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RESEARCH ARTICLE

Statistical Research of the Factors Which Affect the Acceptance of Advanced Driving Assistance System among Youngsters

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ABSTRACT

The automotive industry has witnessed significant growth over the course of over a century since the inception of the first car and so has the frequency of car accidents. The Advanced Driver Assistance System (ADAS) has emerged as a significant invention in aiding drivers in preventing accidents. This technology is gradually being integrated into newly built automobiles. This study examined and developed a model for the acceptance of ADAS systems among young people in TARUMT, considering external factors, based on the literature review and technology acceptance extension models such as TAM and UTAUT. Additional elements that will influence the acceptance of the ADAS system among young individuals are also considered. To verify the model, we employ PSPP to determine the Pearson's Correlation for each element. This study reveals that various factors, including Social Norm, Trust rank, enjoyment, attitude, and Perceived Usefulness, exhibit a significant correlation with Behavioral Intention. Additionally, Perceived Ease of Use, Perceived Usefulness, Safety Risk, Privacy Risk, Individual Innovation, Environmental Protection, and Symbolic Value demonstrate a significant correlation with Attitude. Furthermore, Reliability exerts significant influence on Perceived Usefulness, Enjoyment is significantly related to Perceived Ease of Use, and Perceived Ease of Use exhibits significant correlation with Perceived Usefulness. We employed an online questionnaire developed using Google Form for data collection and distributed a link to friends who are also studying at TARUMT. 162 sets of answers was gathered. The proposed model offers enhanced survey models and assistance to car manufacturers in gaining insights into the acceptance of Advanced Driver Assistance Systems (ADAS) among young individuals in TARUMT. This information can be utilised to determine areas for improvement in the research and development of ADAS systems. Additionally, it can serve as a valuable reference for the government in formulating more effective policies pertaining to ADAS systems.

INTRODUCTION

As we enter the 21st Century, the automotive industry has been around for nearly 100 years, the sheer number of quantities of vehicles has skyrocketed as proportional with the number of accidents occurring. Manufacturers have implemented numerous safety features over the years, and it has helped to reduce the number of accidents as compared year by year. For the past decade, Advanced

Drivers Assistance System (ADAS) has been developed and adapted by various car manufacturers over the past decade (HLDI, 2022) with ADAS Components such as Forward Collision (FCW), Automatic Emergency Braking (AEB), Lane Departure Warning(LDW), Blind Spot Monitoring (BSM), Rear Cross Traffic Alert (RCTA). HLDI (2022) mentioned features are the ones that contributed to reduced road accidents. From a bulletin released by Highway Loss Data Institute (HLDI), cars by manufacturing year starting from 2012 to 2021 from 12 manufacturers and maintain the variables such as price, size, class, model year as close as possible, shows a rising trend in the implementation of ADAS system in the passenger cars and regardless of the features is a basic, optional or not available (HLDI, 2022; Tirupal et al., 2024).

As we scope down to Malaysia, the Ministry of Transport Malaysia has launched a Road Safety Plan from 2022-2030 emphasis that the implementation of ADAS system has the potential to reduce road accidents, for example BSM able to provide appropriate warning to cars regarding the existence of motorcycles around the blind spot of vehicles, thus able to reduce minor road accidents. (Ministry of Transport Malaysia, 2022) From the information available, we can conclude that the ADAS system has been slowly integrated into modern cars and plays a big role in reducing road accidents.

As a clarification for readers with insufficient technical knowledge about the relationship between ADAS system, Smart Cars and Autonomous Vehicles, we would like to clarify that ADAS system is the basis of Smart Cars and Autonomous Vehicles, Cars with ADAS system, connectivity features are already can be considered as Smart Cars as well as Autonomous Driving features also can be considered as Smart Cars (Zeng et al., 2023). Autonomous Vehicles at the point of time this research has been carried out are still not available for the mass public and still in prototype variants which are not legal to be on the public roads. To achieve the status of Autonomous Vehicle which is L5 standards. According to the standards recommended by Society of Automotive Engineers (SAE), Vehicle Automation has been categorised into 6 levels which starts from L0, manual driving with no assistance, and L5 is full automation of the vehicle in which driving tasks are performed by the vehicle without human interaction or attention is required. For cars with the ADAS system, it is being certified on L2, partial automation, in which vehicles can perform steering and acceleration and braking. The driver must be prepared to intervene anytime and be alert to the situation.

The purpose of this research is to find out the factors that affect the acceptance of the ADAS system among youngsters and find out what is the correlation between each of the factors. We wanted to create this research as most of the research paper targets the audience of middle-aged to senior drivers and mostly in other countries not in Malaysia. This is due to different regions having different drivers hence we decided to create this research paper focusing on Malaysian young drivers. This research paper is important in the sense that it allows car manufacturing companies who target Malaysia as their important market can have an insight of what their future customer thinks about the ADAS system as Malaysia is one of the countries that the number of registered vehicles is more than the total population hence indicates a big potential market. This research is also to provide insights for the government to table ADAS related policy to further accept this technology into our society.

1.1 Problem Statement

Investigate the acceptance of Advanced Driving Assistance System ADAS amongst youngsters of TAR UMT as the existing studies found out that there is a low acceptance of Autonomous Vehicles among Malaysian Consumers which in the context of Autonomous Vehicle is built on top of level 5 ADAS technology. This study intends to offer insight about the knowledge of ADAS among TAR UMT youngsters as part of justification for car manufacturers to further develop this technology. ADAS technology is new and the exposure and knowledge among youngsters is still unknown, in order to fully utilise ADAS, users shall understand the feedback given by the ADAS and carry out appropriate action while driving.

1.2 Research Objectives

This research aims to explore the relationship between technology acceptance components (perceived usefulness, perceived ease of use, safety risk, privacy risk, individual innovation, environmental protection, symbolic value, enjoyment, trust rank, social norm, and reliability) with the youngster's attitude and behavioural intention in ADAS system adoption.

2.0 LITERATURE REVIEW

The advent of Advanced Driving Assistance Systems (ADAS) represents a significant step towards increased safety and efficiency in transportation. As a promising technological advancement, user acceptance, particularly among youngsters, constitutes a critical dimension for its mainstream adoption and subsequent impact. This literature review critically examines existing studies on the key factors influencing young individuals' acceptance of ADAS. The literature was identified through systematic keyword search in databases like ScienceDirect, IEEE Xplore, JSTOR, and Google Scholar using terms such as 'ADAS', 'technology acceptance', and 'influencing factors'. Additionally, to ensure currency, a timeframe was set from 2015 onwards.

ADAS comprises a suite of technologies integrated into modern vehicles, ranging from adaptive cruise control to lane departure warning systems. These innovations aim to bolster road safety and mitigate accidents, presenting a significant advancement in automotive technology. Research shows that ADAS Advanced Driver Assistance Systems (ADAS) proved a potential to save lives and reduce serious injury in traffic accidents. But if they are not known and accepted by the drivers, they will not deliver the benefits intended by their designers (Viktorová & Sucha, 2018).

Perceived Ease of Use & Perceived Usefulness

Furthermore, according to research published, we found out that perceived ease of use and perceived usefulness in ADAS is similar in affecting the acceptance of ADAS among its users. (Kaye et al., 2022; Wozniak et al., 2021; Li et al., 2022; Gunther & Proff, 2021) Kaye et al. (2022) mentioned that users who have information regarding ADAS at the point of sales either by salesman and it will affect the perceived ease of use and perceived usefulness of ADAS and account for 40% of the user's intention to use and acceptance of ADAS. Meanwhile, Wozniak et al. (2021) mentioned that the use of ADAS able to reduce the workload of Police Driver and trust ADAS able to improve their safety while driving and allow police driver to perform more secondary task while driving on pursuit or rounding while driving which relates to the perceived usefulness of ADAS. This research also shows extensive exposure to ADAS features can lead to better appreciation towards the ADAS and results in perceived ease of use towards ADAS. This might be the same case for police drivers and civilian drivers when it comes to the effectiveness of exposure to ADAS on their willingness to use ADAS.

Another research by Li et al. (2022) mentioned that driving skills of a driver will also affect the perceived ease of use of ADAS features on being projected on AR-HUD of a vehicles, they concluded that driver's with better driving skills are able to process the information input by the connected AR-HUD and the perceived usefulness of the information including ADAS feature being projected on the AR-HUD is a useful information towards the driver, hence, driving skills will affect the driver's evaluation towards the ADAS. Gunther & Proff (2021) found that age also has an influence towards the perceived ease of use and perceived usefulness towards acceptance and use of ADAS. For older individuals, perceived usefulness and perceived ease of use has a greater influence on the intention to use an acceptance of ADAS. They found out that the ADAS features such as Cross Traffic Alert, Park Distance Control, and trust towards the technology will affect the perceived usefulness of the technology for the age group 50-59 years. This research summarises that perceived usefulness is more important for younger than older driver on acceptance of ADAS especially for the age group from 60-69 years benefits the most as they are starting to suffering from physical deficits more frequent than younger drivers which compensated by ADAS to convey a pleasant and safe driving environment, as for driver elder than 59 years they are used to driving without any technical assistance hence the technology does not make too much sense to them.

Based on the research from Zeng et al. (2023), enjoyment will affect the perceived ease of use and reliability will affect perceived usefulness. Enjoyment is significantly positively correlated with PEOU ($E = 0.541$, $P < 0.05$) and Reliability is significantly positively correlated with PU ($E = 0.348$, $P < 0.05$).

Behavioural Intention

Based on the research that the public have made, performance expectancy, social influence, perceived usefulness, Driver's Belief of usefulness are associated with the behavioural intention to use ADAS system. A study conducted by Nordhoff et al. (2020) revealed that the average rating for the intention

to use a conditionally autonomous automobile is greater than the intention to purchase one among a sample of 17,400 vehicle owners. The primary factor that strongly predicts an individual's intention to use conditionally automated cars is hedonic motivation. This refers to the belief that individuals who find these cars enjoyable are more inclined to use them. Additionally, social influence plays a role, as individuals are more likely to be influenced by important people in their social network who already use conditionally automated cars.

In a study conducted by Chada et al. (2023), it was discovered that the perceived usefulness of a predictive eco-driving assistance system (pEDAS) is the most influential factor in determining individuals' intention to use it. If people believe that pEDAS is beneficial for their daily commute, such as improving fuel efficiency, reducing speeding, and minimising time spent at traffic lights, they are more likely to use it. These perceived rewards and performance benefits ultimately contribute to the intention of using pEDAS.

Furthermore, Zeng et al. (2023) have done a research based on the acceptance of ADAS among middle-aged and elderly people. Based on their study, Social influence ($E = 0.112$, $P = 0.038 < 0.05$), Perceived usefulness ($E = 0.217$, $P = 0.004 < 0.05$), Enjoyment ($E = 0.191$, $P = 0.026 < 0.05$), Attitude ($E = 0.483$, $P < 0.05$) and Trustrank ($E = 0.033$, $P = 0.638 > 0.05$) both have a significant positive correlation with Behavioral Intention. In our study, we will do the research about the Social influence, Perceived usefulness , Enjoyment, Attitude and Trust rank among youngsters.

Safety Risk

According to a statistical report from the World Health Organization(WHO), each year nearly 1.3 million people die and million more are injured from car accidents, mostly in low- and middle-income countries (World Health Organization, 2023). The ADAS is developed to improve drivers' attention and risk perceptual ability by guiding their driving behaviour and pre-accident human errors (Lyu et al., 2020). A research paper investigating between the driver using the ADAS system and the driver who does not use them. The result shows that the drivers who use ADAS will decrease the perceived accident probability and increase perceived controllability for risky driving situations (Hagl & Kouabenan, 2020).There are many systems included in the ADAS to help increase the safety on the road. For example, Blind spot Monitoring, Adaptive cruise control, Automatic Emergency Braking and so on. In Europe, all vehicles made by 2022 must feature a set of systems above (Press Corner, 2019); in the United States, 92.7% (American Automobile Association, 2019) of vehicles have integrated at least one ADAS system. Another study has shown that the use of ADAS systems have reduced the six most frequent car accident types. According to the study, the lane departure accidents have reduced 26.2% using the Line Departure Warning, the intersection accidents reduce the highest percentage which is reduced 28% using Automatic emergency braking (Masello et al., 2022). All the previous studies have shown that the ADAS can improve the safety on the road. However, this study will discover the view of youngster towards the safety risk about ADAS.

Reliability

The reliability of ADAS is closely tied to trust in the ADAS. Non-ADAS owners who are more knowledgeable about the system will have less trust in it (DeGuzman & Donmez, 2021). This is because they will be more aware of the ADAS's limitations but will not have direct interaction with them. Furthermore, ADAS reliability is determined on how well the driver understands ADAS. Greater conceptual understanding enables drivers to forecast the behaviour of automation based on their experience (Papis et al., 2019). For example, they understand what to do when a specific danger alarm sounds. The limitations of ADAS-equipped vehicles will have an impact on their reliability. One of the disadvantages of ADAS is that it heavily relies on numerous sensors to provide information. A study has investigated the impact of rainfall on ADAS and they concluded that the ability of ADAS sensors to identify and recognize lane information will decrease rapidly by the rainfall (Roh et al., 2020). Our study aims to explore the perceptions of young drivers regarding the reliability of ADAS and examine how these perceptions influence their acceptance and adoption of this technology.

Attitude

Attitude is defined as a person's emotional condition towards using new technology. There is a study investigating the factors that influence the acceptance of ADAS using TAM questionnaire. The results of the study showed that there are two primary factors which influence the acceptance which is

Attitude and Perceived usefulness (Voinea et al., 2020b). Furthermore, another research study from (Liang et al., 2020b) examined the factors affecting the seniors' attitude toward adopting ADAS after substantial driving exposure. The finding showed that safety is the main concern of seniors' drivers and the user interface of ADAS should be accommodated to senior drivers. Providing training programs will help them to have positive change in attitude because of lower concern about false alerts, and trust in the effectiveness of the systems (Liang et al., 2020). Based on the previous study among middle-aged and elderly people, Zeng et al. (2023) found that Safety risk, Privacy risk, Symbolic value, Environment Protection, Individual innovation, Perceived usefulness, Perceived ease of use will affect the attitude of drivers towards the acceptance of ADAS system. They found out that Safety risk ($E = -0.031$, $P = 0.598 > 0.05$) and Privacy risk ($E = -0.023$, $P = 0.655 > 0.05$) have the negative significant negative correlation with Attitude. On the other hand, Symbolic value ($E= 0.158$, $P = 0.002 < 0.05$), Environment Protection ($E = 0.126$, $P =0.046 < 0.05$), Individual innovation ($E = 0.293$, $P <0.05$), Perceived usefulness ($E = 0.277$, $P < 0.05$), Perceived ease of use ($E = 0.201$, $P < 0.05$) have positive significant negative correlation with Attitude.

Individual Innovation

ADAS technology is influenced by several factors, one of which is individual innovation. Individual innovation plays a crucial role in the acceptance rate of ADAS. Driver innovation can be understood as the process by which individual drivers or groups of drivers develop novel solutions to challenges encountered in driving contexts. While innovation traditionally implies technological advancements, in the context of driving, it extends beyond technology to encompass new approaches, techniques, and behaviours that enhance safety, efficiency, and sustainability on the roads .Several studies have identified various manifestations of driver innovation. These include the development and adoption of advanced driving techniques to optimise fuel efficiency, reduce traffic congestion, or enhance safety. Additionally, drivers may innovate by customising their vehicles with aftermarket accessories or modifications to meet specific needs or preferences (Zeng et al., 2023). Research suggests that several factors contribute to driver innovation. These include individual characteristics such as personality traits, attitudes towards risk-taking, and levels of driving experience. Environmental factors such as traffic conditions, infrastructure design, and regulatory frameworks also play a significant role in shaping opportunities for driver innovation .Driver innovation has far-reaching implications for road safety, efficiency, and sustainability. Innovative driving techniques and behaviours can contribute to the reduction of traffic accidents, congestion, and environmental impact. Moreover, driver-led innovations may inform the development of future transportation policies, technologies, and infrastructure designs aimed at promoting safer, more efficient, and sustainable mobility solutions (Cai & Li, 2018).

Environmental Protection

For environmental protection, Various studies have highlighted the integration of ADAS with eco-driving techniques as a means to minimise fuel consumption and emissions. These systems provide real-time feedback to drivers, encouraging smoother acceleration, deceleration, and optimal speed, consequently reducing environmental footprint (Fleming et al., 2018). ADAS systems such as adaptive cruise control (ACC) and traffic sign recognition contribute to optimising traffic flow, thereby reducing stop-and-go traffic patterns and idling, which are major contributors to emissions (Liu et al., 2017).In recent research, a novel approach was presented for the automatic generation of predictive models aimed at forecasting the power behaviour of GPU-based (Graphic Processing Units) edge data centres during runtime, particularly for real-time data analytics applications (Perez et al., 2019). The study utilised real traces of traffic demand and a real CNN-based (Convolutional Neural Networks) application profile on actual GPU devices to validate the effectiveness of the proposed method. Through the integration of Deep Learning techniques, the developed model achieved a remarkable accuracy, with an Normalised Root Mean Square Deviation (NRMSD) error of less than 7.4%. The modelling strategy involved combining a traffic demand prediction model based on Recurrent Neural Networks with a power estimation model based on Feedforward neurons, reflecting the intricate relationship between demand and energy consumption. Application of the predictive model to a scenario involving an edge data centre with 1,534 GPUs demonstrated energy consumption estimation errors below 2.3 kWh when compared against actual traffic data spanning 461 days. This research not only contributes to understanding and optimising energy efficiency in

edge data centres but also holds promise for enhancing the performance of service-oriented applications in the burgeoning field of edge computing.

Privacy Risk

Privacy risks represent a significant concern in the implementation of Advanced Driving Assistance Systems (ADAS), despite their manifold advantages. Akca et al. (2020) underscore the importance of General Data Protection Regulation (GDPR) compliance, emphasising principles such as lawfulness, transparency, and data minimization to safeguard individuals' rights and regulate data collection and usage in ADAS. Van Huynh (Le et al., 2018) draw attention to privacy vulnerabilities in automobile applications, particularly the transmission of personally identifiable data like car IDs and location information for Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communication, stressing the necessity for ensuring location and ID privacy in automotive platforms. Furthermore, Mehta et al. (2024) examine the threat landscape, highlighting the potential risks posed by unauthorised access and malware attacks targeting ADAS systems. They elucidate the susceptibility of roadside and onboard equipment to malware assaults, especially within Vehicle Ad Hoc Networks (VANETs), and the consequential disruptions and impacts on system functionality. These studies collectively underscore the critical need for robust privacy measures to mitigate the inherent risks associated with ADAS deployment.

Trust rank

Trust from drivers is one of the factors from accepting ADAS. Research shows that trust can affect a person to accept using ADAS, drivers were split on opinions about how trustworthy, and dependable and reliable ADAS systems are in their vehicles (Attuquayefio, 2023). Specifically, drivers who experienced both LDW and LKA systems showed a significantly higher level of trust than those who only used the LDW system. This might be because the LKA system provides control assists and drivers can get automatic but gentle corrections of their unintended errors when needed (Yu et al., 2021). Increased ratings of trust over time associated with length of ownership may have implications for the rental and car-sharing industries, where drivers may not have the time to acclimate to the ADAS technologies available on the vehicle (Lubkowski et al., 2021).

Enjoyment

The way we travel is about to undergo a transformation as vehicles equipped with advanced driving automation technology become more widely available. In this particular scenario, driving enjoyment is probably going to be important in such a novel and creative setting. This specific kind of hedonic motivation is called Perceived Driving Enjoyment (PDE) (Panagiotopoulos et al., 2020). As found in the literature, hedonic motivation has been shown to be one of the most important factors influencing consumers' acceptance of technology across a variety of sectors (Venkatesh et al., 2012). In the context of automation in vehicles, according to the study of Madigan et al. (2017), hedonic motivation, or users' enjoyment of the system, was the strongest predictor on consumers' behavioural intentions to use ARTS.

Social norm

The adoption of autonomous driving is expected to be influenced by social factors, as is the impact of subjective norms on perceived utility, which is positively correlated with attitude and, ultimately, intention to utilise autonomous driving. We could not identify a direct, statistically significant prediction of the influence of subjective norm on attitude and intention to use autonomous driving, despite prior research showing a significant effect of subjective norm on the intention to use autonomous driving (Buckley et al., 2018a). Subjective norms, or the "tendency to interpret information from important others as evidence about reality," have an impact on how valuable technology breakthroughs are viewed through specific internalisation effects. Inexperienced individuals are likely to be influenced by the opinion of third parties in the formation of acceptance (Nastjuk et al., 2020). Social norms can have a more significant influence on purchase intention when an innovation is publicly embraced than when it is enjoyed privately. As a result, societal norms are expected to have an impact on the acceptance of emerging AVs, which has the interest of numerous academics. The collected literature includes nine studies that examined the impact of social norms on intention. Out of them, five stated that social norms directly affect conduct intention. In a similar vein, Acheampong and Cugurullo (Acheampong & Cugurullo, 2019) discovered that social norms

have an indirect impact on the adoption of AVs through perceived benefits and ease of use. Meaning that people's opinions about how practical and simple it is to utilise AV are influenced by societal norms as an antecedent. The acceptance of AVs is directly affected by perceived ease of use and perceived benefits.

Symbolic value

Symbolic value can be regarded as a kind of self-identity, meaning that consumers can reflect and communicate their social and personal identity when they own or use innovations (Jing et al., 2020). It has been established that cars are seen as expressions of social status and power. Several scholars have studied whether self-identity affects consumer acceptance of autonomous driving (Salau et al. 2021). According to research conducted by Shabanpour et al. (2018), people are influenced by their social surroundings and use AVs to draw attention to their social standing. Furthermore, people frequently follow the latest social media trends. Some respondents are open to accepting AVs because they believe that their trendiness will become apparent through the application of innovations. In contrast, symbolic value is not expected to have a significant impact on acceptance intention in the AJT study. He clarified that people who want to drive for enjoyment might not find AVs to be suitable. Private automobiles are symbolic in many contexts, and people in various countries place varying amounts of emphasis on them because of cultural differences. The establishment of an individual's image can occur through symbolic consumption. The item being consumed may be pricey or an innovative product, among other things. When an AV is released later in the market, some customers would buy one for sentimental purposes. However, research on people's symbolic attitudes towards autonomous vehicles is currently scarce. This trait could be the subject of future studies (Ting et al., 2023; Ahmad et al., 2024).

Conceptual Framework

From the literature review that we have studied, we came out a conceptual framework on Figure 1 that focuses on using TAM and UTAUT extension models and other external factors that. can affect the acceptance of ADAS among youngsters in TARUMT. We found out that Perceived Ease of Use, Perceived Usefulness, Safety Risk, Privacy Risk, Symbolic Value, Environmental Protection, Individual Innovation are correlated to Attitude. Next, Social Norm, Trust Rank, Enjoyment and Perceived Usefulness and Attitude are correlated to Behavioural Intention. Perceived Usefulness is correlated with Perceived Ease of Use. Reliability is correlated with Perceived Usefulness.

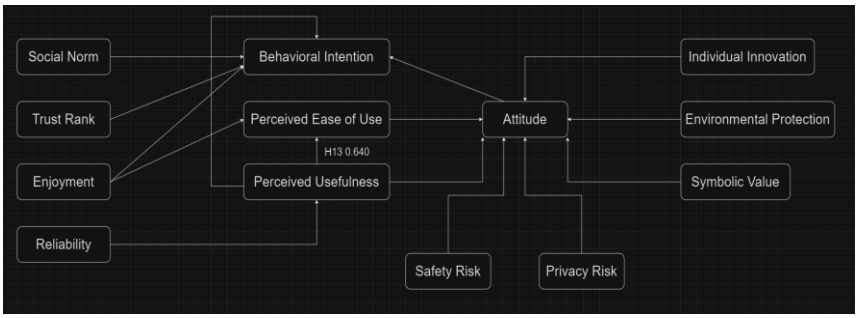

Figure 1. Conceptual Framework for this research study.

3.0 RESEARCH METHODOLOGY

This section describes the materials and methods we used to investigate the factors which affect the acceptance of Advanced Driving Assistance System (ADAS) among youngsters. In this statistical research study, we have chosen to investigate a specific population which is youngster scholars from Tunku Abdul Rahman University of Management and Technology (TAR UMT) of Kuala Lumpur branch. The main reason the population is chosen is because there are many youngster scholars from TAR UMT driving a car to the university compared to others university in Malaysia. The sample plan implemented in this investigation is sample random sampling (SRS).

The data collection method we chose in this investigation is google survey form. We have collected the data through face-to-face and share the google survey form in social media which are WhatsApp, Facebook messenger and Instagram to collect data from youngster scholars from Tunku Abdul

Rahman University of Management and Technology (TAR UMT) of Kuala Lumpur branch only. At the end of the data collection, 162 respondents participated in this survey.

The questionnaire we used for our study is designed to investigate the 4 personal factors and 13 variable factors that will affect the acceptance of Advanced Driving Assistance System (ADAS) among youngsters in TAR UMT of KL Branch, as shown in Table 1. A total of 47 questions were used to assess these factors and the details of the questionnaire will be shown on Table 1 which is adopted from (Zeng et al., 2023). The questionnaire will be distributed into four sections to let the participant fill in the survey form easily. All the question in the survey form will be assess using Likert 5-point scale (1= Strongly Disagree; 2= Disagree; 3= Neither Agree nor Disagree; 4= Agree; 5= Strongly Agree).The questionnaire will be distributed into five section which are: Section 1: Demographic information; Section 2: Perceived usefulness, Perceived ease of use, Attitude, Behavioural intention, Trust rank; Section 3: Safety Risk, Privacy Risk, Reliability, Social Influence; and Section 4: Symbolic value, Enjoyment, Environmental Protection, Individual Protection.

Table 1. Questionnaire items adopted in this research.

Factors	**Questionnaire Items**
Perceived usefulness	Q1. I think ADAS will make driving easier. Q2. I think ADAS will improve my travel efficiency. Q3. I think ADAS will improve my ability to travel. Q4. I think ADAS will improve my quality of life.
Perceived ease of use	Q5. I will quickly learn how to drive a car with ADAS. Q6. I think driving a car with ADAS will be quite simple. Q7. I don't think it will be difficult to operate a car with ADAS.
Attitude	Q8. I think driving a car with ADAS is a good idea. Q9. I think driving a car with ADAS is a wise choice. Q10. I think driving a car with ADAS will be enjoyable.
Behavioural intention	Q11. I will buy and use a car with ADAS when the technology matures. Q12. When the future technology matures, I will encourage relatives and friends to buy and use cars with ADAS. Q13. I will drive a car with ADAS if possible.
Trust rank	Q14. I believe cars with ADAS will reach their destination accurately. Q15. I think cars with ADAS will meet my travel needs. Q16. I think cars with ADAS will reduce the number of traffic accidents. Q17. I think cars with ADAS are reliable and trustworthy.
Safety risk	Q18. I am NOT concerned that cars with ADAS may cause traffic accidents. Q19. I am NOT worried that cars with ADAS will conflict and interfere with the surrounding vehicles. Q20. I am NOT worried that cars with ADAS will not be efficient for travel. Q21. I am NOT worried that cars with ADAS security are not ensured.
Privacy risks	Q22. I am NOT concerned that cars with ADAS will leak my private information. Q23. I DO NOT fear that cars with ADAS will use my personal information for other purposes without consent. Q24. I am NOT concerned that cars with ADAS will share your personal information with other users without my consent.
Reliability	Q25. I believe ADAS will not have many defects. Q26. I think the information prompted by ADAS is accurate. Q27. Overall, I think ADAS is reliable.
Social influence	Q28. The views and attitudes of friends and family towards ADAS will affect my use of them. Q29. The views and attitudes of the people around me about ADAS will affect my use of them. Q30. The government and media publicity will affect my use of ADAS.
Symbolic value	Q31. Driving with ADAS will make me feel very proud. Q32. Driving with ADAS will improve my social image. Q33. Driving with ADAS will make me more confident.

Enjoyment	Q34. I think driving with ADAS will make my life easier. Q35. I think driving with ADAS will be quite interesting. Q36. I think ADAS is very appealing.
Environmental protection	Q37. I think driving with ADAS is more environmentally friendly. Q38. I think ADAS can reduce energy consumption. Q39. I think ADAS can optimise exhaust emissions.
Individual innovation	Q40. I am willing to accept the changes brought about by ADAS. Q41. I'm curious about new things like ADAS. Q42. I often follow the latest developments in technology. Q43. Compared with the people around me, I am usually quicker to use new technological products or services.

4.0 RESULTS AND DISCUSSIONS

Based on the different research objectives from this study, Pearson Correlation method is used to study and analyse the hypothesis H1-H15, to ease up the hard work, statistical analysis tools such as PSPP is used to perform the analysis. As each factor consists of multiple questions, and each question consists of points from 1-5 points we must perform consolidation towards the points accumulated for each factor.

Cronbach's alpha is a measure used to assess the internal consistency or reliability of a set of scale or test items. We have used Cronbach's alpha to test the consistency and reliability of the questionnaire.($\alpha \geq 0.9$=Excellent; $0.9 > \alpha \geq 0.8$=Good; $0.8 > \alpha \geq 0.7$= Acceptable; $0.7 > \alpha \geq 0.6$=Questionable; $0.6 > \alpha \geq 0.5$=Poor; $\alpha < 0.5$=Unacceptable).

Table 2 shows the reliability analysis results we have tested using the PSPP tool. There are a total of 13 questionnaire items to be tested in the table. The results show perceived ease of use, attitude, behavioural intention, trust rank, enjoyment, and individual innovation are good ($0.9 > \alpha \geq 0.8$) reliability levels. Other than that, perceived usefulness, safety risk, privacy risk, reliability, social influence, symbolic value, and environmental protection both have better data reliability, which is excellent ($\alpha \geq 0.9$).

Table 2. Reliability level of questionnaire items

Questionnaire items sections	**Cronbach's alpha**	**Number of items**
Perceived usefulness	0.9	4
Perceived ease of use	0.8	3
Attitude	0.87	3
Behavioural intention	0.86	3
Trust rank	0.88	4
Safety risk	0.92	4
Privacy risks	0.93	3
Reliability	0.91	3
Social influence	0.9	3
Symbolic value	0.92	3
Enjoyment	0.85	3
Environmental protection	0.91	3
Individual innovation	0.87	4
Total	**0.97**	**43**

Table 3 shows demographic information gathered from a total of 162 respondents in this study. We have collected four types of demographic information from the respondents which are age, gender, driving experience and accident experience. Based on the results shown in Table 3, The majority of the participants fall within the age range of 21 to 22 years, which accounts for 46.9% and 12.3% of the total participants, respectively. This suggests that the study mainly involved young adults, with a smaller representation of participants aged 18 to 20 and 23 to 25.The study achieved a balanced gender representation, with 48.8% male and 51.2% female participants. This balanced gender

distribution ensures a comprehensive understanding of the research subject across genders. There are 92.6% of participants having driving experience and the higher percentage indicated that this study has been captured from individuals who have driving experience. Moreover, there are 40.1% of participants having car accident experience but 59.9% of participants do not have car accident experience. This statistic underscores the relevance of the study's focus on driving behaviour and safety.

Table 3. Demographic information of the participants.

Characteristics	Frequency (n)	Percentage (%)
Age		
18	11	6.8
19	11	6.8
20	23	14.2
21	76	46.9
22	20	12.3
23	8	4.9
24	11	6.8
25	2	1.2
Gender		
Male	79	48.8
Female	83	51.2
Driving Experience		
Yes	150	92.6
No	12	7.4
Accident Experience		
Yes	65	40.1
No	97	59.9
Total	**162**	**100.0**

Pearson Correlation Analysis

From the research of Table 4 and Figure 2, we found out that Perceived Usefulness, Perceived Ease of Use, Safety Risk, Privacy Risk, Individual Innovation, Environmental Protection, Symbolic Value have significant correlation with Attitude. Hence, H1, H2, H3, H4,H5,H6,H7 is accepted, As a comparison to other research that have been made, other than Safety Risk and Privacy Risk is being negatively correlated to Attitude, the others factors are consistent with research made by (Zeng et al., 2023), Furthermore, we found out that Perceived Usefulness, Attitude, Enjoyment, Trust Rank, Social Norm have significant impact towards Behavioural Intention of the particular youngster towards the acceptance of ADAS system. Hence H8,H9,H10,H11,H12 is accepted for our research, this is also shown in research made by (Zeng et al., 2023). Next, Perceived Usefulness has significant correlation with Perceived Ease of Use, Reliability has significant correlation with Perceived Usefulness and Enjoyment is also a factor highly affecting Perceived Ease of Use which respondent thinks that it can be factors that can affect the acceptance of ADAS system, hence, H13, H14, H15 are accepted respectively. This is consistent with the research by (Zeng et al., 2023). From the analysis, we can conclude that all the hypotheses are accepted as the factors stated in the hypotheses have significant correlation with each other.

Table 4. Pearson Correlation of Hypothesis

Hypothesis	Pearson Correlation / Sig.(2-tailed)	Hypothesis Result
H1	(E = 0.761)*** / P = 0.000	Supported
H2	(E = 0.704)*** / P = 0.000	Supported
H3	(E = 0.402)*** / P = 0.000	Supported
H4	(E = 0.349)*** / P = 0.000	Supported
H5	(E = 0.531)*** / P = 0.000	Supported

H6	(E = 0.432)*** / P = 0.000	Supported
H7	(E = 0.368)*** / P = 0.000	Supported
H8	(E = 0.635)*** / P = 0.000	Supported
H9	(E = 0.721)*** / P = 0.000	Supported
H10	(E = 0.564)*** / P = 0.000	Supported
H11	(E = 0.743)*** / P = 0.000	Supported
H12	(E = 0.489)*** / P = 0.000	Supported
H13	(E = 0.640)*** / P = 0.000	Supported
H14	(E = 0.471)*** / P = 0.000	Supported
H15	(E = 0.504)*** / P = 0.000	Supported

*** indicates high significant P <= 0.000

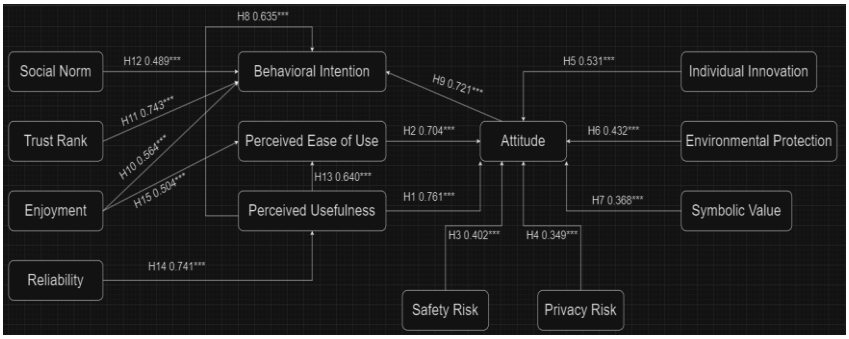

Figure 2. Pearson Correlation Results

DISCUSSION

As from the previous study, we do not find out any of the factors that are the most influential that affect the acceptance of the ADAS system among drivers. This is because the ADAS system is a system that integrates technological advancement and comprises a huge factor of Human Computer Interaction to properly serve the purpose of ADAS, we found out that those factors from hypothesis affects each other in the acceptance of ADAS. The respondent comprises youngsters with minimal driving experience but living in a tech-surrounded environment and having adaptability towards changes of environment and technology, thanks to the tech era, youngsters are more eager to adapt to new technology.

They also believe that driving cars with ADAS system can allow them to drive more efficiently and drive with ease as ADAS system is not difficult to learn and use, moreover due to their lack of driving experience, hot tempered attitude and easily influenced by emotion while driving, ADAS can serve as a supporting mechanism for them to drive safely while on the road and reduce accidents. Other than that, they also believe in the development of an ADAS system able to protect their privacy information and the maturity of the technology which it performs reliably and would not have big mistakes within its capabilities. They are confident in the technology mainly because there is not really much recent news related to failure of ADAS which can cause catastrophic events as well as car manufacturers not releasing technology which is not properly tested and developed. This can be seen on Table 5 the factors Safety Risk, Privacy Risk and Reliability with a Mean Value of 13.42, 9.88, 10.74 respectively which are the highest among all the factors. Finally, driving cars with ADAS features have influence on their symbolic value on their social status, they also think that the social influence such as opinions from their friends and family might affect them to drive cars with ADAS features too and driving cars with ADAS features allow them to feel pleasurable while driving.

Table 5: Descriptive analysis of SR, PR, RL

	N	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
SR	163	13.42	3.95	4.00	20.00
PR	163	9.88	3.12	3.00	15.00
RL	163	10.74	2.73	3.00	15.00

5.0 CONCLUSIONS

Based on the findings from the study, it is evident that there is no single dominant factor influencing the acceptance of Advanced Driver Assistance Systems (ADAS) among drivers. The integration of technological advancements and human-computer interaction within the ADAS system creates a complex interplay of factors affecting its acceptance. The study focused on young drivers with limited experience but high adaptability to technological advancements, typical of individuals in a tech-centric environment. This demographic showed a positive attitude, behavioural intention, and trust towards ADAS systems, as reflected in the mean values obtained. They perceive ADAS as a tool to enhance driving efficiency, ease, and safety, especially considering their lack of experience, tendency towards emotional driving, and the belief that ADAS can mitigate risks and reduce accidents. Furthermore, respondents expressed confidence in ADAS technology's ability to safeguard privacy, ensure reliability, and mitigate safety risks. The absence of widespread reports on ADAS failures and the assurance that manufacturers rigorously test and develop these systems contribute to this confidence. Additionally, the symbolic value of driving cars equipped with ADAS features, along with social influences from peers and family, further enhances the acceptance of ADAS among young drivers. The pleasure derived from using ADAS features also contributes to their positive perception.

Although this study has made certain contributions, it also has some limitations. Firstly, the sample size in this study is relatively small, and a larger sample size would be beneficial for generating more reliable and comprehensive results. However, many previous studies have shown that interesting results can also be obtained from small sample studies. Therefore, in future research, we will try to increase the sample size as much as possible to make for more accurate outcomes. Secondly , the analysis has shed light on various factors influencing the decision-making process, it's essential to acknowledge the limitations. By excluding the affordability component, the holistic understanding of the issue may be compromised, potentially leading to incomplete solutions. Therefore, future research and decision-making processes should strive for a comprehensive approach, considering all relevant factors to ensure effective and sustainable outcomes. The research indicates a predominantly favourable attitude towards ADAS systems among young drivers in the TARUMT region. This underscores the importance of continued research and development in ADAS technology to address evolving user needs and preferences while promoting road safety and efficiency.

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