

Generation of Virtual Environment for Haptic (VR) Application

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ABSTRACT

Virtual Reality [VR] is the first step in connecting a human and virtual environment to give a feel of adventure or exposure to landscape of the imagination. It prominence's the digital world and produces immersion or half immersion. Virtual reality, where Design, Dexterity, Science, Art meets to create a radical inventions/ experience. It can cover or combine feel, presence, and touch. Haptics includes software simulation and hardware accessories, where human haptic glove with FSR sensors controls and interacts with a robotic arm with flex sensor as a result, producing vibration or motion in hand. Flex sensor covert the motion of hand to signals and transfers it to the FSR sensor, which converts the signals back to motion (feel). The application of virtual reality is in the field of Defense related and Medical application.

Keywords

Virtual Reality, Haptics, Blender, Unity, Object modeling, Rendering, FLEX sensors.

1. INTRODUCTION

The object creation [6] is a way to simulate the behavior and characteristics of the real world object. Objects in virtual worlds behave just as induced by the programmer or input supplied. This means the objects in the virtual world have no restriction.

The object doesn't hold the forces as in real-world object forces, such as gravity, friction, and collisions. These produce an external/opposite force that inculcates the applied force. The virtual reality [1] uses both 2d and 3d interfaced for creating and virtual environment [VE]. It can also be said that VR Technology can fool the brain by producing a virtual environment in which the person can feel the objects exist in real world. The graphical tools such as Blender 3D, 3D Max are used to create objects. This Technology can be applied to the environment or work that is not familiar or not suitable and it can be simulated using VR. This technology can be used in showing the open heart surgeries, and also in simulating the driving of a car for learners from the beginning, making education fun for students using VR concepts.

The organization of the paper is Section I, introduces the virtual reality domain and it brief idea about the objects and devices that are interacting with the user. Section 2, literature survey gives the research work in virtual reality application in the field such as gaming, education. Section 3, proposed work depicts the idea that can be applied using haptics into different fields such as medical, defense-related applications. The next Section 4, Experimental results describe the results achieved so far from the project and the work will be continued as a part of the idea.

2. LITERATURE SURVEY

Some of the works carried out in the field of Virtual Reality

The research work carried by Megha Goyal [2] gives an idea about the differentiation between human haptics [10] and machine haptics. The human part has control over the location of the hand, while on the other side the machine part exerts a force from hand to react or contact with the virtual object. The computer takes a part as brain and makes all kind of the sense as the muscles do in the body by means of a sensing device.

According to the work in [4] all gamers want is just to have fun and good experience, Touch feedback[11] are very crucial information that cannot be left out, rumble is best when it's very carefully designed and very closely tied to the player's actions or movement or to onscreen events and/or sounds produced. Gamers [10] say it's great when it's realistic or best of all time — when a machine gun doesn't sound purr like a kitten but instead rattles your teeth giving the feel of it.

3. PROPOSED WORK

This section of a paper explains briefly about the idea of the project. There is no conventional way or algorithm to achieve the proposed work. The present work proposes an algorithm or a rule as depicted below in figure 1, 2 and 3.

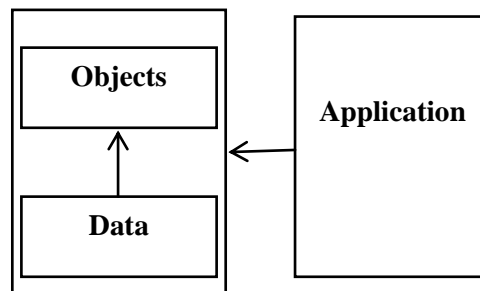


Fig 1: Object and VR system

In figure 1, The VR application/model [3] is built combination of the 3D object created using object modeling graphical tools. Data is nothing but the set of behavior to the object or scripted animation for the object.

Software environment Interface

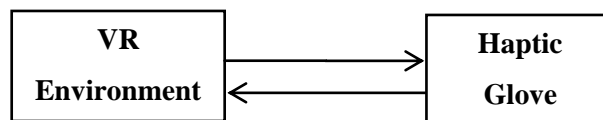


Fig 2: Proposed Work

The figure 2, describes the proposed system and it is hardware to software interaction. The proposed work is explained in detail in further.

The figure 3, shown below the process of designing of an object, it looks similar to the software engineering process. Considering each point while creating an object, gives how its behavior can be showed up.

The proposed work describes of 2 modules haptic glove and the robotic arm with a virtual environment. The robotic arm is mounted with FLEX sensors, which touches the object in the environment and produces sensory signals. These signals are transferred to the haptic [8] glove, where the voltage received is been converted to resistance. FSR sensor converts the resistance to vibrational tactile feedback using actuators.

The objects are designed and rendered into unity virtual environment. Unity tool supports all the virtual reality-based sensory library supports. Hence it behaves as a robotic arm (computer software) that produces the signal.

The interaction component, provides the input value and decodes the value/ behavior and decide where and when to imply the behavior of the object in the VR environment. Which in turn communicate with the behavioral component to update the interaction of objects. There is a need for some implicit interaction which needs to be interpreting the value or input for e.g. robotic arm, hand etc.

4. EXPERIMENTAL RESULTS

The experimental results, object, and its environment has been created using Blender 3d tool and rendered to Unity software environment.

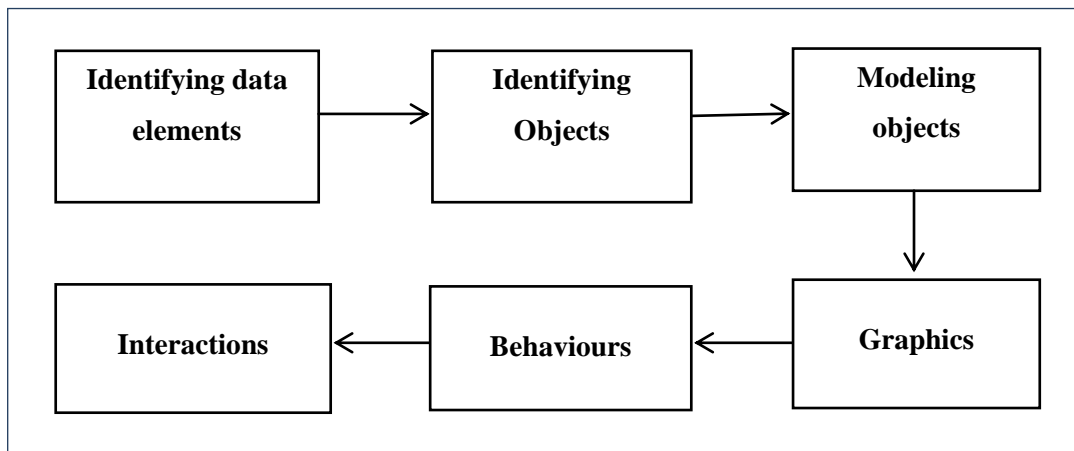


Fig. 3 Designing an Object

The process of the virtual reality as shown in figure 3, objects mean the functional model or part in VR [9], data refers to the script or behavior to be imposed on the objects for animation or interaction with other objects. Once the data is feed to the VR, The application can perform the specified task.

The process shown in Figure 3, starts with primary objects such as a cube, sphere etc. these objects take a complex structure in later stages, 3 techniques namely can be used, Transformation, Rotation and Scaling [7]. These help in creating 3D models required for VR environments. Identifying the data elements, it is the environment in which the object's behavior can be observed. The scene developed for the user to look around and interact with the objects.

Identifying the object component depicts the number of objects that are present and interacting with each other. The objects here can be divided into interactive and non-interactive objects. Modeling the objects part [8] depicts the rough sketch of the object, before imposing or designing it into the environment and gives details about how the object can be utilized. The graphics component depicts the graphical / texture analysis of the interface of the object that must be created. The behavior component depicts, there are 2 types of behavior of objects namely, the Physical behavior of objects observed as any changes in the state of an object in real world. Such as movement of a ball, pen etc. The magical behavior of objects are observed as there is no change or rarely seen change, that to not in real world.

Blender provides an ease to design an object and unity provides virtual environment [VE] for proposing the interacting with the other objects. Designing of an object refers to basic structures of geometry such as a cone, cylinder, plane, and cube. The basic objects are transformed into the required structure as discussed earlier, 3 techniques titled Transformation, Rotation, and Scaling. Translation helps in rotating an object on its axis to counter clockwise. Rotation about a center point of an axis or object. And rotating it in a clockwise direction for placing an object as per required. Scaling stretches or shrinks the size of an object in the environment. The object is placed at center or origin of (0, 0). As the object is used in an environment, it can be positioned using scaling.

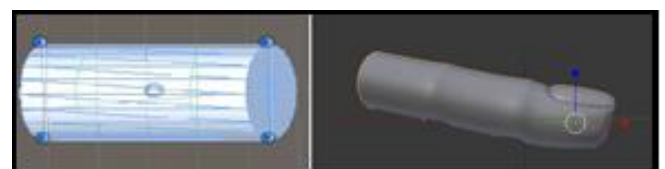


Fig. 4 Translating, rotating, scaling applied to the basic cylindrical object

The figure 5, describes the game development scenario of a player. The object is animated in a virtual environment using C# script and functions. In the game development scene, the person is holding the bow and arrow trying to hit targets. The movement of the hand with bow and arrow provides a feel of

vibrotactile feedback to the real-time player using FSR and FLEX sensors.

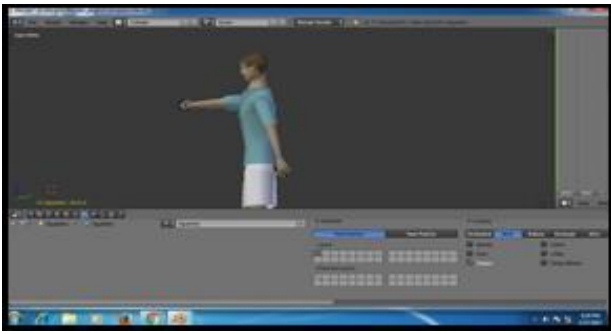


Fig 5. The Player Module Designed to render in Unity

The figure 6, shows complete camera view of the virtual environment. The VE scene describes the PULL, FIRE, SPACE from actuators library support from unity software tools. The PULL and FIRE action need activation of Functions written in the C# scripts.



Fig 6. The Game designed module rendered into a virtual environment.

5. CONCLUSION

The proposed work helps in the defense application in embodying the life of aspirant or life savers. It helps in experiencing the feel of unstipulated object in VR in the form of simulation, in a real-time environment. The current proposed work has depicted in the form of software-hardware interaction, future work of the proposed application will be hardware to hardware interaction for higher experience of virtual reality. Virtual reality is enhancing the experience of gaming development field, medical related applications such as

open surgeries, also in the military field for protection of man force.

The future scope is to build a robotic arm with haptic glove for human hand that help in ensuring safety of person by which he can operate a task being at safe distance(defense field task), and also as an entertainment in terms of gaming etc., such that it can enhance the sense of movement/touch created as vibration.

6. REFERENCES

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