

Implementation of Virtual Drive (3D Simulator)

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Abstract – With the increase in number of vehicles on the road, the driving ability became an important part in normal life, without learning driving when they try to acquire a driver's license, "on-road test" may be very dangerous and difficult. The goal of the project is to make a virtual reality driving simulator in order to check and enhance the subjects' driving ability. Also it includes a module to analyze the subject's driving ability. The simulator consists of a real-time vehicle simulation system, visual and audio system, motion system, control system, and console. The real-time vehicle simulation system supervises the overall operation of the simulator and also simulates the dynamic motion of realistic vehicle models in real-time. The visual system generates high fidelity driving scenes that are displayed on a screen. The system generates realistic motion. The control system acts as an interface between a driver and the simulator. The console monitors the status of the simulator in operation and also collects and manages experimental data.

Virtual drive simulator will be safe way for a beginner to learn driving as there is no means of danger of real world

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Key Words: Virtual Drive, Control System

1. INTRODUCTION

Driving simulators can be effective training tool. They can be used for individuals to learn how to drive with a disability in a safe and controlled environment before driving on real roads, which can be dangerous for an inexperienced driver. Pre-accident conditions can be experienced in the simulator allowing new drivers to get a feel for what is safe and what will result in an accident. Simulator allowed very accurate training methods that can predict vehicle rollovers, stopping distances on wet, dry or icy roads, severe steering moves requiring skill, and a host of other real-life driving situations. Virtual Reality Driving Simulator can safely and reliably expose examinees to hazardous challenges to assess defensive driving skills.

When one individual tries to learn driving without any virtual reality car simulator the major amount of training is completed on road. This can be dangerous for the driver, implementation trainers, and others who are on the road. Driving Simulator provides learning off-road without being

in any kind of danger. Learning with driving simulator is much safer and easy. Possibility of encountering dangerous driving conditions without being physically at risk. Also Unnecessary use of fuel that is petrol and diesel is completely avoided in learning phase. Virtual Drive simulator is eco-friendly as it does not harm environment after being used.

The implemented system Virtual Drive will provide the learner a virtual realistic environment to learn driving without being in any danger. To drive on road without any experience is very risky for the learner, trainer and other people around. virtual car simulator will avoid the danger of being on road directly and providing a training virtually which is much safer. The system consists of functions such as dynamic feedback, hardware interface for user. The simulator provides a realistic, highly immersive driving experience. Even special driving scenarios, such as tight corners, braking, emergency cases and accident situations are simulated realistically and sufficiently dynamically.

2. LITERATURE SURVEY

Different types of virtual reality environment are as follows.

A. Semi-Immersive Virtual Reality: Semi-Immersive environment allow viewer becomes partly but not fully immersed in this environment and operate at costs much less than the CAVE. It has advantages over fully immersive systems such as a CAVE system which includes cost, ease of use and logistics. But its disadvantages include limited range of interaction devices and problems with multi-user applications.

Example, the air force uses a virtual reality flight simulator as a training tool.

B. Collaborative Virtual Environments: It is a special case in which they may or may not aim for complete immersion but the main goal is to share a virtual experience with real people.

C. CAVE Fully Immersive Virtual Reality: The person is fully immersed within it and takes the form of a cube-like space in which images are displayed by a series of projectors. Interaction takes place using a variety of input devices, for example, a joystick, wand or more commonly, a haptic device, i.e. data glove. This enables the person to interact with objects, for example, pulling, twisting or gripping by means of touch. The ability to do this is known as haptic.

Related Work:-

Simulating Driving Feel for Virtual Driving Simulator based on Semi-physical Simulation [1]

It combine research proposal about steering feel and suspension system and led to conclusion of AVSoD (Automobile steering equipment Computer simulation) which including steering feel model and vibrant feel of seats model. By programming scripts using C# and JavaScript language, the system was model in Unity and load to the objects in scenes of visual simulation. They design the method to control the hardware and the system provides the real driving experience to make drivers believe that they are driving the real cars.

Design and Implementation of Virtual Driving System Fusing Driver's Cognitive and Operating Characteristics [2]

The modelling of virtual traffic environment with the 3DS max and the VR tools software. The finished virtual traffic environment is applied to the driver fatigue monitoring experiment. The result shows that the virtual traffic environment can fully, realistically simulate the viewing scene system of driving simulator and the final fatigue status classification accuracy is 94.2529% (82/87).

Modelling Virtual Driving Environment for a Driving Simulator [3]

It focuses on the development of a virtual driving environment to be integrated with other simulator components. In this, the graphic quality and speed were optimized using different techniques in order to produce efficient realism and fidelity. The driving scenes were developed in a customized framework, which allow interaction of different computers in a distributed environment.

Virtual Environment Construction for Driving Simulator [4]

This paper presented a total software system which enables us to construct virtual towns and to drive a car through the town. The advantage of the system is that both city planning and environmental evaluation are realized by the same software. We have just begun to develop the function to be applied for actual city planning problems.

Virtual 3D simulation of a car in traffic [5]

This paper describes the development and possibilities of an application for simulation of car driving in real traffic. The application is be used for teaching and training of individual traffic situations that may be encountered in real traffic. The system designed a suitable physical model of car behaviour so that the user can concentrate on the traffic as much as possible.

3. PROPOSED SYSTEM

Virtual Drive is a system that will be used to enhance the subject's driving ability with ease by facing less complexities on the road. The system will be used to trainee the peoples to learn driving in different situations such as traffic, narrow roads, signals indicating the directions to drive fast on highway, slow driving in cities, sharp turns and driving in proper lanes. The system will consist of steering wheels, brake and accelerator that will be the interface between system and user and the desktop application consists of maps on which the user can drive vehicle.

3.1 Working

Virtual Drive (3D Simulator) is implemented as a two phase system involving both hardware and software implementation.

Phase1: Designing of Simulator.

Phase 2: Implementation of Control System.

The control system acts as an interface between a driver and the simulator. The console monitors the status of the simulator in operation and also collects and manages experimental data. The system will provide dynamic notifications to the user while driving and after login the system will provide previous driving status of the user.

The Fig 1 Architectural Block Diagram shows the working of the system "Virtual Drive (3D Simulator)".

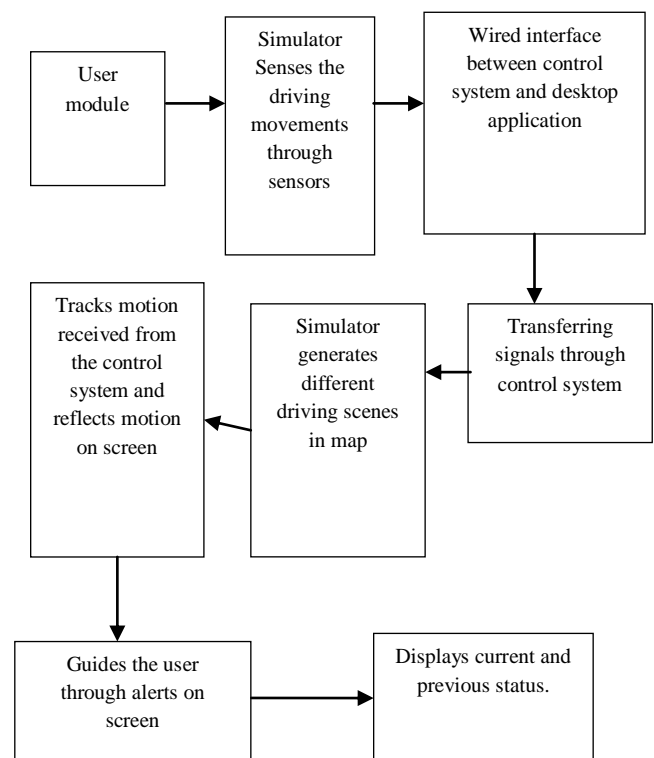


Fig 1. Architectural Block Diagram

The architecture of Virtual Drive system based on Unity and numerical simulation is proposed, the models of steering system, the control strategy of force feedback steering wheel and the control strategy of motion platform are considered. The realization of controlling hardware gives users the authentic feel of driving which can be used to assess and guide the modification of vehicle models.

Driver gives the input to the system by means of hardware, the major hardware used are brake, accelerator and steering wheel. Simulator senses the driving movements through sensors and gives the output by means of wire to the control system. The control system processes these control signal and display results on the display monitor. Features such as map generation, user history, type of car etc are generated by control unit. The information about the user is stored in database and processed when needed. Notification about any mistakes done by user is displayed dynamically on screen.

3.2 Implementation details:

In the first phase of implementation the registration and login module is been created where after registration the password of user is stored in encrypted form. In order to control the motion of vehicle, for detecting collision, login, registration of simulator is implemented using C# and JavaScript. Second phase of implementation of control system consist of Brakes, Accelerator and steering wheel. Microcontroller is used to track the signal from control system and converts the signal in digital form and send it to the simulator.

4. RESULT AND ANALYSIS

User registers to system using username, email-id and sets password shown in following fig 2.



Fig 2: User Login

After Successful login user can drive, view previous records and can end the session shown in following figure.



Fig 3: Login Successful

After clicking on drive option user can drive on different driving levels is shown in following figure.



Fig 4: Level of Driving

Beginner level where simple road with traffic signal is created is shown in following figure 5.



Fig 5: Beginner Level

Alert notifications is given to rider if signal broken is shown in figure 6.



Fig 6 : Traffic Signal Violation

3.2 Comparison of Related Work and Implemented system

Virtual Drive (3D Simulator) differs from other system when it comes to Database and Dynamic notification and it is shown in table 1.

Parameters	Virtual Driving Simulator based on Semi-physical Simulation	Virtual Driving System Fusing Driver's Cognitive and Operating Characteristics	Virtual Environment Construct on for Driving Simulator	Virtual Drive (3D Simulator)
Driving Simulation (Control over car, Movements of car)	Yes (Full control)	Yes (Full control)	Yes (Full control)	Yes (Full control)
Virtual Environment (Virtual roads, maps, buildings)	Present	Present	Present	Present
Collision Detection	Yes	Complete collision detection by comparing car parts colliding through obstacles	Detects collision through footpaths and colliding from other cars.	Present
Map looping	No (Drive from point A to Point B)	Yes	Yes	Yes
Main Goal	Training drivers	To improve driver alertness.	Drivers training, City planning	To enhance the driving ability in user to avoid physical accident
Database (Storing users previous driving status and information)	No	No	No	Yes
Dynamic notifications	No	No	No	Yes

Table:1 Comparison of Related Work and Implemented system

Implemented system stores the user's details that is its personal information, driving details, course history and etc. Dynamic notification is another feature where the details and information about courses are displayed during the driving session. Dynamic notification makes user aware about its mistakes while driving this helps the user to improve. Other features like collision detection, map looping and virtual environment will be also included in our system.

5. CONCLUSION AND FUTURE WORK

Virtual Drive (3D Simulator) is designed to have realistic experience that will help the driver to get trainee with various situation. The system will be able to get status of the driving by means of user actions on the system while driving, the review is given to the user after finishing the driving and dynamic notification are indicated during driving. Virtual drive simulator will be safe way for a beginner to learn driving as there is no means of danger of real world. Unnecessary use of fuel that is petrol and diesel is completely avoided in learning phase. Virtual Drive simulator is eco-friendly as it does not harm environment after being used.

REFERENCES

- [1] Ying Peng, Fei Wang, Yiding Yang, Peng Zhang , "Design and Implementation of Virtual Driving System Fusing Driver's Cognitive and Operating Characteristics", IEEE 2014.
- [2] XIAO Shuxian , ZHANG Linxuan, "Simulating Driving Feel for Virtual Driving Simulator based on Semi-physical Simulation", IEEE 2015.M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.
- [3] Nariman Fouladinejad, Nima Fouladinejad, "Modeling Virtual Driving Environment for a Driving Simulator", IEEE 2011.
- [4] A. Balachandran, J. Gerdes, "Designing steering feel for steer-by-wire vehicles using objective measures", IEEE/ASME Transactions on Mechatronic, 20(1): 373-383, 2015.
- [5] A. Balachandran, J. Gerdes, "Designing steering feel for steer-by-wire vehicles using objective measures, IEEE/ASME Transactions on Mechatronic", 20(1): 373-383, 2015.
- [6] Kasper Guldb and Rene Bach Gustafson, " Developing a low-cost driving simulator and the physical components effect on validity", Aalborg University Spring 2011.
- [7] M. Nemeč, J. Włosok, R. Fauoga, "Virtual 3D simulation of a car in traffic" IEEE 14 May 2015.