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A Future Study on the Adoption of Hologram Traffic Light for Reducing Accidents in Malaysia

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Abstract: Three-dimensional hologram is a system that consists of a virtual holographic wall that can reduce reckless drivers at traffic lights. The concept is based on a laser projector that only shows images of moving pedestrians, visible with a light red-light laser to drivers in front of it. Even with regular traffic lights, it is impossible to reduce traffic accidents. The current study is also focused on road users how to reduce accident, and there is still a lack of research on the following perspectives of hologram traffic lights in Malaysia. Due to the increasing number of vehicles on the highway, the function of traffic lights is critical, and their presence is required to maintain traffic order. When driving, the driver must pay attention to the color of the traffic lights. Hence, this research aims to identify the level of road users to maintain the safety of pedestrians and vehicles if we use hologram traffic lights in Malaysia. Furthermore, holographic traffic lights will aid communication between vehicles and pedestrians in high-risk regions. The sample was gathered using a quantitative research method that included a self-administered questionnaire and an internet survey. All of the gathered data was examined using the Statistical Package for Social Science (SPSS) to create quantitative results in frequency, percentage, mean and standard deviation. These study research ways to decrease accidents by employing hologram traffic lights for drivers.

Keywords: Hologram traffic light, Reduce accidents, Hologram

1. Introduction

Despite advances in traffic signal technology, little has been done to improve the visual warnings provided to vehicles by the systems. The traditional three-light scheme is used in most nations for traffic signals. The lights, which are typically six inches in diameter, do little to attract the attention of distracted drivers (Bellamy, 1980). Halt signifies red, prepare to stop or be cautious means yellow, and go green (Luminocoin,2018). Vehicles which greatly facilitate people's daily lives while also causing traffic congestion are no longer a luxury for people as the modern economy develops (Li &

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Sun,2021). Smart transportation emphasizes integrating fully transportation systems into city development and is not limited to existing transportation system functions. Instead, it collects and analyses massive amounts of traffic data, emphasizing the approach to real-time performance, human-computer interaction, and diverse service objects (Zhang *et al*., 2014). The three-light system takes the place of an innovative innovation called the Digital Ad Wall, which permits a clear holographic system (Luminocoin,2018). The idea will be more efficient than conventional traffic lights even though travelling through a hologram of people is significantly more challenging psychologically (Izady,2015). Hologram traffic lights are deployed at junctions to lower auto accidents. These hologram traffic lights will improve signal visibility from a distance. A hologram is an image of a light field that is used to display a fully three-dimensional image of the holographic subject without the need for special glasses or other intermediary optics, as opposed to an image made by a lens (Luminocoin,2018). According to a recent data from the Malaysian Social Security Organization (SOCSO), there were 1500 more incidents of commuting accidents between 2008 and 2012. As a result, there have been more fatalities, a lot more compensation claims and valuable talents have been lost (Selamat & Surienty, 2015). The usage of hologram technology in Malaysia could reduce the number of accidents on the road. In addition, traffic laws and holographic traffic lights can be employed to lessen the effects of congestion on public transportation. This entails implementing traffic limits that benefit public transportation and eliminating those that do not (Crowd sourced transport, 2019).

The holographic projection can be seen in different sizes and is positioned on the sidewalk in the same location as the corresponding real-world object. Advanced algorithms enable the optical system to project holograms on many levels. As a warning system, a concealed street sign, for instance, might appear as a holographic projection in relation to its true position behind the blockage (University of Cambridge, 2021). Due to its pleasant 3D viewing that spares the user from motion sickness or eye strain, it also offers a wearable Augmented Reality experience that rivals the market leaders. Park (2009) defined projection geometry as the geometric relationship between 3D objects and the view image at the image plane. They numerically recreated the 3D image integration process of integral photography using Fresnel diffraction theory and produced a complex field of an integrated 3D image from the elemental photos. This study could help the enforcer to understand the traffic light situation. Besides, it maintains the safety of pedestrians and vehicles so that they are more vigilant. Several places are associated with intersections, crossings, school zones, and other places frequented by cars and pedestrians; traffic lights will help communicate about risk areas for drivers and pedestrians. Using this study, this research will improve road safety and reduce accidents by using holographic traffic lights.

2. Literature Review

2.1 Hologram traffic light

Traffic light is a signaling device that is important to control traffic flow at intersections, roads, pedestrian crossings, and other locations (Park *et al*.,2009). We propose an idea that incorporates several aspects of these future ideas and our own. These traffic lights are designed to run on solar power and electricity generated by a piezo sensor. Holographic displays that display colors (red, yellow, and green) to signal the driver what to do will replace the trademark LEDs in traffic lights. The goal is to design a traffic light that will make driving more accessible and more efficient (Nelson,2014). In addition, traffic signals need to be changed to prevent overrunning and create a safer society. To ensure safe mobility, an advanced traffic light system should be employed in place of conventional traffic lights. For a safer driving experience and improved traffic awareness, numerous systems must be put in place, and countless designs must be deployed. It will advance transportation and raise the standard of the traffic system (Tandon *et al*.,2018). Holograms present a fully three-dimensional image of the holographic subject without the need for special glasses or other intermediary optics since they are photographic records of a light field rather than images made by lenses. Large electronic advertising signs obscure

conventional traffic signals, and the emphasis is lost at crossings where lights are less visible. This is a whole new high-tech advance in traffic management. The psychological effects of reenacting a visible obstacle in traffic (Sandeep,2019). Modern traffic signal technology keeps track of the number of vehicles per hour, the average speed per lane, and the number of trucks per hour.

According to Bellamy (1980), holography is a method for producing accurate three-dimensional images. Due to television coverage, exhibitions in London and other places, and the public's curiosity about the presumably solid images seen in space, it has recently sparked the public's interest. Holography and the laser, the light source used to make a hologram, are closely related, which has piqued curiosity because lasers are viewed as one of today's wonders due to their quickly expanding applications and the amazing effects they can create.

2.2 Mechanism to Reduce accident.

A traffic accident involving one or more automobiles is known as a traffic accident. Other moving things, such as pedestrians or bikes, can also be involved (Law,2021). The consequences of injuries and deaths caused by road traffic accidents (RTAs) significantly impact a country's socio-economic development (Muthusamy *et al*.,2015). Despite breakthroughs in safety technologies, road traffic injuries increase rapidly year after year (Ghaffar & Ahmed, 2015). Sleep habits and disorders impact driving performance, and poor sleep quality and sleepiness while driving are linked to a significant number of road accidents. Obstructive sleep apnea (OSA) is a sleep disorder caused by a complete or partial airway obstruction during sleep, resulting in hypoxemia and a lack of restful slumber (Ebrahimi *et al*., 2015). Automobile accidents are complicated events caused by human, technical, and environmental factors. The frequency and severity of motor vehicle collisions in urban areas are influenced by the design of streets with traffic stop signs as well as the overall organization of road traffic control by traffic police (Vorko-Jović *et al*., 2006). Sex, age, experience, personality qualities, and other factors all contribute to the risk of motorcycle accidents. Motorcycling is undeniably more than a mode of transportation or a recreational activity. It could be an element of a rider's personal lifestyle that contributes to risky conduct and increased traffic accident involvement (Stanojevi,2020). Moreover, the effects of probable causative elements on accident occurrence are unknown. An algorithm was created to find out which putative cause factors have a major impact on these accidents. The system is also designed to analyze the chances of an accident occurring in a specific location (Ng *et al*., 2002). A large amount of data will be produced by intelligent transportation systems. The design and implementation of intelligent transportation systems will be significantly impacted by the large data that is produced, making them safer, more effective, and more profitable. This ITS will also aid in lowering accident rates (Zhu *et al*., 2019).

2.3 Three - Dimensional Hologram

A three-dimensional hologram is a photographic technique that records the light emitted by a body and then generates a realistic image known as a three-dimensional hologram. A point source of incandescent light or a two-channel transmission hologram is used to reflect and transmit the hologram. 3D holograms can be integrated into mixed reality on the road to help pedestrians and drivers on the road. The importance of this application is that it allows 21st century road users to experience realistic content through 3D Holograms, thereby decreasing the number of accidents in the traffic (Ramachandiran *et al*.,2019). Because of the interaction of quantum mechanics and gravity, the three-dimensional world must be an image of data that can be stored on a two-dimensional projection, similar to a holographic image (Susskind, 1995). Besides, FDAPA-Holograms can reduce the time required to identify the best hologram position from 64 ms to about 14 ms (Alresheedi and Elmirghani, 2015). In general, three-dimensional hologram (3DH) technology involves spatial displays that detach the display technology from the user and integrate it into the real environment. For several decades, this type of technology has been introduced with proven benefits, particularly in the fields of digital art and medicine, but it has yet to be explored in the context of road users (Barkhaya & Abd Halim, 2016).

According to the University of Cambridge (2021), instead of the 2D windscreen projections used in most head-up displays, it uses LiDAR data to create ultra-high-definition holographic representations of road objects that are beamed directly to the driver's eyes. While the technology is not yet checked in a car, slightly earlier tests, based on data collected from a crowded intersection in central London, showed that the hologram images appear in the driver's field of view according to their actual position, creating an augmented reality. This could have been especially useful when objects like road signs are obscured by large trees or trucks, allowing the driver to see through visual obstructions.

Hologram projection is a new wave of technology that will change how we see things in the future, having a huge impact on all aspects of life, including education and infrastructure. In general, a hologram is a three-dimensional record of the positive interference of laser light waves. Three-dimensional hologram (3DH) technology entails spatial displays that detach the display technology from the user and integrate it into the real environment (Elmarash, 2021). According to Vassallo and others (2017), to keep the hologram in its intended position. When actions are taken that may cause a shift in the hologram's pose due to errors in its simultaneous localization and mapping, the stability is measured. Actions that are more likely to be performed in a clinical setting are prioritized. This will be used to determine the most applicable future use cases for this technology and how to minimize errors when in use.

2.4 STEEPV Analysis

The STEEPV analysis is used to determine the major drivers and issues pertaining to the adoption of hologram traffic light in Malaysia. The issue and key drivers are categorized into six groups which are, social, technological, economic, environmental, political and values. this will provide a clear image of the research's issues and key drivers.

Table 1: Outputs of STEEPV Analysis

Factors	Total
Social	3
Technological	17
Economics	6
Environmental	2
Political	2
Values	4

2.5 Table of Merged Issues and Drivers

Table 2: Key Terms with Merged Issues and Drivers

No.	Issues and Drivers
1	Modern traffic light technology
2	Mixed reality
3	Minimize errors
4	Overshadow traditional traffic lights
5	Reduce accidents
6	Signaling device
7	Rider's personal lifestyle
8	Socio-economic development
9	Electronic advertising
10	Risk of motorcycle accidents

3. Research Methodology

3.1 Research Design

The data in this study were analyzed and interpreted using both quantitative and qualitative methods. Due to its traits and advantages, academics choose the quantitative approach (Daniel,2016). The information for this study is gathered via a questionnaire form. Data will be gathered from Malaysia's Road Transport Department via questionnaires. Data from respondents is helpful in examining information about prospects and options for satisfying needs. SPSS is hence the qualitative method's enlightened analysis technique. Future traffic light holograms may take care of a variety of crucial needs and problems.

3.2 Data Collection

Data for this study were gathered through both secondary and primary data collection. To get preliminary data, questionnaires are utilized. The road transport department in Malaysia will get the questionnaire. The analysis of a range of sources, including journals, articles, magazines, conference papers, websites, and theses, will be used to compile secondary data. To supplement primary data, this study will rely on the acquisition of secondary data. As a result, for optimal effectiveness, primary and secondary data are integrated (Tran & Khuc, 2021). For instance, primary data will provide freshness, correctness, and updating if secondary data is inherited and used as a basis.

3.3 Population and Sampling

A big group of individuals or objects being examined scientifically is referred to as a research population. In the best interests of the public, the researchers are acting. It also refers to a clearly defined collection of similarly specified individuals or things. A population is described by Allen (2017) as "all objectives or events of a particular kind that researchers are interested in learning more about." A population is a group of things or people on which research is done (Population of Cities in Malaysia, 2019). The Road Transport Department in Malaysia is the study's target demographic because it focuses on motorists and road users in Malaysia.

3.4 Research Instrument

A set of inquiries used to collect data from respondents is known as a research instrument. A questionnaire, observation, and reading are some of the study instruments. For the current investigation, the researcher must select an accurate and trustworthy tool. The questionnaire was selected for this investigation because it provided useful and straightforward data. The survey is divided into four sections which are Section A, Section B, Section C and Section D.

Table 3: Questionnaire's Structure

Section	Item
A	Demographics
B	The importance of adopting hologram traffic lights in Malaysia
C	The impacts of adopting hologram traffic lights in Malaysia.
D	The uncertainty of adopting hologram traffic lights in Malaysia

3.5 Data Analysis

The information has been compiled and arranged in a logical and understandable manner. The purpose of data analysis was to determine the research findings and determine whether the study's goals will be met. A questionnaire was used to gather the data from the primary sources, and the data will be evaluated using the descriptive analysis method and correlation analysis.

In the descriptive analysis, frequency, average mean values, and percentages are all shown. In this study, the researcher will employ descriptive analysis to ascertain how to extract population data from a sample. The data for this study's statistical analysis method were analyzedusing the SPSS software. Users have a variety of options with this tool for quickly examining data and putting scientific theories to the test. Additionally, the study should make use of percentage and mean to clarify its key findings and data information.

The Statistical Package for Social Science (SPSS) will be used to assess the outcomes. Researchers can carry out statistical analysis, text analysis, large-scale data integration, and othertasks using the software program SPSS. Researchers may use this software to get data on the most important drivers as rated by survey participants. The critical drivers will be set up and put to the test in an impact-uncertainty study. The main forces behind the impact-uncertainty study are the variables with the greatest impact and uncertainty.

The purpose of developing a scenario is to describe how a situation might turn out, including potential issues, trends, events, tactics, and future-related developments. Lessening the number of traffic accidents and increasing the number of people who follow the rules of the road are two ways to evaluate Malaysia's deployment of holographic traffic lights.

4. Result and Discussion

4.1 Results

This section described the results of the data analysis that was carried out through the distribution of questionnaire surveys. The data was analyzed using the Statistical Package for Social Science (SPSS) version 25 to determine the respondent's overalldemographic information as well as the mean of each issue and driver. From the highest to the lowest average, the obtained mean was ordered in descending order.In an impact-uncertainty study, the ten were chosen. Finally, in the next chapter, two drivers having the greatest impact and uncertainty will be used to buildscenario analysis.

(a) Response Rate

For this study, 70 respondents have been selected from the green building developers in Malaysia. The survey was sent out via email and social media platforms including WhatsApp, email and Instagram. Table 4.1 shows that 70 out of138 valid surveys were gathered. There is a 100.00 percent response rate.

(b) Demographic Information

A demographic analysis of responders is shown in Table 4. Compared to male respondents, female respondents made up most of the sample. Most of the respondents were in their 20s to 25 years old. Malay people made up over half of the respondents.Additionally, a larger percentage of respondents hold a driver's license, and most of them have less than five years of driving experience. Most of them are knowledgeable about hologram traffic light technology.

Table 4: Demographic Analysis

Item	Response	Frequency	Percentage
Gender	Male	54	50.9
	Female	56	49.1
Age	20-25 years	92	83.6
	26-30 years	8	7.3
	31-35 years	5	2.7
	36-40 years	0	0.0
	41-45 years old	3	2.7
	46 years and above	4	3.6
Race	Malay	69	62.7
	Chinese	16	14.5
	Indian	8	7.3
	Others	17	15.5
Driving License of Respondent	Yes	93	84.5
	No	17	15.5
Driving Experience	Less than 5 years	72	65.5
	6 years-10 years	27	24.5
	11 years-15 years	6	5.5
	16 years and above	5	4.5
Knowledge about Hologram Traffic Light	Yes	64	58.2
	No	46	41.8

c) Impact-Uncertainty Analysis

Plotting the mean of the impact and uncertainty variables on a graph was used to analyze the impact uncertainty. The future scenario will be determined using the two drivers with the highest mean values of the impact and uncertainty of the variables. Table 9 provides an illustration of the average impact and uncertainty variables. The two primary drivers will be chosen based on the graph's highest plot.

Table 5: Mean of the 10 Leading Drivers on Level of Impact and Uncertainty

No.	Issues and Drivers	Mean	
		Impact	Uncertainty
1.	Modern traffic light technology	4.3091	4.1545
2.	Mixed reality	4.1364	4.0182
3.	Minimize errors	4.1636	4.0091
4.	Overshadow traditional traffic lights	3.9455	3.9636
5.	Reduce accidents	4.1545	4.2347
6.	Signaling device	4.1273	4.0727
7.	Rider's personal lifestyle	4.0364	3.8727
8.	Socio-economic development	3.8455	3.8273
9.	Electronic advertising	3.9273	3.9455
10.	Risk of motorcycle accidents	4.1091	3.9364

Figure 1: Impact-uncertainty Analysis

The top two factors with the greatest influence and degree of uncertainty on Malaysia's adoption of hologram traffic lights were determined, as shown in Figure 1. While reduce accident (D5) has the most uncertainty, modern traffic light technology (D1) has the greatest influence. To explore potential adoption patterns for hologram traffic lights in Malaysia, these two drivers (D1, D5) were used to construct a scenario study.

4.2 Discussions based on the First Research Objectives

For this study, there are two specified research goals. The primary goal of this research is to identify the factors that influenced adoption of hologram traffic in Malaysia signals for accident reduction. To do this, the STEEPV analysis was used. The installation of smart hologram traffic lights in Malaysia, which may be advantageous to future road users, drivers, and the Road Transport Department Malaysia, must be understood in its entirety. The problems and factors will affect how hologram traffic lights are used in Malaysia in the future. According to a STEEPV study, the technological element is more important than value, economic, environmental, political, and social issues in determining if hologram traffic light technology is used in Malaysia.

4.3 Discussions based on the Second Research Objectives

The research second objective is to investigate into Malaysia's potential use of hologram traffic signals in the future. The objective is to research the potential use of hologram traffic lights to lower accident rates in Malaysia. By using the top two drivers from the impact-uncertainty study to generate scenario analyses for four different alternative scenarios, the trend is attained. In the section that follows, the top two drivers have been discussed. It is discussed how unclear next developments will be and what effect this will have on Malaysia's deployment of hologram traffic lights. The top two picks had the most influence and unpredictability compared to the other drivers.

Efficiency has the greatest impact and is the most uncertain driver when compared to the other resources (4.3091, 4.1545). According to Diaz and others (2018), traffic lights are a common piece of equipment used to manage traffic flow and give pedestrians a safe method to cross streets. Though imperfect, traffic lights have the potential to add to already existing delays. Desai (2016) asserts that technology is always enhancing people's lives. The control of traffic is one example. The first traffic lights used gas-based lighting, but it didn't take long for the system to switch over to an all electrical one. Traditional traffic lights are now LED-based due to their low energy usage.

These hypothetical scenarios shed light on four different possibilities that could happen between 2022 and 2032, over the course of the next five to ten years. Figure 5.1 shows the analysis of the four potential outcomes. The scenarios will be looked at to determine any potential effects of Malaysia's anticipated use of hologram traffic lights in the future. Four potential future scenarios for the installation of hologram traffic lights in Malaysia are shown in Figure 2.

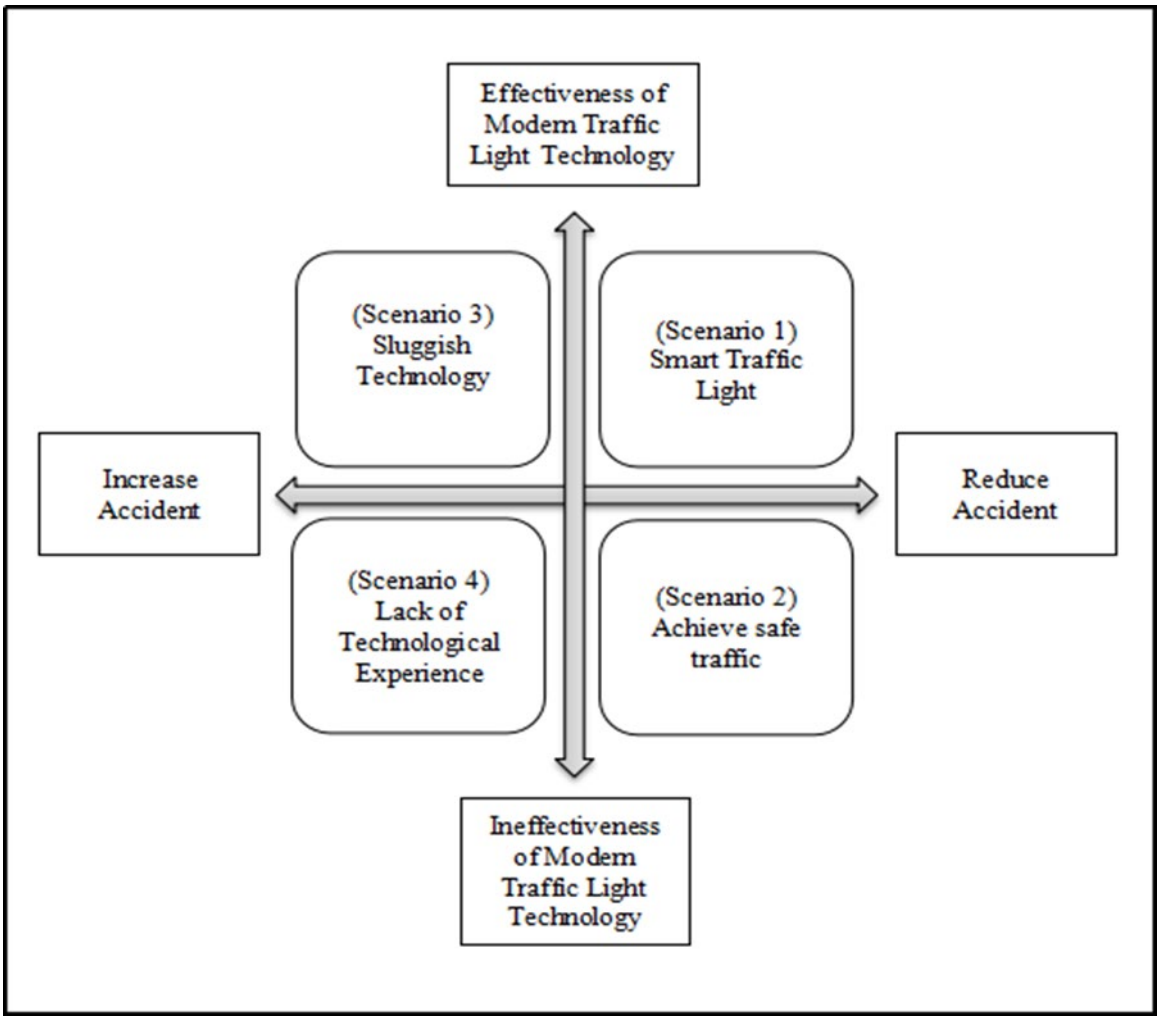

Figure 2: Four Alternative Scenario

(a) Scenario 1 (Smart Traffic Light)

In the first scenario, a vehicle is discovered by an active infrared sensor that emits low-level infrared energy into a predetermined zone. This is the ideal scenario to attain since it affects the adoption of hologram traffic lights in Malaysia and serves as a stimulus for their long- term development. Sustainable development of holographic traffic light refers to a situation in which holographic traffic light technology can enhance the experience of road users since it concerns safety and boosts productivity for the user. Hologram traffic signal technology advancements can reduce angle collision occurrence at intersections, enhance traffic conjunction management, and enhance road user experience. However, few people realize that signals can also cause a rise in other sorts of crashes. According to Mohamed and others (2021), the modern era is distinguished by tremendous technological advancement and improvement. The traffic signal is one of the most important areas that requires upgrading because it is the heart of the traffic system. With the emergence of Smart Cities, this demand gets more stringent.

Smart traffic signals may even make it safer to have entire streets, in which automobiles and trucks share streets with cyclists, pedestrians, and individuals using mobility devices such as scooters. A smart traffic light may be able to recognize pedestrians at street corners and determine how much time they need to cross a junction safely (Kiger,2022). Some companies are developing a smartphone app for disabled pedestrians that will connect with smart signs. Smart traffic lights will become even more powerful as more automobiles and trucks use connected vehicle technology, which allows them to communicate with one another as well as with infrastructure such as traffic signals (Ghazal,2022). To improve traffic flow, smart traffic signs can modify recommended speed limits based on weather or road conditions. Intelligent traffic lights, in turn, can modify signal timing based on vehicle volume at various intersections and variable parameters such as time of day. Such a configuration can ensure smooth traffic flows and limit the number of instances where breaching traffic regulations appears enticing or undetectable (Dutka,2022).

(b) Scenario 2 (Achieve Safe Traffic)

The least desirable scenario is scenario two because it involves fewer accidents and the ineffectiveness of Malaysia's hologram traffic signals, which are a more recent circumstance non traffic light technology. Failure to implement hologram traffic signals will limit adoption since society will think that road users don't need them, and the next generation won't be interested in developing the technology. Since society does not think hologram traffic signal technology can improve driving efficiency and effectiveness enough to reduce accidents, this is the worst-case scenario for adoption.

Accident rates are reducing, but not sufficiently to compensate for the additional road traffic victims caused by greater mobility. If an accident cannot be avoided, the likelihood of significant harm is greatly reduced (Huang *et al*.,2015). A key feature of a sustainably safe traffic system is that all necessary infrastructure, vehicle, and traffic control characteristics are optimally tailored to the capabilities and constraints of road users, as well as their acceptance of the measures. The advanced sustainable safety vision is intended to motivate the road safety community and all levels of government to improve road safety over the next 15 to 20 years (Gorodokin *et al*.,2021)

Moreover, some application of information technology in traffic management can improve traffic intersection capacity and reduce vehicle delays. Adaptive traffic control at traffic lights junctions is well established in cities. Adaptive regulation is mostly used on standalone traffic lights with a mostly exponential distribution of intervals (Andronov, V., & Leverent, E., 2019). Experiment results show that the method's effectiveness declines with supersaturated traffic flow, making it harder to determine a "cutoff point" or a good time to switch the traffic light signal (Jagadeeshwaran *et al*., 2021). According to Li and Shimamoto (2012), at uninsulated intersections, the incoming flow will have clear stretches of time without vehicles, making adaptive traffic control more efficient in these conditions at a multi-lane crossing. This suggests that more research on the patterns of distribution of intervals between cars in urban environments at approaches to non-isolated intersections and approaches to intersections running without coordination with other traffic lights is needed.

In addition, the ineffectiveness of modern traffic lights will delay the process of using hologram traffic lights in Malaysia. This is because, if road users do not know about technological progress, the superiors will not care about traffic light holograms. Using the traffic light hologram can reduce the accident rate and traffic congestion.

(c) Scenario 3 (Sluggish Technology)

After scenario two, in which there is an increase in accidents, scenario three is less ideal, but it benefits from the use of hologram traffic lights in Malaysia. Future days may see further development of Malaysia's adoption of hologram traffic lights. However, because to the rising rates of accidents caused using hologram traffic lights in Malaysia, the researcher would confront issues like low productivity of road users and consequences.

According to Road accidents in Malaysia (2022), from 2010 through 2019, the Ministry of Transport recorded a consistent rate of traffic accidents, with over 6,100 fatalities in 2019. Malaysia's Movement Control Order resulted in fewer accidents in 2020 and 2021, however they were still alarming. Accident numbers show an important fact that accidents can cause fatalities, serious injuries, mental stress, and financial loss. Thus, we must focus on preventing them (Gorodokin *et al*.,2021). Many accidents are caused by external or environmental variables, such as severe weather, over which drivers have no influence. However, most accidents are caused by subjective dangers, such as human error. If can be avoid these it will take the necessary safeguards. Besides, a road accident is an unpleasant incident that occurs because of losing driving control until a collision with an object occurs, or producing a vehicle crash that causes property damage, harm to the driver, passenger, and other road users or otherwise.

According to Yang and others (2015,) various internal and external factors influence pedestrian crossing behavior. Many studies have been conducted on the factors that influence the behavior of crossing the road. Human elements such as personality and mood are associated with pedestrian red light crossing behavior. The proportion of red-light violations is also affected by situational variables such as the volume of motor vehicles, the behavior of others and the size of the group (Brossea *et al*., 2013). As the amount of passing traffic increases, the distance between cars in turn narrows, making it less likely for pedestrians to cross the intersection safely and speeding drivers will find it difficult to control their vehicles and will cause traffic accidents. However, pedestrians are considered vulnerable road users because they are not adequately protected in a car collision. Pedestrians are overrepresented in road accidents worldwide, causing injuries and deaths.

(d) Scenario 4 (Lack of Technological Experience)

The last scenario was granted increased accidents and the ineffectiveness of modern traffic light technology. Generally, increased accidents can impact road traffic injuries and cause considerable economic losses to individuals, their families and to nations. These losses result from the cost of treatment as well as missed production for individuals killed or crippled by their injuries, as well as for family members who must miss work or school to care for them. This scenario is good for a road traffic department to adopt this technology but must be concerned about the area.

According to road traffic injuries (2022), transport plays a critical and significant function in a nation's living level. Transportation regulatory bodies around the world are always dealing with difficulties such as traffic congestion, major increases in pollution, and an increase in the impurity level of the air quality index. To address these issues, intelligent transportation management solutions based on automated software and IoT enabled mechanisms are continuously in demand (Sathya *et al*.,2022). These technologies are not extensively used in the transportation industries because to cost-effective rationing and a lack of knowledge. Besides, the design of roadways has a significant impact on their safety. Roads should ideally be planned with the safety of all road users in mind (Boot *et al*.,2014). This would imply providing suitable facilities for walkers, bikers, and motorcyclists. Footpaths, bike lanes, safe crossing points and other traffic calming measures can help reduce the risk of injury among these road users.

Moreover, older drivers are more likely to be harmed or killed in a car accident. The normative age-related changes in perceptual, cognitive, and motor abilities that lead to increased crash risk and lower driving comfort and emphasize certain driving scenarios and settings that are especially difficult for ageing road users (Ghazal *et al*.,2016). According to Raji and others (2022), congestion also may be ascribed to Malaysia being a particularly car- dependent country in South-East Asia, as well as a poor public transportation system and connectivity. Building more highways and motorways, as well as expanding public transportation capacity, do little to reduce traffic congestion. According to Liu and others (2022), Malaysia requires clever solutions to its traffic problems rather than new roadways. Trying to alleviate traffic problems by creating new roads is like to using gasoline to put out a fire. Malaysia requires a clever solution to its severe traffic congestion. Smart solutions in this context refer

to utilizing the advancement of technology through artificial intelligence (AI) and hologram traffic lights to solve vexing traffic issues.

In this case, the adoption of hologram traffic lights has a high resource and road efficiency, but it has the problem of modern traffic light ineffectiveness and road user neglect. The deployment of hologram traffic lights in Malaysia can help a country flourish by lowering the number of accidents. As a result, the government must apply a variety of novel regulatory ways to address road user irresponsibility.

5. Conclusion

In a nutshell, this study was done to identify the major problems and factors that drove the use of hologram traffic lights and to research the potential adoption of hologram traffic lights in Malaysia in the future. The investigation into the use of hologram traffic lights in Malaysia will establish a new direction in the improvement of road transportation technology in that country. The top two drivers and four alternative future trends that show how the need for the interaction between the real and virtual worlds and technology knowledge development will influence and shape how people live in the future were identified, demonstrating the success of this research's objectives.

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References

Crowdsourced transport. (2019, February 2). Reduce Traffic Congestion. Crowdsourced-Transport.Com. https://crowdsourced-transport.com/working-pages/improve-public-transport/reduce-traf fic-congestion/

Ebrahimi, M. H., Sadeghi, M., Dehghani, M., & Niiat, K. S. (2015). Sleep habits and road traffic accident risk for Iranian occupational drivers. Int J Occup Med Environ Health, 28(2), 305-12.

Elmarash, G. A., Adrah, M. M., & Eljadi, E. E. (2021). 3D hologram technology in Libyan educational institutions in future: Re-view. Journal of Pure & Applied Sciences, 20(3), 6-10.

Fournier, C., Denis, L., Thiebaut, E., Fournel, T., & Seifi, M. (2011, May). Inverse problem approaches for digital hologram reconstruction. In Three-Dimensional Imaging, Visualization, and Display 2011 (Vol. 8043, pp. 234-247). SPIE.

Ghaffar, U. B., & Ahmed, S. M. (2015). A review of road traffic accident in Saudi Arabia: the neglected epidemic. Indian journal of forensic and community medicine, 2(4), 242-246.

Izady, H. P. (2018, August 9). Virtual Wall - A New Traffic Light. https://www.linkedin.com/pulse/virtual-wall-new-traffic-light-hojjatollah#:%7E:text=Th e%20system%20is%20a%20holographic,drivers%20in%20front%20of%20it.

Kapoor, R. (2019, April 29). Video: This new digital wall could be the traffic signal of the future. Financial Express. https://www.financialexpress.com/auto/car-news/video-this-new-digital-wall-could-be-th e-traffic-signal-of-the-future/1562704/#:%7E:text=Globally%2C%20pedestrian%20deat h%20has%20been,make%20them%20difficult%20to%20miss.

LuminoCoin. "Digital Ad Wall at Traffic Signal by LuminoCoin." Medium, 23 Feb. 2018, medium.com/@LuminoCoin/introduction-42adb0713dd5.

M. M. Barkhaya and N. D. Abd Halim, "A review of application of 3D hologram in education: A meta-analysis," 2016 IEEE 8th International Conference on Engineering Education (ICEED), 2016, pp. 257-260, doi: 10.1109/ICEED.2016.7856083.

McFadden, C. (2018, December 25). 11 Futuristic Traffic Lights That Could Make Roads Safer. Interesting Engineering. https://interestingengineering.com/11-futuristic-traffic-lights-that-could-make-roads-safe r

Mishra, S. (2017) 'Hologram the future of medicine – From Star Wars to clinical imaging', Indian Heart Journal, 69(4), pp. 566–567. doi: 10.1016/j.ihj.2017.07.017.

Morelli Law. (2021, November 4). How Are Traffic Accidents Defined? | FAQ | Morelli Law Firm. https://www.morellilaw.com/faqs/what-is-the-definition-of-a-traffic-accident/

Muthusamy, A. P., Rajendran, M., Ramesh, K., & Sivaprakash, P. (2015). A review on road traffic accident and related factors. International Journal of Applied Engineering Research, 10(11), 28177-28183.

Nelson, R. (2014, January 27). The Holographic Traffic Light. Prezi.Com. https://prezi.com/5-066vup3ln0/the-holographic-traffic light/?frame=19fc1133197b350b561983de216e2dc8c5a2325b

Park, J. H., Kim, M. S., Baasantseren, G., & Kim, N. (2009). Fresnel and Fourier hologram generation using orthographic projection images. Optics express, 17(8), 6320-6334.

Ramachandiran, C. R., Chong, M. M., & Subramanian, P. (2019). 3D hologram in futuristic classroom: A review. Periodicals of Engineering and Natural Sciences, 7(2), 580-586.

Sandeep (2019, May 22). HOLOGRAPHIC PROJECTION BASED TRAFFIC LIGHT SYSTEM.pdf. Scribd. https://www.scribd.com/document/405989981/HOLOGRAPHIC-PROJECTION-BASE D-TRAFFIC-LIGHT-SYSTEM-pdf

Selamat, M. N., & Surienty, L. (2015). An examination of commuting accident in Malaysia. In 3rd Scientific Conference on Occupational Safety and Health: Sci-Cosh 2014.

Sheriff, F. (2021). ELMOPP: an application of graph theory and machine learning to traffic light coordination. Applied Computing and Informatics.

Smart Traffic Lights on Cyberjaya streets | Disruptive Tech Asia. (2016, February 12). Disruptive Tech Asia | Big Data News, Asia Big Data Jobs, Employment, Events, Big Data Seminars.

https://disruptivetechasia.com/big_news/smart-traffic-lights-on-cyberjaya-streets/ Stanojević, D., Stanojević, P., Jovanović, D., & Lipovac, K. (2020). Impact of riders' lifestyle on their risky behavior and road traffic accident risk. Journal of Transportation Safety & Security, 12(3), 400-418.

T. Alresheedi and J. M. H. Elmirghani, "Hologram selection in realistic indoor optical wireless systems with angle diversity receivers," in Journal of Optical Communications and Networking, vol. 7, no. 8, pp. 797-813, August 2015, doi: 10.1364/JOCN.7.000797.

Tandon, S., Subramanian, K., Tambi, H., & Samiappan, D. (2018). Advancement in Transportation and Traffic Light Monitoring System. Advances in Intelligent Systems and Computing, 409–420. doi:10.1007/978-981-13-0617-4_41

Terry, J. (2022, May 23). The Effects of Technological Innovations in Traffic Management. TorHoerman Law.

https://www.torhoermanlaw.com/the-effects-of-technological-innovations-in-traffic-man agement/

University of Cambridge. (2021, April 25). 3D holographic head-up display could improve road safety. ScienceDaily. Retrieved April 10, 2022 from www.sciencedaily.com/releases/2021/04/210425190400.htm

Vassallo, R., Rankin, A., Chen, E. C., & Peters, T. M. (2017, March). Hologram stability evaluation for Microsoft HoloLens. In Medical Imaging 2017: Image Perception, Observer Performance, and Technology Assessment (Vol. 10136, pp. 295-300). SPIE.

Vorko-Jović, A., Kern, J., & Biloglav, Z. (2006). Risk factors in urban road traffic accidents. Journal of safety research, 37(1), 93-98.

Workman, R. (2013, May 23). What is a Hologram? Livescience.Com. https://www.livescience.com/34652-hologram.html

Zhu, F. R. Yu, Y. Wang, B. Ning and T. Tang, "Big Data Analytics in Intelligent Transportation Systems: A Survey," in IEEE Transactions on Intelligent Transportation Systems, vol. 20, no. 1, pp. 383-398, Jan. 2019, doi: 10.1109/TITS.2018.2815678.