ISSN: 2277-9655
Scientific Journal Impact Factor: 3.449
(ISRA), Impact Factor: 1.852

IJESRT
INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

Effects of visual conflicts on 3D Object Picking Process In Non Immersive Virtual Environment

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Abstract

Object Picking in Virtual Environments is one of the main tasks along with travel and manipulation. It deals with indicating objects and has been implemented with multiple techniques, each trying to improve performance measures such as accuracy, speed and task completion time. Various interaction techniques have been developed for interactive 3D environments. This paper presents an effect of Visual Conflicts on 3D object Picking Process in Non Immersive virtual Environment. There are a few fundamental pointing-based user interaction techniques for performing pick process. One of these techniques is based on ray casting, which makes selections by determining intersections of objects with the mouse click. In this paper I describe about an object picking algorithm with embedded coding and present a simple yet effective application-independent for 3D input devices. We also discuss a differential geometry based surface constraint that can be applied to the 3D cursor position for improving points matching.

Keywords: object picking, non immersive virtual environment, bounding box, picking process, 3D selection..

Introduction

People spend all their lives in a 3D world and they develop skills for manipulating 3D objects, navigating around the 3D world, and interpreting 3D spatial relationships. However, they often find it difficult to interact in interactive 3D environments. Quite often, this is the result of a not properly designed user interface or due to inappropriate selection of interaction techniques. Therefore, in this paper we present a comprehensive review of the state of the art of mouse and touch based interaction techniques for interactive 3D environments. We hope that this survey can use for both researchers and developers of interactive 3D applications in having a clearer overview of the topic and in particular can be useful for practitioners and researchers that are new to the field of interactive 3D graphics. We designed a pointing-based probabilistic selection algorithm that alleviates some of the error in user selections. This technique takes into consideration the hierarchical structure of the scene objects. It assigns probabilities that the user has selected particular objects, within a frustum along the user's pointing direction, using a set of low-level 3D intersection-based selection techniques and the relationship of the objects in a hierarchical database, and makes the selection using one of several weighting schemes. Non-immersive systems are a relatively new implementation of VR technology and borrow considerably from technologies developed in the flight simulation field. Using a wide field of view, these systems increase the feeling of immersion or presence experienced by the user. However, the quality of the projected image is an important consideration. It is important to calibrate the geometry of the projected image to the shape of the screen to prevent distortions and the resolution will determine the quality of textures, colors, the ability of define shapes and the ability of the user to read text on-screen which are more expensive. The non-immersive variety, refers 'artificial reality,' requires no personal hardware. Rather, the person enters an environment - a room, a simulator, etc. - where normal sensory cues are not cut off, but are supplemented by additional sounds, images, or other sensations. The advantage of this type of VR is that it can be a communal experience, with many people participating at once. In a sophisticated enough environment, it might be difficult to determine who the "real" participants are. In this environment, they remain themselves, participating in their own quite real body,

ISSN: 2277-9655
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although obviously costuming and masquerade may be part of the experience.

Related work

Previous experiments have identified factors that influence user performance on picking process. They have also shown factors that can be used to differentiate performance between the pick techniques but have not developed predictive models using the factors. The goal of our experiment was to gather the data needed to create a model of the known factors that influence performance.We define interactive 3D environments as computer representations of real world or imaginary spaces through which users can navigate and in which they can interact with objects in real time. In this paper, we have chosen to focus solely on improving pointing-based selection. Our selection algorithm introduces the concept of executing multiple selection techniques and choosing the selection from the results of those techniques using a touch sensor scheme. Users often make pointing errors, especially when selecting small objects, objects at a distance, or when trying to make a selection quickly. Furthermore, pointing provides the object's direction, but not distance, so when several objects lie in the direction the user is pointing, it remains unclear which object the user intended to pick. The algorithm combines several object picking algorithms and the hierarchical structure of the dataset ,and then integrates the resulting candidate selections. We focused on an understanding of the fundamental tasks users may engage in while exploring non immersive virtual environments and included a review of mouse-based 3D interaction techniques useful in the context of 3D Web. Commonly known approaches to collision detection perform in real time only when applied to facetted models. Another modeling on is, that collision detection mainly focuses on sparse environments with many small moving objects. In contrast to that, in a part modeling application, the scene is mainly build up by one complex CAD model with a moving 3D cursor.

Picking Process in Non immersive VE

The most common way to pick objects in non immersive VEs is position a mouse cursor over given object and clicking a mouse button. The technique is based on ray casting and it uses the ray from the eye point through the pixel currently selected by the mouse pointer to find the first intersection point with the scene. If the virtual ray intersects an object, it can be selected for further manipulation. This analytical study based on developing, analyzing and evaluating new techniques for artificially improving target acquisition in 2D, but this work can also be useful in the 3D context. Our algorithm presents a user study comparing the performance of object picking in virtual environments. The reported study indicates that accuracy is improved by picking, but not task completion time. Moreover, the surface of this volume is semi-transparent, thereby affording occlusion cues during target acquisition.

Fig 1: Non Immersive Virtual Environment

Object picking is a primary interaction technique which must be supported by any interactive three-dimensional virtual reality application. Although numerous techniques exist, few have been designed to support the selection of objects in dense target environments, or the selection of objects which are occluded from the user's viewpoint. There is, thus, a limited understanding on how these important factors will affect selection performance. In this paper, we present a set of design guidelines and strategies to aid the development of selection techniques which can compensate for environment density and target visibility. Based on these guidelines, we present new forms of the ray casting and bubble cursor selection techniques, which are augmented with visual, audio, and haptic feedback, to support selection within dense and occluded 3D target environments. We perform a series of experiments to evaluate these new techniques, varying both the environment density and target visibility. Objects available in the second phase basic interaction task correspond to an indivisible unit of information that is meaningful in the context of the application. The bounding boxes are usually axis-oriented, described by two opposite corner vertices, and the bounding spheres are described by the centre and the radius. A Bounding Box for an object is just a rectangular box in three dimensional spaces, with sides parallel to the coordinate planes, that contains the

ISSN: 2277-9655
Scientific Journal Impact Factor: 3.449
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object. A bounding box is an orthogonal, rectangular volume that bounds an object. More complicated bounding volumes maybe considered for efficient bounding when a small number of bounding primitives are required. Such volumes use more parameters in their description, allowing a wider range of shapes in optimizing their filling efficiency and trading away some of their computational simplicity.

The choice is highly dependent of the shape of the objects to be bounded. For elongated objects, possible solutions include bounding ellipsoids and cylinders. Clicking a mouse will create an appropriate picking bound at a 3D coordinate associated with the current mouse position. Object within a bound is selected. When no bounding box intersects with the picking ray, no object is selected. Using a mouse to select objects in 3D is a little tricky because the mouse gives only 2D pixel coordinates which must be somehow converted to 3D coordinates. In fact, the mouse location on screen represents an infinite number of points in world space which are projected on to a single point in screen space. In a 3D environment, there may be more than one object under the mouse pointer when it is clicked. Normally, the user's intention is to select the object which is visible at this point. The general approach will be to use the mouse coordinates to generate corresponding points on the near-plane and far-plane in world coordinates. These points will form a ray. The ray will be compared against every object. For intersection If more than one object is intersected, the object nearest the viewer is selected. We may pick object within a specific bound which can be updated dynamically depending on changes in the view point of a user with in the 3D world using mouse.

Need of Object Picking Algorithm

Object picking process provides an initial understanding of how these factors affect selection performance. Furthermore, the results showed that our new techniques adequately allowed users to select targets which were not visible from their initial viewpoint. In its simplest form, picking can be defined as the problem of estimating the trajectory of an object in the image plane as it moves around a scene. Additionally, depending on the picking process, a tracker can also provide object-centric information, such as orientation, area, or shape of an object. Picking 3Dobjects can be complex due to:

- loss of information caused by projection of the non immersive virtual environment
- complex object motion and shapes of 3D objects
- nature of objects and object movements
- Scene illumination changes and processing requirements.
- Distance
- Scene complexity

One can simplify the pick process by imposing constraints on the motion and/or appearance of objects. For example, almost all picking algorithms assume that the object motion is smooth with no abrupt changes. One can further constrain the object motion to be of constant velocity or constant acceleration based on a priori information. Prior knowledge about the number and the size of objects, or the object appearance and shape, can also be used to simplify the problem. Our algorithm can handle objects of different shapes and sizes since it does not depend on object specific features such as lines, circles etc. Thus, new objects can be handled without any change in the algorithm, except for the pre-computation of a database of the object

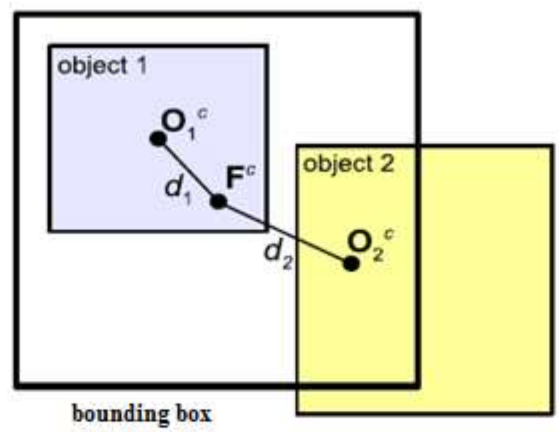

Fig 2: object1 will be picked

Algorithm

The following steps summarize the process of object picking

1. Create a virtual scene
2. Create a picking behaviour object with root, canvas, and bounds specification
3. Add the behaviour object to the scene graph
4. Enable the appropriate capabilities for scene graph objects
5. Picking object using bound volume
6. Finding the shortest distance object

ISSN: 2277-9655
Scientific Journal Impact Factor: 3.449
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7. Checking whether the click point lies on the object or not
8. Converting local coordinates to screen coordinates

This technique is used to pick a 3D object the user clicked on with the mouse. It can be used to discover the object at any X,Y,Z position on the screen. The mouse picking operation can be performed by an ordinary ray-object intersection test and accelerated by lots of schemes for high efficiency. This algorithm performs a intersection tests between a picking ray and multiple objects in an arbitrarily complex 3D environment using some new features of graphics hardware. a Pick action has to be performed with every cursor movement, to detect if the cursor has to be snapped to an object. In the above-described Pick procedure, the nearest point calculation is the crucial time-consuming factor. Thus, the number of these calculations has to be further minimized beyond the level already reached with the bounding box checks to enable real-time snapping on moderately complex and precise models. In order to find the nearest point, the boundary points of the object should be found. Calculate the distance between the center of the cube and the boundary points. Then the distances should be compared and the shortest distance is picked up. The boundary point, which produces the shortest distance, is the nearest point.

Distance = sqrt((cx-bpx[i])^2 + (cy-bpy[i])^2 + (cz-bpz[i])^2)

Where cx, cy, cz are the mouse clicked position with respect to the screen dimension. When picking an object, typically we are not interested in the entire scene graph tree to that object, just the actual object that was picked. Since the object is a visible item, it has no children and the end of the path is the picked object. The picked item can never be an item in the middle of the path. This module performs very important task of this algorithm. Because this module only finds the top most object among all the selected objects. This is done by maintaining the distance of the plane to eye. The details retrieved from the database are in the format of original data. This original data format is converted into the format of shape and appearance and build into 3D part. All the transformations can be performed only on the 3D part. For all the surfaces in the 3D part, check from the transformed data format builds the 3D part of an object. For all the surfaces in the 3D part determine whether the mouse lies on the plane or not. If yes, Set the found Flag and store its distance to eye in the buffer else go to the next surface. Sort all the objects by its distance. After sorting the distances of objects in descending order, the top most object is declared as the selected object. Figure 3 illustrates the output of our algorithm. Each object detected is marked with a bounding box and its corresponding output is displayed.

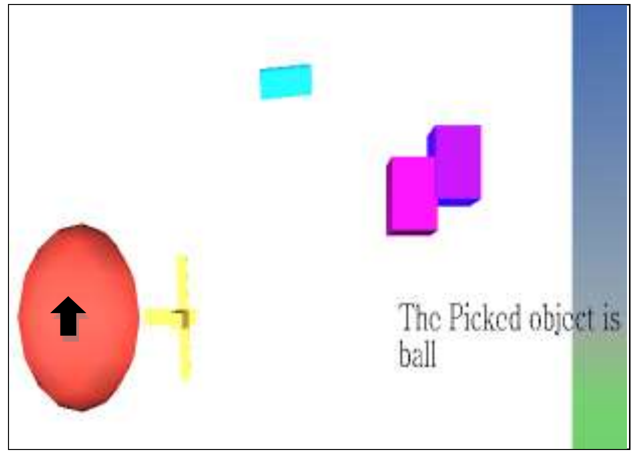

Fig 3: Picking process in non immersive VE

Furthermore, the Analytical Report provides some new areas for future developments of usability evaluation methods. We have compared the performance of the algorithm, with retrieval results. Furthermore, the results showed that our handle the hits, and get the picked new techniques adequately allowed users to select targets which were not visible from their initial viewpoint. This paper has given a good starting point for designers and can be directly applied to all objects. Thus this algorithm is too simple, more efficient and it helps in easy interaction with the virtual world, hence it makes the Virtual world user friendly. Depending on the application, it can be advantageous to provide visual feedback to the user on the state of the semantic pointing functionality. Therefore, it is important to examine the comparative study that are available and determine those that are best suited for the tasks that need to be accomplished. The algorithm gains its performance by multi-level bounding sphere checks and by taking succeeding coherence. With this algorithm it is possible to pick an object with a bounding box along the surface of moderately.

Table 1 shows the number of correctly selected target objects as time goes by. Vertical movements of the line indicate execution of a selection operation where horizontal movements indicate navigation and manipulation. Examining these results, a designer can determine where the bulk of the

ISSN: 2277-9655
Scientific Journal Impact Factor: 3.449
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interaction time is spent and can concentrate their efforts to pick a 3D object.

Experimental result

Table 1: Example of picking object from virtual world

Clicked position	distance							
	Cylinder	Pink box	Bar1	Bar2	Bar3	ball	Blue box	Picked object
X=-3.916022 Y=-2.422956 Z=0.0715973	4.78848183	6.1944302948	3,205730567	3.30397738577	3.3097738577	0.93164151	7.01198483	ball
X=-3.673018 Y=1.1096474 Z=3.4792087	0.19848991	7.10501907	3.99254785	3.9925234156	3.91190438	5.593527	7.768119732	cylinder
X=1.9328213 Y=-0.363214 Z=0.166437596	3.8810306866	4.184392079	0.5445843398	0.5446779926	0.5740348562	3.126088927	4.981104856	Bar1
X=3.21772360 Y=-0.87868607 Z=0.618315339	7.682824064	1.2015054431	5.3549604654	5.3549795978	5.2729266702	7.5846631577	0.5700156877	Blue box

Conclusion

This paper has given a good starting point for designers and can be directly applied to all models. The technique provides the user with an easy and precise way to pick the desired object, independent of its size, location or orientation. We have analysis object picking algorithms and shown their characteristics and limitations through a user study. Therefore, it is important to examine the comparative study that are available and determine those that are best suited for the tasks that need to be accomplished. With this algorithm it is possible to pick an object with a pick sphere along the surface of moderately in Non immersive VR Environment. Thus the performance of the picking process increase while using this picking algorithm. We evaluate state-of-the-art online picking algorithms with detailed analysis on their performance. The experimental comparisons demonstrate the strength as well as weakness of these algorithms, and shed light on future research directions.

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Scientific Journal Impact Factor: 3.449
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