VR CAR SIMULATOR TO LEARN DRIVING

ABHISHEK A
Electrical and Electronics Engineering
Panimalar Engineering College
Chennai, India

BHARATH KUMAR V
Electrical and Electronics Engineering
Panimalar Engineering College
Chennai, India

ARJUN LOKESH G
Electrical and Electronics Engineering
Panimalar Engineering College
Chennai, India

JAIVARTHAN N
Electrical and Electronics Engineering
Panimalar Engineering College
Chennai, India

BALAMURUGAN G
Electrical and Electronics Engineering
Panimalar Engineering College
Chennai, India

Abstract-

Learning to drive may be a difficult process that calls for both academic preparation and hands-on training. Traditional driving education techniques, such classroom lectures and on-the-road instruction, frequently fall short of giving students enough chances to practise and engage in a variety of driving scenarios in a secure setting. The use of virtual reality (VR) technology to give students a more immersive and interesting learning experience has the potential to overcome some of the drawbacks of conventional driving education techniques. This essay examines the possible advantages of teaching driving skills using VR automobile simulators and explores the drawbacks of the technology.The report also suggests future lines of inquiry in this area, including the creation of more accurate simulations and the assessment of the long-term impacts of VR-based training on on-road driving ability. The quality and efficacy of driver education could be increased by the use of VR automobile simulators, which would ultimately lead to safer roads and fewer accidents.

Keywords— Unity,VR Headset,Steering,Footrest,Gear,etc

1 Introduction:

With a safe and regulated environment to practise and experience various driving scenarios, virtual reality (VR) technology has created new opportunities for driver education. Being able to drive is a necessary ability for freedom of movement and personal independence. Traditional driving instruction techniques, however, fall short in giving students ample chances to practise and engage in various driving scenarios in a secure and regulated environment.

VR driving simulators are a viable way to improve driver training and education. They offer a realistic, dynamic, and immersive environment that enables students to practise fundamental driving skills, experience various driving scenarios, and get quick feedback on their performance. VR technology has a number of advantages, including improved safety, higher motivation and engagement, and lower training expenses.

This essay examines the usage of virtual reality automobile simulators for learning how to drive while examining both the advantages and disadvantages of this technology. We'll start by talking about the situation of driver education right now, emphasising the shortcomings of conventional techniques and the demand for fresh ideas. The potential of VR technology for driver instruction will next be briefly discussed. After that, we'll examine the benefits and difficulties of using VR automobile simulators for driver instruction and present various instances of effective use. We'll wrap up by discussing potential paths for future study in this area and the potential effects of VR automobile simulators on driving instruction and traffic safety.

Literature Review:

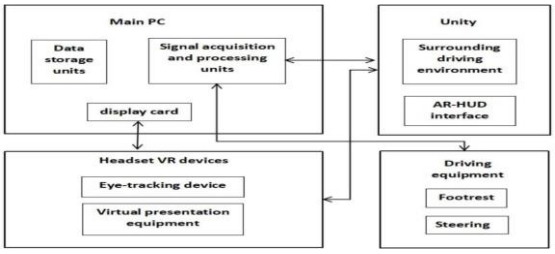
Overall, we think that using VR automobile simulators in driver education has a lot of promise to improve the calibre and efficacy of driver training, which will ultimately lead to safer roads and fewer traffic accidents.

The efficiency of VR automobile simulators in enhancing driving abilities and knowledge has been examined in a number of research. For instance, Li et al.'s (2020) study compared the performance of rookie drivers who got both on-road instruction and VR-based training with those who received only on-road training. The findings demonstrated that the group that received VR-based training outperformed the group that only received on-road training in a number of driving skills, including lane keeping and hazard perception. Similar to this, a research by Hatzigeorgiadis et al. (2021) discovered that older persons with little prior on-road experience were able to improve their driving abilities with VR-based instruction.

Drivers can be trained in specific driving scenarios using VR automobile simulators, such as driving in bad weather or responding to emergencies. For instance, a study by Auerbach et al. (2019) employed a VR driving simulator to teach inexperienced drivers how to drive in limited visibility. According to the findings, the VR-based training helped the participants keep a safe distance from other cars and prevent collisions. Similar to this, a 2019 study by Pardillo-Martin et al. trained professional drivers in emergency braking using a VR automobile simulator. The outcomes demonstrated that the drivers' reaction times and braking lengths were enhanced by the VR-based training.

The use of VR automobile simulators in driving instruction is not without its drawbacks, though. One of the biggest issues is the price of the technology, which some students and driving schools may find prohibitive. Another difficulty is the simulation's realism, which can hinder the application of information and abilities to driving on the open road. For instance, according to several research, learners who underwent VR-based instruction improved their performance in the driving simulator but did not significantly improve their on-road driving (Li et al., 2020).

2 Proposed System:



3 Proposed method

Setting up the required hardware is the first step in using a VR automobile simulator. This hardware often consists of a computer or game console, a VR headset, and specialised controllers like a steering wheel, pedals, and gearshift. The user must also install any required drivers or plugins in addition to the simulation software.

3.1Calibration:
To make the virtual driving experience as authentic and immersive as possible, the user must calibrate the hardware prior to starting a driving simulation. This could entail adjusting the VR headset's position and orientation, calibrating the pedals and steering wheel, and changing various settings like the seat's position and the mirrors.The user can choose from a variety of driving settings, including city driving, interstate driving, and off-road driving. Different environmental elements, such as traffic volume, the state of the environment, and the state of the roads, can have an impact on the driving experience.

3.2Driving simulation: The simulation starts after the user selects a driving scenario. Through the VR headset, the user can view a virtual depiction of the driving environment and interact with it using the specialised controllers. In reaction to user actions like steering, accelerating, and braking, the simulation software models the physics and behaviour of the vehicle.Feedback is given to the user as they navigate the virtual world, and tutorials and driving exercises are supplied to aid in the development of safe driving practises. Performance tracking software keeps tabs on a user's actions and gives them immediate feedback on their driving prowess, including speed, acceleration, and braking. The feedback is intended to assist the user in honing their abilities and forming responsible and safe driving practises.The driving simulation can be repeated as many as necessary to help users hone their abilities and confidence. Additionally, individuals can modify the simulation's level of complexity to correspond to their skill level, progressively raising the difficulty as they advance.

4 Challenges and Limitations of VR Car Simulators in Driver Education:

VR driving simulators might be more expensive to buy and maintain than more conventional driver instruction techniques. This may restrict some students' and schools'access to technology.

Although the simulation software is capable of simulating the vehicle's physics and behaviour, it cannot offer the same level of physical feedback as actually driving an automobile. For instance, novice drivers are unable to feel the engine's vibration, the steering wheel's resistance, or the forces applied during acceleration and braking.

4.1Limited Real-world Experience:
Although VR driving simulators can model a variety of driving scenarios, they are not able to fully capture all of the real-world situations that a student might run into when operating a real car. For instance, the simulation is unable to take into consideration unforeseen circumstances or interactions with other motorists and pedestrians.

4.2 Limited Customization:
While some virtual reality (VR) automobile simulators allow for the customization of the driving scenarios and teaching materials, others are less flexible in this area. The capacity of students and teachers to customise the experience to meet their unique needs and objectives may be hampered as a result.

Some users who utilise VR technology may feel queasy or uncomfortable, which might reduce the simulator's utility as a teaching tool.

5 Features of VR car simulator:

5.1 Realistic Virtual locations:
Learners should be able to practise driving in the simulator's variety of lifelike and immersive virtual locations, which should include various road types (highways, city streets, etc.), traffic situations, environmental factors, such as weather, and lighting conditions.

5.2Scenarios that Learners Can Customize:
Learners should be able to alter the scenarios to their specifications, enabling them to practise particular driving techniques like parallel parking or merging onto a motorway. A realistic representation of the physics and behaviour of the vehicle, including acceleration, braking, steering, and handling, should be offered by the simulator.

5.3Performance Monitoring:
The simulator ought to have performance monitoring features to monitor the student's development and offer comments on their driving abilities, such as speed, acceleration, braking, and handling.

5.4Tutorial Materials:
To aid students in acquiring sound driving practices and abilities, the simulator should offer educational resources including interactive exercises and video tutorials.

5.5Adaptive complexity:
The simulator should change the situations' level of complexity in accordance with the learner's proficiency, progressively posing more of a challenge as they advance.

5.6Feedback and Analysis:
The simulator should offer the student feedback and analysis of their driving performance, outlining their strengths and flaws and offering recommendations for development.

6 Realistic Traffic and Pedestrians:
By simulating realistic traffic and pedestrian behaviour, the simulator enables students to practise safely negotiating challenging driving situations.

6.1Accept for Specialized Controllers:
To give a more realistic and engaging driving experience, the simulator should accept a variety of specialized

controllers, including steering wheels, pedals, and gearshifts. For the learning experience to be more accessible to students with impairments, the simulator should have accessibility features including movable text sizes and co-lours, closed captioning, and voice commands.

Applications of vr car simulator:

Driver Education:
VR automobile simulators can be included into conventional driver education courses to offer students a secure and realistic setting in which to hone their driving abilities and form safe driving practices.

Commercial Driver Training:
VR automobile simulators can be used in commercial driver training program mes, such thosefor bus or truck drivers, to give a realistic and affordable way to train drivers on a variety of scenarios and situations.

Military Training:
VR driving simulators can be incorporated into military training program mes to offer drivers with realistic training scenarios in warfare and other demanding environments.

6.2Public Education:
VR driving simulators can be included into public education campaigns to increase awareness of safe driving habits and the risks associated with texting or drinking and driving.

7Experimental Setup:

Hardware: A computer system with a potent graphics card, a VR headset with high resolution, and a joystick or steering wheel controller to simulate driving.

Software:
A VR car simulator programme with a range of driving scenarios, including in cities, on highways, and off-road, as well as accurate physics-based vehicle simulations.

Participants:
A group of individuals with little or no prior driving experience.

Experimental design:
A randomized controlled trial design where participants are randomly assigned to either a VR car simulator group or a traditional driver education group. Both groups would receive the same number of training sessions, but one group would use the VR car simulator, and the other would use traditional driver education methods, such as classroom lectures and on-road practice. Training protocol: Participants in the VR car simulator groupwould receive training on a variety of driving scenarios using the simulator program. The training would include a progressive difficulty level, with easier scenarios at the beginning and more challenging scenarios as the participants improve their skills. The traditional driver education group would receive classroom lectures and on-roadpractice sessions.

Outcome measures:
The effectiveness of the VR car simulator would be evaluated by measuring various outcome measures, such as driving performance metrics (e.g., speed, distance traveled, accidents), self-reported driving confidence and skills, and retention of skills over time. Data analysis: Statistical analysis would be utilised to contrast how well the two groups performed,and any differences in outcomes would be interpreted as an indication of the effectiveness of

the VR car simulator in learning to drive.

Conclusion:

In conclusion, VR automobile simulators have the potential to completely transform the driver education industry by giving students a secure, realistic, and efficient environment in which to hone their driving abilities and form a lifetime of safe driving practises. With realistic virtual surroundings, sophisticated vehicle simulations, performance monitoring systems, and variable difficulty settings, technology has improved significantly in recent years. These simulators can be utilised in a variety of contexts, including conventional driver education courses, military training, and programmes for therapy and rehabilitation. Future uses of VR automobile simulations are likely to be much more creative and useful as VR technology develops, enhancing road safety and training drivers for a variety of real-world driving circumstances. A reasonable investment in the field of driver education, VR automobile simulators are a promising tool for learning to drive and have the potential to save lives and prevent accidents.

Reference:

1.J. Xu and A. Howard, "How much do you trust your self-driving car? exploring human-robot trust in high-risk scenarios", 2020 IEEE International Conference on Systems Man and Cybernetics (SMC), pp. 4273-4280, 2020.

2.M. Wu, T. Louw, M. Lahijanian, W. Ruan, X. Huang, N. Merat, et al., "Gaze-based intention anticipation over driving ma-noeuvres in semi-autonomous vehicles", 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 6210-6216, 2019.

3.F. Pallavicini and A. Pepe, "Comparing player experience in video games played in virtual reality or on desktop displays: Immersion flow and positive emotions", Extended Abstracts of the Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts ser. CHI PLAY' 19 Extended Abstracts, pp. 195-210, 2019.

4.M. N. Mohammed, Y. Ghanesen, S. Al-Zubaidi, M. A. M. Ali, O. Ismael Al-Sanjary and N. S. Zamani, "Investigation on Carbon Monoxide Monitoring and Alert System for Vehicles", 2019 IEEE 15th International Colloquium on Signal Processing & Its Applications (CSPA), pp. 239-242, 2019.

5.T. Williams, D. Szafir and T. Chakraborti, "The reality-virtuality interaction cube: a framework for conceptualizing mixed-reality interaction design elements for hri", 2019 14th ACM/IEEE International Confer-ence on Human-Robot Interaction (HRI), pp. 520-521, 2019.

6. S. Mustapha, C. A. Chong and M. N. Mohammed, "Review on the Usage of Mixed Reality and Augmented Reality Assisted Learning Tool in Aircraft Maintenance", 2021 IEEE 9th Conference on Systems Process and Control (ICSPC 2021), pp. 168-173, 2021.

7. Gisli Thorsteinsson and T. P, "Using Virtual Reality for Developing Design Communication" in , Iceland:University of Iceland, 2010.

8.P. E Backlund, "Games for traffic education: An experimental study of a game-based driving simulator", Simulation & Gaming, pp. 145-169, 2010.

9.A. Stricker, "Simulation Game for Education in MyBase: The future of Air Force and Training with Virtual World Learning", Proceedings of the 2009 Spring Simulation Multiconference, 2009.

10.Xu Jiayi, "Application and Reflection of Virtual Reality in Each Social Field[J]", Chinese After-school Education, no. 06, pp. 39-40, 2019.