ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 8, Issue 3, March 2020

Virtual Reality Based Gamified Car Driving

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ABSTRACT: The last few decades have seen phenomenal increase in the quality, diversity, and pervasiveness of computer games. Car racing is popular in computer games. Virtual Reality Driving Games are used for entertainment as well as in training of driver's education courses. An attempt is made to help the user to learn about avoiding the increased risk of crashing by providing an environment for driving the car. An enhanced user interface is provided by creating the car and all the real world objects individually and placing them on the environment.A score board is provided on the screen which has lap time and best score of the individual player at that time. Finally, the environment is converted into a single virtual reality scene and builds as an APK for mobile phones. The user has to drive the car without crashing in any of the objects in the environment. Based on the way the user drives the car the score gets increased on the score board. Hence the users will be much interested in increasing their scores and try to avoid crashing on the objects.

I.INTRODUCTION

Driving Games are proven to be excellent practical and effective tools to impact safe driving training techniques for all drivers. Virtual Reality Driving gamesaims to efficiently guide some sort of vehicle towards a goal. More than just knowing the mechanisms to control the vehicle, driving requires knowing how to apply the road rules. The challenge for the player comes from controlling the dynamics of the vehicle.
These Gameshelp the users to practice driving without any fear. They are also used for research purposes in the area of human factors and medical research, to monitor driver behavior, performance, and attention and in the car industry to design and evaluate new vehicles or new advanced driver assistance systems.

II.RELATED WORK

Introduction to Virtual Reality

Virtual Reality is a term used for computer-generated 3D environments that allows the user to enter and interact with alternate realities [1]. The users are able to "immerse" themselves to varying degrees in the computers artificial world which may either be a simulation of some form of reality or the simulation of complex data. When simulating an environment, the focus is on reproducing its aspects as accurately as possible to create the illusion of an alternate reality. C.Nagarajan *et al.*[3][6] proposed 3D images but the incorporation of 3D sound, artificial smell generation and force feedback [1]. The resulting digital world may either be representation of realworld objects or the imagination of a designer. Some of the examples of this type of simulation include architectural walk through and VR games.

Real Time Simulation of a Racing Car

In order to obtain a real-time simulation of the vehicle, with man-in-the-loop control, the time integration must be computed really quickly: each time step should not require more than 0.001 s of computational wall-clock time (in some cases, even smaller time steps may be required)[2]. For this reason of efficiency, the simulation software was developed as a C# application. The executable is dynamically linked to the multibody simulation library, Chrono::Engine, which offers more than one thousand of ready-to-use C# functions and data structures for the creation and simulation of mechanical systems [2]. Basically, this library allows the creation of unlimited rigid bodies in 3D space: those parts can be constrained by joints (selectable among a vast set of holonomic, rheonomic, scleronomic constraints) or spring-dampers.

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The user can see the road from the car or from other point of views in full-screen visualization. The car can be driven with controls over steering, throttle, braking and gear. A synthetic sound is generated too, so that the user can feel also the noise of the engine.

Study for Virtual Reality

Virtual reality (VR), which can be referred to as immersive multimedia or computer-simulated reality, replicates an environment that simulates a physical presence in places in the real world or an imagined world, allowing the user to interact with that world [3]. Virtual realities artificially create sensory experience, which can include sight, touch, hearing, and smell.

C.Nagarajan *et al.*[9] proposed logistic or then hiddenunits with "memory cells" that can store an analog value. Each memory cell has its own input andoutput gates that control when inputs are allowed to add to the stored analog value and when thisvalue is allowed to influence the output. These gates are logistic units with their own learned weightson connections coming from the input and also the memory cells at the previous time-step. There isalso a forget gate with learned weights that controls the rate at which the analog value stored in thememory cell decays [3]. For periods when the input and output gates are off and the forget gate is notcausing decay, a memory cell simply holds its value over time so the gradient of the error with respect to itsstored value stays constant when backpropagated over those periods.

Evolving robust and specialized car racing skills

The experiments were performed in a 2-dimensional simulator, intended to qualitatively if not quantitatively, model a standard radio-controlled (R/C) toy car (approximately 17 centimeters long) in an arena with dimensions approximately 3*2 meters, where the track is delimited by solid walls[4]. The simulation has the dimensions 400*300 pixels, and the car measures 20*10 pixels. R/C toy car racing differs from racing full-sized cars in several ways. One is the simplified controls; many R/C cars have only three possible drive modes (forward, backward, and neutral) and three possible steering modes (left, right and center)[4]. Other differences are that many toy cars have bad grip on many surfaces, leading to easy skidding, and thatdamaging such cars in collisions is harder due to their low weight. A track consists of a set of walls, a chain of waypoints, and a set of starting positions and directions [4]. When a car is added to a track in one of the starting positions, with corresponding starting direction, both the position and angle being subject to random alterations. The waypoints are used for fitness calculations.

Tuninga Fuzzy Racing Car by Coevolution

The challenge was to develop the best fuzzy car driver controller for a basic form of car racing in which a pair of simulated cars are raced to a series of waypoints within a 2D plane, and compete between them to reach the maximum number of waypoints [5]. Basic aspects of the car racing are the following: 1, a car only sees the next three waypoints at a given point in time; 2, waypoints have to be visited in order and the next one to visit is highlighted; 3, waypoints are randomly generated on a 2d plane; 4, the car that first reaches the next waypoint scores; 5, cars cannot collide with each other, so both cars can follow the same paths at the same time; 6, cars have imperfect sensors and actuators; 7, it is tested general driving ability rather than specialization to a particular track[5]. The simulation is performed on a two-dimensional plane, where the main components are: 1, a track that generates the waypoints on demand; 2, two cars that compete between them; 3, an evaluation engine for running the simulation (updating the car states, detecting when waypoints have been hit, and keeping the scores for each car).

An Evolutionary Tuned Driving System for Virtual Car Racing Games

The system aims to design,implement, and test a complete architecture enabling automatic driving in racing situations; and to gain in sight in to how to construct efficient and simple to understand controllers for car bots [6]. In this sense, it is based module responsible forcalculatingtheallowedspeedachievedexcellentresultsintheSimulated Car Racing Competition. The architecture is based on the conjunction of simple functional modules each responsible for controlling the vehicle.

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III.METHODOLOGY

The System is a Virtual Reality Driving Game which helps the users to self asses themselves. The system involves driving the vehicle in the environment as of in the real world along with multiple other vehicles. The user experiences the real driving by wearing a Head Mounted Display and controls the vehicle using a VR Controller. Based on the inputs given to the controller the vehicle starts running in a particular speed.

Creating 3D models

Blender is very intuitive and provides many means of creating the models are assets in a quick and efficient manner. All the models which have to be placed on the environment are created as a 3D model using Blender and converted into assets in order to use them in Unity. The 3D model of a car has been created in Blender and it is rendered and imported to Unity.

Figure 2. 3D model of a car

Developing the User Interface

The environment and the road in which the vehicle has to be driven can be built using both the fully customizable built-in systems or by importing the assets in Unity 3D. The side objects such as fences, walls, tree lines, power lines, etc. has been added to the environment either directly from the Side Object System tool or manually.

The interface also includes a timer which starts running once the user starts the game. A scoreboard is also added to provide scores for the users based on how they drive the vehicle.

Figure 3. User Interface

Creating VR Environment

Creating VR Environment in using the unity to run a game. In unity Environment poses the real environment effect. It gives the driver the real experience to drive the car. In the environment the scenes contains the 3D objects that are modeled in the unity.

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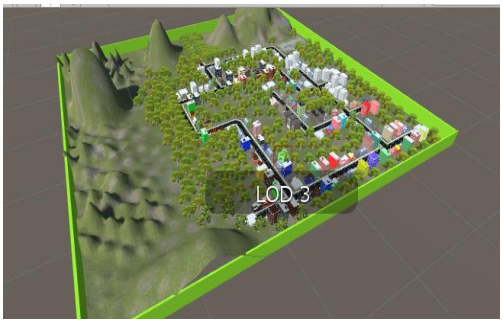

Figure 4. Overview of Driving Environment

Building the APK

Unity VR lets to target virtual reality devices directly from Unity, without any external plug-ins in projects. It provides base API and feature set with compatibility for multiple devices. It also provides forward compatibility for future devices and software.

Figure 6. Users view

After the scene is completely developed and the objects are placed in their positions, the scenes are converted into an executable VR Application which can be run on Android or iOS Devices. The application that is being deployed is easily accessible to the user who uses it.

IV.RESULTS AND DISCUSSIONS

It is a driving game,complex decision-making processes are required in order to play such games.The user can able to experience the driving as of in the real world.The car will be placed initially at a particular point. Controls are being given for the movement of the car. Once the user enters the application, the user can start driving the car after wearing the VR Headset. As the user continues to drive the score board gets added up until the game is finished. The user should try to drive the car in such a way that they get the maximum possible score.In order to measure the performance of the system, a group of people were made to experience the game. It is observed that the system has very good user interface, and the feature of score board motivated to drive for a longer time without crashing on the objects.It is also found that, multiple vehicles on the environment give the feel as of driving in the real world.

V.CONCLUSION AND FUTURE SCOPE

The driving game has been developed for helping the users to learn driving on a simulated environment. This game helps the users to self-assess the driving capabilities and to improve their confidence level while driving. It also helps the users to learn about the level of distraction. i.e. the attention given by the user to non-driving related activity. The users can use this game for relaxation whenever they get stressed or bored. The future scope is to develop a Driving Simulator using Virtual Reality by providing the environment for driving along with a road map of the provided environment. By using the road map the user can be able to know the directions of the road in advance and also the

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shortest route to reach the destination. It also includes, environment with different climatic conditions, traffic signs and signals. The users can also select the car they want to drive.

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