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THE MALAYSIAN PERSPECTIVE ON IMPOSING CIVIL LIABILITIES IN ROAD ACCIDENTS INVOLVING AUTONOMOUS VEHICLE

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ABSTRACT

The advancement of artificial intelligence (AI) technology has become the fundamental catalyst in the research and development of autonomous vehicle (AV). AVs equipped with AI are expected to perform better than humans and forecasted to reduce the number of road accidents. AV will improve humans' quality of life, such as creating more mobility for the elderly and disabled, increasing productivity, and creating an environmentally friendly system. Despite AV's promising abilities, reports indicate that AV can go phut, causing road fatalities to the AV user and other road users. The autonomous nature of AV exacerbates the difficulty in determining who is at fault. This article aims to examine the ability of the existing legal framework to identify the person at fault so as to determine the tortious liability in road accidents involving AV. This article demonstrated that the existing legal scheme is insufficient to determine tortious liability

in road accidents involving AV. This article explored the possibility of shouldering the liability on the manufacturer, the user, and even on the AV itself. This article also investigated alternative approaches that could be adopted to resolve issues on the distribution of tortious liability in road accidents involving AV. The outcome of this article could contribute to issues relating to the liability of AI.

Keywords: Artificial intelligence, autonomous vehicle, liability, negligence, tort.

INTRODUCTION

The intersection between artificial intelligence (AI) and law has led to the emergence of pertinent issues that will impact humankind's future in decades to come. AI has changed the way humans perform their daily routines. AI is able to resolve problems that previously would require human intelligence. The most obvious example is the autonomous vehicle (AV). The world is now excited to see AV's appearance on roads that are capable of acting autonomously using modern AI technology (Sulaiman, 2018). The promising advantages of AV has managed to entice new demands in the automotive market. The United States (US) is the earliest country that is vigorously involved in the AV development. These new demands have prompted giant car manufacturers like Tesla, Volvo, BMW, Audi, Volkswagen, Nissan, GM, Toyota, Hyundai, Jaguar Land Rover, and new entrants like Google, Apple, and Uber neck and neck to invest in astronomical experiments towards designing the best roadworthy AV for the consumer market (Herrmann et al., 2018).

One of the motivations that persuaded automotive industries to manufacture AV is to promote road safety. The reason being is that the number of road accidents multiplies each year. For instance, in Malaysia alone, 554,120 accidents were recorded in 2019 as compared to 536,250 accidents in 2018 and 520,223 cases in 2017 (Statistik, 2020). A research conducted by the Malaysian Institute of Road Safety Research predicted that road fatalities would increase by 10,716 in 2020 (Sarani et al., 2012). The Road Safety Plan of Malaysia 2014–2020 had been replaced with the new Road Safety Plan of Malaysia 2021–2030, which is expected to be launched in the third quarter of

2021 (Sivanandam, 2021). The Road Safety Plan of Malaysia 2021-–2030 will continue to reduce the number of fatalities and injuries from road accidents (Ministry of Transport Malaysia, 2021). In this connection, the integration between AI and road vehicles is expected to increase the safety of vehicles and reduce the possibility of road accidents (Trubia & Whitson, 2017). Apart from road safety, AV is also expected to increase the mobility of the geriatrics and physically impaired (Hevelke & Nida-Rümelin, 2014).

The presence of AV on public roads can be appealing, but AV will bring a new form of legal challenges, especially liability in road accidents (Marchant & Lindor, 2012). Road accidents involving AV in Malaysia is nowhere to be reported as yet. However, this issue must be considered as a mere conjecture because AV technology is gradually arriving in the Malaysian automotive market. The National Automotive Policy 2020 (NAP, 2020), which was launched on 21 February 2020 (The Star, 2020), reinvigorated the nation's aspiration towards having AVs on public roads in the near future. NAP 2020 emphasised the incorporation of modern technology in the automotive industry (Daim & Yusof, 2020). Although NAP 2020 did not specifically mention AV, the policy gave recognition to automated vehicles called the Next Generation Vehicle (NxGV). NxGV is an energy-efficient vehicle enhanced with intelligent mobility application (MITI, 2020). Malaysia is at the dawn of the AV's arrival. Therefore, this article foresees tortious issues that will emerge as the consequences of AV's operation on public roads. Reference to some of the leading incidents in the US will be made in this article to illustrate the seriousness of the threat and its challenges.

Generally, five technological risks are commonly associated with AV, namely safety, liability, privacy, cybersecurity, and industry influence (Taeihagh & Lim, 2018). However, the area of AV's technological risks, which this article intends to address, will be confined to the aspect of liability, particularly in road accidents. This article aims to examine the existing legal framework's ability to identify the person at fault and determine the civil liability between the manufacturer, user, and AV in road accidents within the existing tort structure. Civil law means private law where wrongs originate from contractual and civil wrongs (Turner, 2019).

THE PERSPECTIVES OF AV

Fiction movies, magazines, and books have repeatedly played the idea of AV. The idea was then translated into hope when the radio-controlled car was first introduced in 1926, called the 'Linriccan Wonder' (Bimbraw, 2016). The Linriccan Wonder was a 1926 Chandler mounted with a transmitting antenna mounted on its rear that sent impulses to another car tailing it (Bimbraw, 2016). Meanwhile, in 1939, an automatic radio control system was exhibited during the 1939 World Fair in New York, which displayed the idea of cars' ability to maintain a safe distance on the road (Jurgen, 2013). Subsequently, an idea coined in 1940 that all cars should be guided by magnetic wires buried under the road surface capable of emitting signals to avoid car collision (Herrmann et al., 2018). General Motors adopted the wire guidance technology in 1950 in designing its Firebird I and II self-driving prototypes (Herrmann et al., 2018).

AV projects then accelerated when the Defence Advancement Research Projects Agency (DARPA) organised its first Grand Challenge in 2004 (Jurgen, 2013). The Grand Challenge came with a USD1 million reward to the first vehicle that could navigate 241.4 kilometres of rugged terrain (Kaplan, 2016). Unfortunately, most of the participants only managed to cover not more than 11 kilometres (Kaplan, 2016). The second Grand Challenge was held in the following year, which saw 23 teams participated, but only five managed to complete the course, and Stanford University was announced as the champion (Kaplan, 2016). The third challenge came in 2007 when DARPA threw an Urban Challenge, where contestants were required to manoeuvre 9.6 kilometres through the streets (Kaplan, 2016). The challenge required contestants to comply with the road regulations, and Carnegie Mellon University won the challenge (Kaplan, 2016). The Stanford team leader, Sebastian Thrun, was subsequently appointed by Google to work together with its engineer Chris Urmson to develop the Google self-driving cars (Guizzo, 2011).

What is AV

AV is defined as relieving occupants of the burden of driving and allowing them to spend the travel time on other activities, like working, relaxing or even sleeping (Anderson et al., 2016). AV can guide itself,

familiarise itself with the environment, create safe mobility patterns, navigate the journey without any data from humans, independently make timely decisions, and operate autonomously without any human assistance (Hussain & Zeadally, 2019). To achieve these capabilities, AV must perceive its environment by using sensors, cameras, and radars (Bagloee et al., 2016). AV's autonomous nature leads to the pertinent issue on the trolley problem (Bhargave & Kim, 2017).

However, researchers are inclined to rely on the classification of vehicle automation given by the Society of Automotive Engineers (SAE) (Beiker, 2016 & Herrmann et al., 2018). Furthermore, the SAE classification has been adopted worldwide (Diaz & Soriguera, 2018). The automation levels described by SAE have been widely accepted by various jurisdictions like Australia, Canada, and the European Union (Taeihagh & Lim, 2018). SAE defines the word 'autonomous' as a system with the ability and authority to make decisions independently and self-sufficiently (Surface Vehicle, 2018). According to SAE, there are five automation levels ranging from Level 0 to Level 5 (Surface Vehicle, 2018). The automation levels correspond to the degree of driving automation. Level 0 means that there is no driving automation and Level 5 is the complete automation where the vehicle is able to act autonomously without human interference. Whereas Levels 2, 3, and 4 signify some variable degrees of automation, as they would still require human assistance (Surface Vehicle, 2018). AV is expected to drive under any environmental conditions at Level 5 (Milakis, van Arem, & van Wee, 2017).

SAE and NAP 2020

The definition of AV in NAP 2020 is quite different from the SAE standard. Unlike the SAE standard, NAP 2020 has emphasised the Next Generation Vehicle (NxGV). NxGV is a vehicle that meets the standard of an energy-efficient vehicle and is enhanced with intelligent mobility application (MITI, 2020). A vehicle is considered to be NxGV if it achieves Level 3 (conditional automation), Level 4 (high automation), or Level 5 (complete automation) of NAP 2020 (MITI, 2020). At Level 3 of NAP 2020, a driver of NxGV would still control the vehicle and take over the vehicle when alerted by the system. The standard which was set by NAP 2020 requires that the vehicle has to be an energy-efficient vehicle. NAP 2020 has also fixed five vehicle

autonomy levels, which is called the 'Autonomous/Automated and Connected Vehicle' (Azhar, 2020). The level of autonomy set out by NAP 2020 is similar to the levels set out in SAE. The only difference is that NAP 2020 concentrates on energy-efficient AVs, whereas SAE includes both non-energy efficient and energy-efficient AVs.

Nevertheless, be that as it may. For the discussion on the scope of liability in this article, the word AV shall refer to the road vehicles that match the descriptions set out in Levels 4 and 5 of SAE and Levels 4 and 5 of NAP 2020; and not limited to energy-efficient vehicles only. Vehicles that are within Levels 4 and 5 are generally able to perform longitudinal control (speed, acceleration, and braking) and lateral control (navigational and steering) without any human control for the entire journey (Trommer et al., 2016). The longitudinal and lateral controls are only possible if modern technologies like AI, cameras, sonar, laser range finder, sensors, GPS, LADAR, RADAR, advanced algorithms, and inertial navigation systems are integrated with AV (Sulaiman, 2018). Vehicles that do not match the descriptions set out in Levels 4 and 5 can only be regarded as semi-AV and do not entail legal issues on the liability because the chain of causation remains with the driver.

ACCIDENTS INVOLVING AUTONOMOUS VEHICLES

The recent advancement in AI machine learning and sensor created a new frontier in the AV industry, yet AV's safety remains murky (Yu et al., 2019). The AV driving system can be inaccurate due to incorrect perception of the environment variations, such as the colour of the sky, rain, snow, and fog (Yu et al., 2019). The risk of AV on public roads comes at a hefty price. Reports indicated that AVs are frequently involved in serious road accidents. This article would be remiss in not mentioning some of the accidents involving AV to support this point. Most of the incidents mentioned herein occurred in the US because AVs have widely experimented there. Furthermore, no records are available at the moment regarding road accidents involving AV in Malaysia or its neighbouring region to illustrate the same issue. However, these following incidents will illustrate the kind of threat that AV could bring to humans.

In July 2015, a Google Lexus SUV AV was involved in an accident at Mountain View, California. The self-driving Google Lexus had stopped at an intersection near the company's headquarters. The traffic light was green, but the traffic congestion halted the Google car and two others in front of it. The Google car could not go through the intersection without blocking the intersection (Isidore, 2015). The driver of a fourth car did not realise the stalled traffic and suddenly hit the rear of the Google car at 17 mph, without braking. Chris Urmson, the head of Google's self-driving car programme, told reporters that since the beginning of the self-driving car programme, Google car had been hit 14 times (11 rear-end accidents) and not once the self-driving car had caused any collision (Isidore, 2015). Urmson immediately proclaimed that AV demonstrated good signs because driverless cars are performing better than human drivers.

Meanwhile, in January 2016, a 23-year-old driver Gao Yaning died after crashing into the back of a road-sweeping vehicle while travelling on the autonomous mode in Tesla Model S in the province of Hebei, China (Boudette, 2016). On 14 February 2016, a month later, a Google self-driving car was involved in its first crash while trying to change lanes in Mountain View. The Google test driver was aware of an approaching bus on the left side of the car and thought that the bus would slow down. Instead, the bus had grazed the side of the Google car. Google acknowledged that the accident was due to its fault and reported that the car was on autonomous mode before the crash happened ("Google self-driving", 2016). Unfortunately, the mishap did not stop there.

Once again, Tesla's AV went berserk on 7 May 2016 when its Model S involved a road accident that killed its passenger, Joshua Brown. According to the National Transportation Safety Board (NTSB), Brown was using the Traffic-Aware Cruise Control and Autosteer lane-keeping assistance when the accident occurred. The car struck a Freightliner Cascadia truck-tractor and collided with a utility pole (NTSB, 2016). Further, on 19 March 2018, Elaine Herberg, a 49-year-old pedestrian, was killed by a self-driving car (Volvo XC90) operated by Uber while she was crossing at an intersection in San Francisco (Wakabayashi, 2018). This case marked as the first incident involving an AV killing a pedestrian. Not long after that, Mountain View in California once again became the world's focus when another

Tesla Model X hit a concrete divider on 23 March 2018, killing its driver, Walter Huang ("Tesla car", 2018). Before the incident, Huang had been complaining about Tesla's faulty autopilot (Noyes, 2018). Unfortunately, Tesla had pushed the blame onto Huang because Huang was supposed to put his hands on the steering wheels. The car's data indicated that Huang's hands were not on the steering wheels when he was alerted by the system to do so. Tesla also blamed that the concrete divider was previously damaged, which exacerbated its impact ("Tesla Car", 2018).

It would not be too far-fetched to suggest that as much as AV may reduce human error accidents, AV creates a new risk for drivers, especially when it fails due to system error. Even the best programmers could not write error-free codes all the time. On average, well-written programmes have one to three bugs for every 100 statements (Ahamed, 2009). These circumstances have posed new challenges to the application of the law. Intellectual discourse within the AI community demands AV to be liable for any damage caused by road accidents. The standard legal approach must be reviewed to determine whether the existing legal principles are dynamic enough to resolve liability issues relating to AV.

THE LEGAL APPROACH

At the outset, the law is made by humans to regulate human behaviour and any legal subject (Glazebrook, 1997). The application of law so far does not extend to AV because it is not a legal subject. Due to this legal hurdle, lawyers would methodologically adopt the existing legal approach to determine the liability of the tortfeasor in accidents involving AVs. The standard legal approach involves fitting new problems into the existing legal framework (Petit, 2017). It would require the law to squeeze issues on AV into the corset of the standard legal provisions. This article identifies five legal methods that are regarded as feasible to address issues regarding the legal liability of AVs in accidents. The discussion on the five legal methods will follow according to the following arrangement:

i) The principle of volenti non-fit injuria;
ii) No-fault liability scheme;
iii) Liability on the car manufacturer;

iv) Liability is on the AI producer (because AV functions on AI);
v) Liability is on the AV owner; and
vi) Liability on the AV itself.

THE PRINCIPLE OF VOLENTI NON-FIT INJURIA

Under this principle, the loss lies where it falls (Holmes Jr., 2013). Volenti non-fit injuria is a form of defence in a negligence action. It means that the claimant voluntarily agrees to undertake the legal risk or harm at his own expense (Cooke, 2015). The law requires that the claimant had acted voluntarily in the sense that they could exercise freedom of choice. In *Bowater v Rowley Regis Corp*[1], the learned judge ruled that willingness is where a person must have the opportunity to make his own choice without any elements of constraint and having complete knowledge about what he is about to engage. In the case of *Mohd Shabudin Abu Hassan*, *Wakil diri kepada Akif Fahmi Mohd Shabudin*, *simati v Muhamad Safwan Abu Bakar & Ors*[2], the learned High Court Judge applied the principle of volenti non-fit injuria on the parties because they had voluntarily increased the speed of their vehicles having full knowledge about the danger of other road users.

The application of this legal principle could be illustrated in accidents involving AVs. The AV driver and its passenger involved in accidents may be unable to seek relief or damages from the manufacturer of the car because the driver and passenger have voluntarily agreed to assume all risks associated with the use of AV. In other words, this is a complete defence to an action (Cooke, 2015). Indeed, this legal approach would be less favourable and considered radical. This is because it will discourage people from travelling in AVs and ultimately destroy AV sales in the automotive market.

Looking from another aspect, what about employees who participate in their employer's vehicle testing. Would the defence of volenti non-fit injuria be able to be pleaded by the employer? In this situation, the consent given by the employee cannot be regarded as good consent to the AV testing due to the employer and employee relationship. The employer, however, may succeed to plea volenti non-fit injuria

[1] *Bowater v Rowley Regis Corp* [1944] KB 476
[2] *Mohd Shabudin Abu Hassan, Wakil diri kepada Akif Fahmi Mohd Shabudin, simati v Muhamad Safwan Abu Bakar & Ors* [2018] 1 LNS 464

if the employee had been paid with some danger money to undertake the risk or the employee deliberately chose a dangerous method or working (Cooke, 2015). In the case of *Smith v Baker*[3], the House of Lords ruled that even though the employee continued to work after knowing the risk, it did not mean that the employee had voluntarily accepted the risk of injury because it is the employer's duty to provide a safe working environment. A similar expression echoed through a local case in *Nowran Begam Mohamed Saliff v Nantha Kumar Devar Sangaran & Anor.*; *CTRM Aviation Sdn Bhd* [4]. In this case, the deceased died in an air crash. The defendant pleaded volenti non-fit injuria against the deceased because the deceased knew about the flying risk activity and had signed a disclaimer. The court ruled that the defendant could not rely on the defence because the defendant failed to fully appraise the deceased about the risk, including the risk of death from flying into clouds.

Therefore, for instance, if Google engages its employee in an AV testing, and subsequently, the AV is involved in an accident, Google may still be liable for the injuries suffered by its employee. Google will be unable to utilise the plea of volenti non-fit injuria unless danger money has been paid to its employee who participated in the testing, or the employee had deliberately exercised a dangerous method of working during the AV testing, and Google had fully appraised the risks of AV including, risk of death.

THE NO-FAULT LIABILITY SCHEME

Under this liability scheme, parties involved in AV accidents will not shoulder any liabilities. It is an alternative system specifically designed to provide insurance coverage for road accidents. This scheme will ensure that the victims will receive compensation without requiring them to identify the party at fault and relieving them from any protracted litigation process (Anderson et al., 2014). This scheme would be able to save the AV manufacturers from product liability suit by the AV victims. The insurance adjuster will devise straightforward mechanisms to determine the extent of damage and the amount to be compensated.

[3] *Smith v Baker* [1891] ALL ER Rep 69

[4] *Nowran Begam Mohamed Saliff v Nantha Kumar Devar Sangaran & Anor.; CTRM Aviation Sdn Bhd* [2016] 7 CLJ 760

This scheme is attractive to resolve issues relating to liabilities in road accidents involving AVs. Accident claims will not be made against the tortfeasor (Turner, 2019). Furthermore, insurance premiums can be reduced and stimulate AV technology adoption in the consumer market because AV is expected to perform better than humans on the road. However, new categories of accidents will surface, which will challenge the principle of duty of care owed between parties. For instance, can pedestrians recover damages for reasonably expecting an AV to stop automatically the moment it detects a pedestrian crossing the road? (Anderson et al., 2014). What if some AVs are not equipped with such a feature and hit a crossing pedestrian? (Anderson et al., 2014). Another setback of this scheme is that it covers only physical harm to humans and excludes other forms of losses like property and financial losses (Turner, 2019).

LIABILITY ON THE AV MANUFACTURER

Liability on the car manufacturer can be imposed by way of strict liability. Strict liability is a theory of liability based on causation without regard to whether a tortfeasor's conduct is socially blameworthy (Abbott, 2018). Strict liability means no fault is required. Suffice to show that the defective product has caused damage or injury in the accident. This approach can be appealing, especially when the function of AV prevents human interference from controlling the car. Recently, Google released its second-generation AV that lacks steering wheels or other controls to ensure that human intervention is impossible (Issit, 2018). Refuse to be outdone, Peugeot has released its autonomous AV called the E-Legend, which hides away the steering wheel into the dashboard when it is on autonomous mode (Savov, 2018). The technology introduced by Peugeot is attractive but denying humans from controlling the car while on autonomous mode raises the question on AV's trustworthiness on public roads.

AV manufacturers can be held liable for any damage or injury caused by AV in applying strict liability. Product liability falls under this legal scheme. Views championing this line of argument will regard AI as a product. This approach allows the manufacturer to control the risks and balance the benefits of using its AV. The manufacturer, in this respect, should have the most significant knowledge about the capability of its AV that functions on AI technology (Silverman et al.,

2018). The manufacturer should be able to identify what went wrong with its AV if the vehicle involves in an accident. This approach seems ideal; however, things can be worse if the manufacturer is no longer in business and cannot be traced (Silverman et al., 2018).

On the other hand, AV manufacturers may not be able to identify the error that caused the accidents because of the AI techniques employed by AVs. AV is integrated with AI technology that collects data and translates it into instructions for the AV. Defects in the design of a complex AI system might be undetectable to the consumers, the downstream manufacturers, and the distributors (Vladeck, 2014). Especially when the AV equipped with AI is capable of learning from new datasets. AV operates on a vast AI network of artificial neurons that receive data, process the data, and deliver a command to operate the AV (Abduljabbbar et al., 2019). AV equipped with machine learning can learn its own experience to solve problems using complex algorithms and advanced techniques (Barfield, 2018). The output path produced by AV cannot be discoverable due to the black box problem (Pande, 2018).

A legal complication may entail if strict liability or product liability is applicable to AV manufacturers. The reason being is that AV is capable of learning from its environment and make decisions based on its own experience. AV's behaviour could be different than what was initially programmed by the manufacturer. In a worst-case scenario, AV will override human instructions and human will lose control over the AV. Moreover, the manufacturer cannot foresee some of the AV's decisions due to the unpredictability of AI (Barfield, 2018). Imposing the standard strict liability regime on manufacturers can be a harsh approach that will consequently frustrate the future development of AVs or even cause another AI winter.

Imposing strict liability on the manufacturers is less complicated than fixing fault-based liability. Fault-based liability, such as negligence, will require judicial assessment by the court. The manufacturer can be held liable if it is proven that there is fault on the part of the manufacturer. Fault-based liability demands the court to decide complex legal issues, such as whether the manufacturer or the AI owes the duty of care. The court would generally apply available existing laws to deal with AI-related issues. In the end, it will create more complicated legal quandaries.

In all negligence cases, the claimant must prove to the court that the tortfeasor breached the duty of care. The court in *Blyth v Birmingham Waterworks Co*[5] had classically interpreted 'negligence' as an omission to do something that a reasonable man would do or doing something that a reasonable man would not do. The objective test set out in *Blyth* had been accepted and applied by the Malaysian Federal Court in *Wu Siew Ying v Gunung Tunggal Quarry & Construction Sdn Bhd & Anor*[6]. It is regarded as a subjective inquiry by the court. The kind of test to prove breach is to deploy the *reasonable man's test*. Greer LJ, in the case of *Hall v Brooklands Auto Racing Club*[7], described a reasonable man as the man on the street or the man on the Clapham Omnibus, or the man who takes the magazine home and, in the evening, pushes the lawnmower in his shirt sleeves.

The expression of a *reasonable man* as the legal standard to prove liability in AV cases cannot be the minimum threshold to determine liability on AV manufacturers. The reason being is that AV is expected to perform better than humans. The objective determination of the reasonable man concept is unsuitable to be used on AV. AV that functions on an AI system is expected not to err like humans. Anthropomorphic features and traditional legal framework may not be suitable to implicate liability on the manufacturer for negligence. Alternatively, AV manufacturers should follow Volvo's unprecedented move in accepting all liability voluntarily if its AVs are involved in accidents (Korosec, 2015). Volvo has sent a signal that Volvo is confident with its technology and will be accountable if its self-driving vehicle is involved in a crash (Gorzelany, 2015). This is a smart move made by Volvo and currently gives intense pressure on other AV manufacturers in making the same pledge.

LIABILITY ON THE AI PRODUCER

This approach would be relevant if the AI producer is independent from the autonomous car manufacturer. If the AI producer is an independent entity different from the car manufacturer, AI producers would be effectively involved in the entire assembly process. From the business perspective, AI producers are able to oversee how the

[5] *Blyth v Birmingham Waterworks Co* [1856] 11 EX 781
[6] *Wu Siew Ying v Gunung Tunggal Quarry & Construction Sdn Bhd & Anor* [2011] 1 CLJ 409
[7] *Hall v Brooklands Auto Racing Club* [1933] 1 KB 205

complete AI system is being integrated with the AV. Consequently, the car manufacturers may be required to engage into bargains at arm's length with the AI producers.

The imposition of liability on the AI producer would normally recourse for a standard legal regime on product liability, which is strict liability. Several legal tests are developed to impose liability on the producers, such as the risk-utility test and the consumer expectation test. However, the more autonomy machines can achieve, the more tenuous becomes the strategy of attributing and distributing legal responsibility for their behaviour (Chinen, 2016). As mentioned earlier, the strict liability framework is not suitable for facing the challenges created by new technology, especially on the liability of AV. AI products may be identical 'at birth'; however, upon reaching the end-user, AI may develop its own behaviours that may be beyond the producer's foreseeability (Barfield, 2018).

The following legal issue is whether a defective product is evaluated based on its condition at the time of sale or when the product causes damage (Silverman et al., 2018). By definition, AI is capable of self-modification during use, which in turn may preclude the design defect claim. When any products become more autonomous, traditional strict product liability law may fall to negligence principles. The focus will then be on whether the product's action was reasonably foreseeable and could have been avoided through exercising due care (Silverman et al., 2018). Fewer parties will have control over AV if it is equipped with more sophisticated AI technology. It will consequently affect the opportunities in recovering damages through the traditional theory of negligence (Sullivan & Schweikart, 2019).

From another standpoint, it may be unfair to assign blame on the designer of a component whose work was far-removed in both time and geographical location from the completion and the operation of the AI system (Scherer, 2016). Blaming AI designers who are remote in the chain of causation through the strict liability regime will thwart the future development of AI technology. Moreover, the producers of AI leave very minimal footprints. AI systems will operate using a mixture of hardware and software components taken from different companies. The interaction between these different components and disparate geographical locations further compound the law's difficulty to single out which designer is at fault (Scherer, 2016).

LIABILITY ON THE AV OWNERS

One of the formidable capabilities of AI is the capability of learning. Learning in an AI system involves modifying or adding to its knowledge (Whitson, 2018). Deep learning is the fundamental subfield of AI, which is applied for the development of self-driving cars (Dun, 2018). In the effort to make car owners tortiously liable for any damage, an analogy can be drawn between keeping dangerous animals as pets and owning AV that can injure humans.

The common law principle of the 'one bite rule' provides that the pet owner shall be responsible for any injury caused by its pet (Silverman et al., 2018). Owners or keepers of dangerous animals are held strictly liable for any damage caused by them, regardless of any illicit or culpable behaviour of owners and keepers of such animals (Pagallo, 2013). The relevance of this doctrine to the case of AV is obvious. An AV that is potentially a dangerous kind, and where harm is likely to cause damage or injury, the person with custody of the AI should be liable for damage even in the absence of proven negligence. AI might include malware such as viruses, worms, and Trojan horses (Chopra & White, 2011).

In the current research on human and AI interaction, any injuries or damages caused by an AV correspond to the manner of the AV treated by its owner (Pagallo, 2013). The owner of an AV can be held liable for negligence for any damage or injury caused by their AV. AV can modify its behaviour different from its original setting once it rolls out from the factory. Its adaptive learning makes it capable of adjusting itself to any given environment (Pagallo, 2013). The owners as caretakers are responsible for the type of data fed into the AV. However, the increasing autonomy and unpredictability of robotic behaviour will make it difficult for users or AV owners to evade responsibility (Pagallo, 2013).

Categorising the use of AV as engaging in the ultra-hazardous or abnormally dangerous activity is another area that researchers can explore to impose liability on AV owners. The Common Law defines ultra-hazardous activities as those which are inherently dangerous that come with special responsibility on the persons who undertake to perform the activity (Harpwood, 2000). This category involves the

risk of unavoidable serious harm in nature to person, land or chattels even if meticulous care is taken and not as a matter of common usage. This approach may be controversial because the meaning of the word ultra-hazardous cannot be exactly defined. Ultra-hazardous means unacceptable risk; nevertheless, the level of risk acceptable in a particular activity depends on how it is valued (Cane, 1994). This approach is unappealing to some due to the difficulty in defining 'ultra-hazardous' (Cane, 1994). This approach will discourage consumers from buying AV and consequently affect AV's production for consumers, resulting in huge losses to the AV industry players. The House of Lords in *Cambridge Water Co. v Eastern Counties Leather Plc.* [1994] 2 AC 264 (HL) 305 had endorsed the Law Commission report, which described the uncertainty in the meaning of the word 'ultra-hazardous'. Lord Goff of Chieveley in *Cambridge Water Co.* opined that the Parliament must determine what is regarded as high risk by promulgating a specific statute. Once the statute has identified the scope of activity, the extent of liability can then be determined.

LIABILITY ON THE AUTONOMOUS VEHICLE

AV, by nature, is a legal object. An object can never be held liable under the law. However, due to its capability to think and act using AI functions, efforts have been made to make AV that operates on AI to be liable. More serious consideration is given in Europe. In February 2017, the European Parliament proposed for recognising AI as 'electronic persons' (EU Parliament, 2017). It is said that the idea of granting legal personality to AI is not a utopian thought (Eidenmüller, 2017).

However, granting legal personality on AI will pose further complications since this idea will fail to satisfy the fundamental requirements to possess legal personality. Apart from legal theories, AI must satisfy the essential qualities of a legal person, namely: i) capable of having rights and duties, and ii) ability to exercise free will (Brölmann, & Nijman, 2017). AVs in this respect meagre for such qualities. Applying the legal requirement to grant legal personality on AI will attract criticisms, and the effort seems unnecessary. Recently, Saudi Arabia enrolled Sophia, the AI robot, as its citizen. So far, no legal justifications have been offered by the Saudi Government in

granting legal personality to Sophia. Granting personhood to a non-biological person emulates what was written by Suetonius in the Lives of the Twelve Caesars (121 AD). The story was about the Roman Emperor Caligula, who had planned to make his horse, Incitatus, a Senator, and 'the horse would invite dignitaries to dine with him in a house outfitted with servants there to entertain such events' (Pagallo, 2018). Therefore, advocating legal personality to be given to AVs can be an ideal option, but the execution of such an effort would require strenuous legal exercise.

ALTERNATIVES

Several alternative methods can be devised in order to overcome legal hurdles involving AVs. The fault finding mechanism, as earlier discussed, is unable to provide a promising solution and unable to withstand new forms of legal challenges on AVs. The alternatives discussed below could water down issues on the risks involving AVs and address issues relating to liabilities in accidents involving AVs.

Special Zone

The special zone's function is to ensure machine safety, prevent high litigation risk, and ease radical ethics disputes. The special zone will allow regulators and manufacturers to identify foreseeable risks before an AV is released into the real world (Abdul Manap & Abdullah, 2020). The setting up of special zones for robotics empirical testing appears to be relevant because potential issues relating to AV can be adequately addressed (Pagallo, 2018). The purpose of creating a special zone system or the robot kingdom is to observe the co-existence between the society and AVs. The special zone serves as a shock buffer for supporting the new human-AV ecology (Weng et al., 2015). Special zones can be modelled after the Tokku - a Special Zone for Robotics Empirical Testing and Development (RT special zone) in Japan. Since 2003, the world's first RT special zone had already been established in Fukuoka Prefecture, Fukuoka City, and Kitakyushu City (Weng et al., 2015).

Recently in August 2020, Malaysia had launched its National Technology and Innovation Sandbox (NTIS) as one of the government's key initiative under the Short-Term Economic Recovery

Plan (Penjana) (Sivanandam, 2020). NTIS provides the facility for researchers, innovators, startups, and high-tech investors to test and experiment with their innovations in a direct environment (Sandbox, 2020). NTIS can be said to be quite different from the special zones because NTIS does not involve robots living within the human ecosystem. Real human and robot interaction does not exist in NTIS, unlike in special zones. Special zones can be a promising method for countries that are giant producers in robotics. The initiative undertook by the government in introducing NTIS can be seen as the catalyst towards promoting the future development of AI in Malaysia.

The Digital Peculium

This approach is a new form of accountability for the behaviour of robots and traditional ways of distributing risk through insurance models or authentication systems. The Digest of Justinian defines peculium as a "sum of money or property guaranteed by the head of the household to a slave. Although considered for certain purposes as a separate unit and allowing a business run by slaves to be used almost like a limited company, it remained the property of the head of the household technically" (Watson, 1998).

The peculium aims to strike a balance between the claim of the masters not to be ruined by their slaves' businesses and commercial activities. The peculium will encourage the counterparty to have more confidence to enter into a commercial transaction negotiated by a slave on behalf of its master. The counterparty can make monetary claims from the peculium if they suffer losses due to the slave's misbehaviour whilst conducting business. Most of the time, a master's liability is limited to the value of their slave's peculium and yet, the legal security of the latter guaranteed that obligations would have been met (Abdul Manap & Abdullah, 2020). Contrary to traditional forms of distributing responsibility and risk, "only robots shall pay" (Chopra & White, 2011). Legal systems may sever the responsibility of designers, manufacturers, operators, and users of robots dealing with third parties so that, based on the warranty of their peculium, only robots would be held liable for damages caused by them (Chopra & White, 2011). The personal accountability of robots will simplify several contentious issues if this approach is adopted.

Issues like whether robots are acting beyond certain legal powers, which party should be held liable for conferring such powers, and whether humans can evade liability for possible malfunctions of a machine are skimmed-off (Chopra & White, 2011).

Strict Liability by way of Contract between the AV and the User

This approach imposes strict liability on the user to be legally liable for any possible accidents occurred in using AV. The user is expected to understand the consequences of using AV on public roads. Moreover, most of today's available AVs are equipped with options for the user to select whether to be on autonomous mode or non-autonomous driving mode. If the user selects to be on autonomous mode, the user is expected to be aware about the risks associated with autonomous driving.

To achieve this, all AVs must be equipped with a warning system. The warning system must always appear on the display screen each time the AV is to be switched to autonomous mode. The warning system serves as a caution for the AV user about the risks associated with autonomous driving. The warning system would appear together with contractual terms, which would require the AV user to agree with the stipulated terms. The terms must specify that all forms of liabilities expected to be borne by the AV user the moment autonomous driving is switched on. The autonomous system would only be activated once the user has agreed to the terms. The contractual terms will place the AV user strictly liable in case of accidents and thereby oust others from the liability loop.

Indeed, this option has its own set of drawbacks, especially on the question of the validity of the contract. Whether the AV is entering a contract with the user in its own right or on behalf of its principal. However, this issue is outside the scope of this article that warrants for another detailed research on agency. Another possible hurdle to this option is that it will limit the use of AV for the disabled and elderly. AV users would be placed in a 'no choice' situation where they would have to just agree with the dictated contractual terms to avoid interruptions in their mobility. AV users will also shy away from AV, fearing to shoulder legal liability.

CONCLUSION

Both AV manufacturers and AI developers are working around the clock to create a new driving experience through AV. AV operates on an advanced AI system. AI techniques allow AV to learn from its environment, process data, and react according to its required environment. Sometimes AVs are bound to make miscalculations and error in their judgment, which result in accidents. The conventional legal methods are not sufficient to resolve issues concerning the liability in AV accidents. Therefore, the conventional structure of the law must be reviewed to fit the modern technology advancement. The standard legal framework's operational failure will leave victims helpless and unable to seek relief from the tortfeasor. For that reason, alternative methods are necessary. The no-fault liability scheme can be an appealing approach for AV, yet it will create new forms of accidents that are not accustomed by the law. The digital peculium will function as a coffer for the victim to seek relief for the damage caused by the AV. Meanwhile, special zones ought to be established so that any AV can be tested within the special zones, thereby reducing accidents once it is out for the consumer market. Another option is to allow strict liability to be enforced on AV users by way of contract. The user will be directly responsible for road accidents involving AV and spare legal discussion in identifying the responsible tortfeasor liable to pay damages. However, the alternative approaches highlighted herein will entail advantages and drawbacks, calling for further cost-benefit analysis and research.

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