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EFFECT OF SEAT VIBRATION ON THE DRIVER AT HIGH-SPEED SIMULATION-BASED ON UNREAL ENGINE 4

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ABSTRACT

Driving at high speed is one of the highest causes of accidents. The higher the vehicle's speed, the narrower the driver's reaction time. In addition, they are not concentrating while driving is also the biggest contributor to accidents. For this reason, tools are needed to overcome these two things. Vibration is used in electronic devices. To give notifications to users such as cellphones and joysticks for that vibration can alert the driver when the vehicle reaches high speed. Because the test carried out is related to high-speed vehicles, the test using simulation uses an unreal engine 4. An unreal engine is used because it has many assets that can be directly used. This study aims to see the effect of vibration on concentration and concentration. Driver reaction. Scenario scenarios were carried out to test the participants' reactions and concentration. The scenario was divided into three types of light obstacles, heavy obstacles and sudden brakes, and the test was carried out two times using a vibrating motor and when using a vibrating motor. This test is carried out to test the test taker's reflexes. This study aimed to analyze the effect of vibration on the vehicle seat on the driver's concentration. Therefore, the test participants used were aged around 20-25 years to balance the participants. The results showed that participants who used a vibrating chair were more concentrated than those who did not use a vibrating chair.

Keywords Vibrating Motor; Unreal Engine 4; Vehicle
Paper type Research paper

INTRODUCTION

High speed is a contributing factor to vehicle accidents. Increased speed when driving for some people has become a habit. Habits like this and harming yourself can also endanger the safety of others. At this time, online ticketing began to be applied, and on highway speed traps were being installed to ticket vehicles with speeds exceeding the recommended maximum speed (100 km/hour). Public vehicles such as taxis and buses tend to be more frequent at high speed. Apart from being self-harm for the driver, the ticket can also tarnish the travel agent's name carried by the driver. The problem experienced by the driver is a habit of high speed [1-7]. Therefore we need a tool to get rid of these bad habits. This tool will make the driver's seat vibrate when the speed has exceeded the set speed. The effectiveness of the tool testing, a simulation is made on the unreal engine 4. In the simulation, several scenarios will be made.

The main reason for using the unreal engine is the blueprint feature, a prefabricated code block that can be added to objects for interaction. This blueprint feature is beneficial because it can help program without coding; reading blueprints is much more intuitive, making it easier to learn this engine. Unreal Engine 4 has a lot of presets and documentation to make it easier to use. Unreal Engine four is used as the simulation software used [8-12]. The code script will be generated and combined in the unreal engine.

METHOD

The method of this research is experiment and survey. The equipment is namely making a tool that consists of hardware and software. This tool provides haptic feedback in vibrations to the driver at high speed to increase the driver's concentration. The data collection method used is survey research which is quantitative research. Data were obtained from the questionnaire given to 11 men aged 20 to 25 years. Survey participants will sit on chairs. When sitting in the chair, the participants will carry out the simulation. The simulation was divided into three scenarios which were carried out

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twice, namely using a vibrating motor and not using a vibrating motor. Simulation 1, driving on a foggy road with obstacles. Simulation 2, driving on a foggy road with many obstacles. Simulation 3 is a sudden braking test where the driver goes in full throttle then braking without hitting the obstacle. The data analysis uses non-parametric because the sample size is limited, and comparing the non-motorized and motorized group uses Wilcoxon, Chi-Square, and McNemar.

Figure 1. Example Test Being Conducted

The working principle of the tool
Xbox 360 Controller functions as an input to be connected to the Personal computer; if the car in the simulation exceeds the predetermined speed, Unreal 4 will send a signal to Arduino. The signal sent q and w, the car's speed is below 50 km/h. The signal is sent to Arduino *w*, and if the speed is above 50, then the signal sent is Q. Arduino has been programmed if it gets a signal w then close the relay and get a signal Q, then open the relay so that it can start the motor.

Research Tools and Materials
- Arduino Uno is used to receiving codes from Unreal 4 so that it can open and close relays
- The 12 V power supply is used to power the DC motor
- The relay module is used to connect and disconnect the current from the power supply to the DC motor
- Personal computer
- Casing Box
- The DC motor serves as an output to make the chair vibrate. The motor rotation speed is around 7800 RPM
- Xbox 360 controller
- Chairs

DISCUSSION

Initial exposure describes the time required to complete a simulated light and heavy obstacle course. Simulation conditions in 3 states light obstacle, heavy obstacle, and sudden brake case. In the implementation of this simulation, the sequence of conditions is carried out randomly, meaning that half of the respondents will simulate the sequence using a chair without a motorbike and then proceed with a simulation using a seat with a motor. And half of the respondents are doing simulations in the opposite order, namely doing the first simulation using a chair with a motor and then followed by a simulation using a chair without a motor. And the process of randomizing this sequence is done by asking the respondent to have one of two rolled papers containing the simulation sequence.

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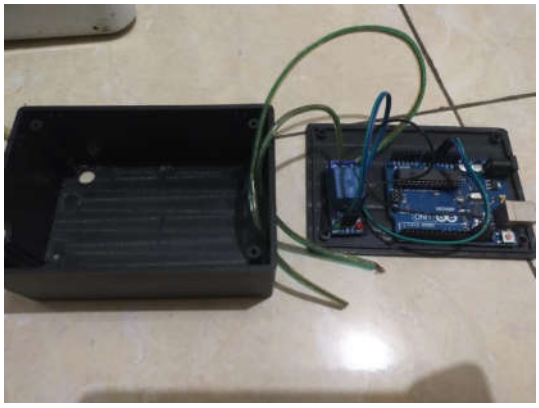

Figure 2. Arduino Relay Assemble

Figure 3. The DC Motor Assemble

The attitudes and conditions of the respondents when performing the simulation vary, representing many driver conditions. From the data, over 91% of the participants were familiar with joysticks and among 11 only 1 person wore glasses because of myopia. When the driver uses a seat with a vibrating motor, 81.8% stated that they do not feel pain in their body due to a vibrating motor device to the driver's seat. All participants become more focused when the motorbike starts and all agree that being sleepy will make the driver more focused while driving. Most of the respondents (81.8%) were shocked when the motor started, because of the vibration effect produced by the motor. When the driver is in a simulation using a seat with a vibrating motor added, 81.8% of respondents feel they can focus again when the vibration sensor turns on. However, 54.5% of respondents felt that the vibrating motor instrument was already on. The vibrating motor instrument needs to be developed functionally to help the driver be more alert and comfortable to use.

The mean time to complete the mild obstacle simulation without the vibrating motor was in the range of 44 - 71 seconds with an average of 56.45 seconds and a standard deviation of 7.57 seconds. Meanwhile, when performing the simulation using a chair with a vibrating motor, the completion time ranges from 36 - 66 seconds with an average of 51.36 seconds and a standard deviation of 7.57 seconds. In the heavy obstacle simulation, the average completion time without a vibrating motor is in the range of 43 - 83 seconds with an average of 62.82 seconds and a standard deviation of 11.31 seconds. Meanwhile, when performing the simulation using a chair with a vibrating motor, the completion time ranges from 41 to 77 seconds with an average of 56.64 seconds and a standard deviation of 11.17 seconds. In the heavy obstacle course simulation, the driver is on a foggy road with light obstacles. This description explains that the addition of a vibrating motor that alerts the

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driver to speed limits can help to concentrate more so that he can complete simulations of both light and heavy obstacles in less time. The time range for completing the simulation was quite wide, presumably because the age and eye conditions of the respondents in this study were quite varied.

TABLE 1. DESCRIPTION OF SIMULATION COMPLETION TIME

Group	N	Minimum	Maximum	Mean	Std. Deviation
Light obstacle					
Non-Motorized Seat Group Low Level Test Times	11	44.00	71.00	56.45	7.57
Seat Group Low Level Test Time with Motor	11	36.00	66.00	51.36	8.14
Heavy obstacle					
Non-Motorized Seat Group High Level Test Times	11	43.00	83.00	62.82	11.31
Motorized Seat Group High Level Test Time	11	41.00	77.00	56.64	11.17

TABLE 2. . WILCOXON TEST RESULTS ARE DIFFERENT FROM TWO GROUPS

		N	Mean Rank	Sum of Ranks
Light obstacle				
Motorized Seat Group Low-	Negative Ranks	10	6.40	64.00
Level Test Time - Non-	Positive Ranks	1	2.00	2.00
Motorized Seat Group Low-	Ties	0		
Level Test Time	Total	11		
Z = -2,770 (p = 0.006)				
Heavy obstacle				
Motorized Seat Group Low-	Negative Ranks	10	6.45	64.50
Level Test Time - Non-	Positive Ranks	1	1.50	1.50
Motorized Seat Group Low-	Ties	0		
Level Test Time	Total	11		
Z = -2.805 (p = 0.005)				

Testing the differences between the two groups was carried out by two methods. First, continuous data such as recording the completion time of the first and second simulations will be analyzed using the Wilcoxon Ranked Test. At the same time, observations with categorical data such as sudden brake test results will use the Chi-Square and McNemar test. The use of non-parametric statistical methods is because the research sample is less than 30, namely only 11 respondents.

The difference in simulation completion time between groups without a vibrating motor compared to using a vibrating motor, as many as ten respondents had a difference of positive and one negative, meaning a shorter vibration motor simulation time. The z value = -2.770 ($p < 0.05$) explained a significant difference in the simulation completion time in the two groups. Using a vibrating motor in the driver's seat in conditions of mild obstacles is proven to increase alertness, with evidence that the average value of 51.36 seconds is lower (faster completion time) than the average of 56.45 seconds in the group without using a vibrating motor. In the group without vibrating motor compared to using a vibrating motor, as many as ten respondents had a difference of positive and one negative. The z value = -2,805 ($p < 0.05$) explains a significant difference in the simulation completion time in the two groups. Using a vibrating motor in the driver's seat under severe obstacles increases alertness, with evidence that the mean value of 56.64 seconds is lower (faster completion time) than the average of 62.82 seconds in the group without using a vibrating motor.

The third part of the simulation in the case of sudden braking; when not using a vibrating motorbike, the proportion of unsuccessful responses (7) is more than successful (4). The test results with a Chi-Square value = 0.818 ($p > 0.05$) explained that statistically, there was no significant difference in the number of successes and unsuccessful ones in simulating sudden brakes in conditions without using a vibrating motor.

In simulated sudden brake cases using a vibrating motor, the proportion of unsuccessful responses (4) is less than successful (7) in the sense that the driver is not late in braking to avoid collisions due to vibration signals when reaching a certain speed. The test results with a Chi-Square value = 0.818 ($p > 0.05$) explained that statistically, there was no significant difference in the number of successes and unsuccessful ones in simulating sudden brakes in conditions using a vibrating motor.

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TABLE 4. MCNEMAR TEST RESULTS CHANGE IN FREQUENCY OF SUDDEN BRAKE SUCCESS GROUPS WITHOUT AND WITH VIBRATING MOTOR

Motorless Seat Group Brake Test	Seat Group Brake Test With Motor	
	Not pass	Pass
Not pass	3	4
Pass	1	3

McNemar test, p = 0.375

Test McNemar will test the magnitude of the change in the status of the test results by paying attention to the number of frequencies outside the diagonal. If the total frequency outside the diagonal is greater than the total number in the diagonal, it means that the description of the two states has changed. The significant change for the seven drivers who did not pass the sudden brake simulation was that as many as 57.1% passed the status when using a seat with a vibrating motor. And for four respondents who passed the sudden brake test using a chair without a vibrating motorbike, it turned out that 25% did not pass the test when using a chair with a vibrating motorbike added. This description explains that adding a vibration sensor to the driver's seat and activating it when it reaches a certain speed can help increase alertness and concentration in the driver. The total number of frequencies inside the diagonal is 6, and those outside the diagonal are 5. This description explains that in the case of sudden brakes, the additional role of the vibrating motor is not yet influential; respondents who do not pass without the vibrating motor are still quite a lot who do not pass even though they have passed. Given a vibrating motor. The results of the McNemar test with p = 0.375 (p> 0.05) explained that there had been a significant shift from the condition of not passing the sudden brake test without using a vibrating motor to the extent of the test when using a vibrating motor. There are still many people who do not pass even though they have been given a vibrating motor. The results of the McNemar test with p = 0.375 (p> 0.05) explained that there had been a significant shift from the condition of not passing the sudden brake test without using a vibrating motor to the extent of the test when using a vibrating motor. there are still many people who do not pass even though they have been given a vibrating motor. The results of the McNemar test with p = 0.375 (p> 0.05) explained that there had been a significant shift from the condition of not passing the sudden brake test without using a vibrating motor to the extent of the test when using a vibrating motor.

From the results above, it can be seen that vibrating chairs can make participants complete the test faster. Participants who used glasses struggled to carry out the test, especially in test 5 because the fog was too thick. High speed is a contributing factor to vehicle accidents. High speed when driving for some people has become a habit. Habits like this and harming yourself can also endanger the safety of others. Installation of a vibrating motor that it has exceeded the maximum speed set in the vibration motor sensor.

Although this vibrating motor instrument must be developed a prototype that is more comfortable when used, this has been effective in helping to maintain driver alertness and focus. Currently, online ticketing is being implemented and speed traps are being installed on toll roads to ticket vehicles with a speed of more than the recommended maximum speed (100 km/hour). For ordinary high-speed drivers, they will unconsciously get a ticket. In addition, public vehicles such as taxis and buses tend to be more frequent at high speeds. This can not only be detrimental to yourself because the ticket can also tarnish the name of the travel agent that the driver is carrying.

The habit of high speed, especially on straight roads or highways, is one of the bad habits made by many drivers. So this vibrating motor instrument is an attempt to reduce or even eliminate these bad habits. This tool will make the driver's seat vibrate when the speed has exceeded the speed set in the sensor. Using this vibrating motorbike has been proven effective in light, heavy obstacles and conditions that require sudden braking.

CONCLUSION

Using a vibrating motor in the driver's seat has been proven effective in increasing the driver's awareness and focus in running the vehicle. Suggestions for improving the motor vibration include reducing motor noise, providing options (variations) of motor vibration, increasing the minimum speed for the motor to start because at the speed level of 50 km, it is considered still at a low speed.

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