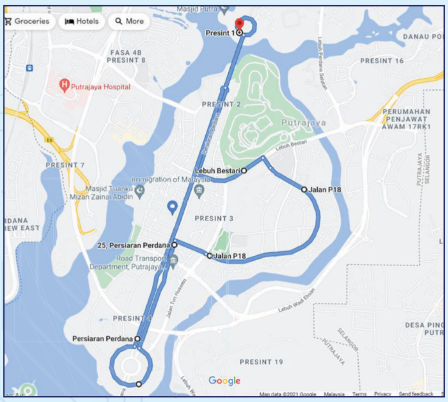


Fig. 3. Route A (Putrajaya).

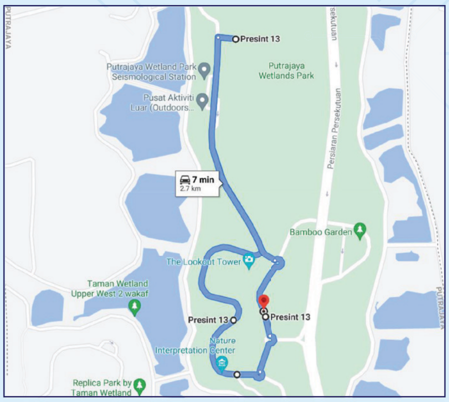


Fig. 4. Route B (Putrajaya).

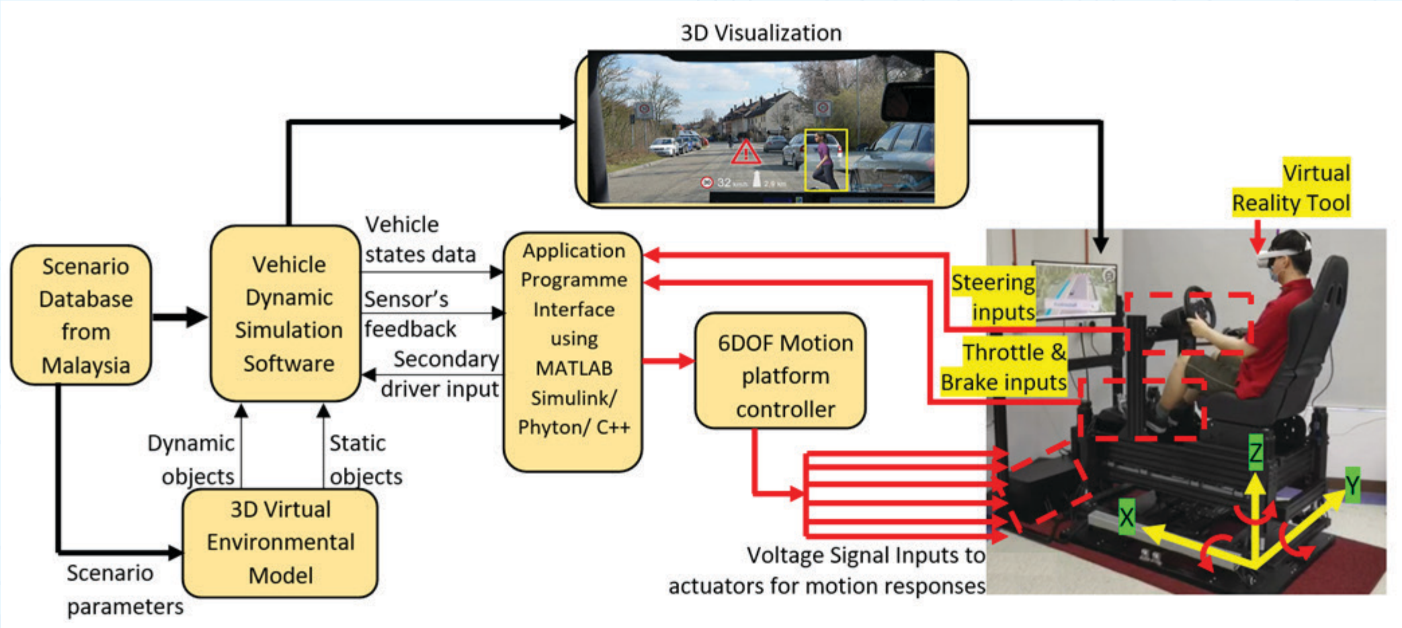


Figure. 5. Assessment Methodology for AV Virtual Simulation.

MARii plays an important role in establishing AV testing protocol, and over the past two years, it has been very active in supporting initiatives such as planning for AV test bed, signing Memorandum of Understanding (MoU) with Proton, CARARC and DRB-HICOM for the adoption of next-generation mobility technologies and AV development in Malaysia. To add, MARii and Multi-Code Electronics Industries (MCE) have signed an MoU to develop critical components to accelerate the implementation of autonomous driving and connected mobility, in line with the National Automotive Policy 2020. In addition, the Malaysian Research Accelerator for Technology & Innovation (MRANTI) is looking into the My Autonomous Vehicle (MyAV) initiative by addressing aspects such as regulatory sandbox, supporting infrastructure for testbed, test route for AV testing, and developing a living lab for AV.

Challenges for safety testing of AV in Malaysia

Several challenges have been identified in the assessment and deployment of AVs in Malaysia, one of which is the identification of suitable sensors for AVs to overcome under different weather conditions, road signs and traffic settings. It is worth stating that the use of machine learning approach in AVs is not widely agreed upon among industry and standardisation bodies. Another challenge is that of the lack of clear milestone assessments for AVs. Milestone assessments mainly focus on virtual simulation tests and physical tests in closed environments. Yet another challenge is that of the regulation of the AV.

The many initiatives by the Malaysian government, companies and universities show that Malaysia is already moving forward towards the deployment and testing of AVs. However, a proper homologation process is required to address most of the challenges before actual physical testing is possible, as mentioned in some guidelines, such as the Technical Reference for Autonomous Vehicle (TR) 68, proposed by the Singapore government.

Scenario-Based Virtual Safety Assessment Framework

The virtual safety testing framework (Figure 5) is developed to evaluate the performance of AVs. There are a few stages in the assessment methodology. First, scenario identification and classification are needed to investigate the scenario to be developed and assessed in a virtual testing platform. This requires video recordings from actual scenarios in selected roads and traffic networks in Malaysia.

Next, environment modeling and virtual scenario generation, which are based on the actual scenario classified in the first stage, are developed. The third stage focuses on the development of a vehicle model based on actual vehicle, followed by the development of a driver prediction model. The vehicle model developed in this platform needs to be validated using actual vehicle to ensure the accuracy of the model before conducting virtual testing.

Meanwhile, the driver model is validated using actual human driving response data collected from various drivers in Malaysia as well as from a vehicle driving simulator. The driving pattern of Malaysian drivers need to be studied carefully in order to select the optimum driving response to validate the driver prediction model. This model is used as the benchmark driver model in the virtual safety testing platform.

The last stage assesses safety in urban driving, whereby, a collision avoidance system is used. A combination of both automated emergency steering (AES) and automated emergency braking (AEB) are used to avoid any frontal or rear-end collision. Using this virtual scenario-based assessment, a final report is generated to measure the score of the AV in various test cases.

/mbot gallery

19 January | Dr. Md Fauzi Md Ismail, MBOT Registrar and Ts. Hj Muhtar Suhaili, Group Chief Operating Officer, Eastern Pacific Industrial Corporation Berhad (EPIC) during the souvenir presentation session in conjunction with MBOT's courtesy visit to EPIC.

9 January | Prof. Datuk Ts. Ir. Dr. Siti Hamisah Tapsir, President of MBOT, paid a courtesy visit to Tuan Wan Abdul Latiff Wan Jaffar, Director General, Department of Environment.

28 January | MBOT Professional Assessment Panel Workshop Series 1/23 - Central Zone.

19 January | The MBOT delegation, represented by Dr. Md Fauzi Md Ismail, MBOT Registrar, paid a courtesy call on Tuan Hamdan Hashim, Deputy Director of Training, ADTEC Kemaman.

10 February | Courtesy visit of MBOT's President, Prof. Datuk Ts. Ir. Dr. Siti Hamisah Tapsir to Datuk Dr. Alauddin bin Sidal, Director of National Institute of Public Administration (INTAN).

11 February | The MOU Exhange Ceremony between MBOT and PERKESO was represented by Prof. Datuk Ts. Ir. Dr. Siti Hamisah binti Tapsir, President of MBOT and Dato' Sri Mohammed Azman bin Aziz Mohammed, Chief Executive Officer of PERKESO. The ceremony was witnessed YAB Dato' Seri Anwar bin Ibrahim, Prime Minister of Malaysia and YB Tuan V. Sivakumar, Minister of Human Resources at the Launching Ceremony of the Housewife Social Security Scheme and Myfuturejobs Career Carnival 2023.

/MBOT registration

Graduate Technologists	Qualified Technicians	Professional Technologists	Certified Technicians	Total MBOT Registrants
39,359	7,955	17,910	2,132	67,356

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