Different levels of interaction in a Virtual Environment

D. Oyarzun
Edutainment and Graphical UI Department
VICOMTech Research Centre
Paseo Mikeletegi,57
20009 San Sebastian, Spain
doyarzun@vicomtech.es

A. Ortiz
Edutainment and Graphical UI Department
VICOMTech Research Centre
Paseo Mikeletegi,57
20009 San Sebastian, Spain
aortiz@vicomtech.es

ABSTRACT

The widespread use of electronic devices in the daily tasks has motivated the research in user interfaces. The conversational user interfaces using virtual characters are starting to be widely used in order to improve the human-computer communication, due to the illusion of having a conversation with a real human. Our approach is based on having an avatar as the main interaction element in the virtual environment. Thanks to the virtual characters we can "connect" all the components in the system, such as user, VE and avatars, and having a high level of interaction. In one hand, the user can interact with the avatar and with the environment. In the other hand, the avatars can interact with the user or behave in an autonomous mode, interacting between them. Having this kind of interaction implies the development of animation techniques, path finding, collision detection, human behaviours, etc. The techniques implemented for achieving the different levels of interaction are also explained in this paper.

Keywords

User interfaces, animation techniques, Virtual characters, path-finding, collision detection

1. INTRODUCTION

In order to have a natural communication with electronic devices, it is obvious that the interaction with the user interfaces should be totally different to the actual desktop paradigm based on windows, icons, mouse and pointers (WIMP Paradigm), which almost have not been changed since it appears in 1984. In this paper we explore the possibility of improving the interaction using virtual characters.

Projects as [Oli00a, Eur04a, Mar03a] have been focused their work in having a realistic avatar, which can help or represent the user in the virtual environment.

Our approach is based in this premise but extended to having different levels of interaction.

In section 2, our way of understanding the different levels of interaction, which should be included in a virtual environment, are explained. The necessary techniques, including the explanation of our facial and body animation engine and the static and dynamic collision detection, are explained in section 3. In section 4, the prototype, which consists in a virtual museum with two avatars integrated, is explained. The avatars can interact with the user or the environment, or act in an autonomous mode, interacting between them.

Conference proceedings ***ISBN 80-903100-8-7***
WSCG'2005, January 31-February 4, 2005
Plzen, Czech Republic.

2. INTERACTION IN THE VIRTUAL ENVIRONMENT

Our approach is based on having an avatar as the main interaction element in the system. In this way, the system is going to be made up of avatars, the virtual environment and the user. Thanks to the virtual characters we can "connect" all the components in the system, obtaining the following levels of interaction:

Between the user and the avatar: If the user asks about some information related with the environment, the avatar will react in a natural way, with verbal and corporal language.

Between the user and the environment: The user is able to move through the environment freely, interacting with the objects and navigating through the rooms.

Between avatar and environment: As the user, the avatar is able to move through the environment freely, interacting with the objects and navigating through the rooms, avoiding the walls or other avatars which are in the environment

Between avatars: The avatar can adopt several roles in the environment. By means of behavioural rules, their behaviour when they are not interacting with the user can be defined.

3. ACHIEVING THE INTERACTION

Every levels of interaction involve the development of techniques that can carry out them.

Animation engine

A facial animation engine has been developed using advanced morphing techniques [Ale00a] and individual deformations and transformations. The animations are defined using a VHML authoring tool [Car04a].

The body animation engine uses VRML for predefined animations as walk or run, and inverse kinematics for real-time generated movements as pointing [Wel89a].

Collision detection and automatic computation of new trajectories

Other fundamental module in the application is the collision manager. Without it, the avatar could move in the virtual world without taking the relative position of walls, objects or other virtual characters into account. We have developed an algorithm in order to solve it.

In a first step, the algorithm calculates a trajectory between two desired points avoiding the walls; it is done abstracting the virtual world into cells and connections between them. Each cell is an area that has not static obstacles and where the avatar can walk in straight line without colliding. These cells are used in order to create a graph to perform a heuristic search. Then, using the A* algorithm, the shortest path between the two points is obtained.

In a second step, the possible collisions with dynamic elements, as other avatars, are detected. First, the algorithm tries avoid a detected collision stopping one avatar; then, if the collision persist, we shirk between them by means of calculus the internal tangent of the two circles that abstracts the avatars. This step is periodically done on an efficient way. Having the speed of the avatars into account, the minimum time that they would take on meet another time is calculated, and it will be the next time that the step will be executed.

Finally, the definitive trajectory is computed taking into account the positions of the dynamic and static obstacles, because, due to the changes in the trajectory in order to avoid the dynamic obstacles, a new collision with a static obstacle could be caused.

4. DESCRIPTION OF THE PROTOTYPE

In order to test the techniques developed, a prototype has been developed.

Our prototype is a virtual museum, where two virtual assistants are integrated, and the user can navigate and interact with the environment, with the objects and with the avatars. The virtual world and the avatar's body are made in VRML and the avatar's head is a polygonal model saved in the Alias/Wavefront format (*.obj).

While nonuser is interacting with them, they start to interact by means of some predefined behaviour rules. When they meet, they salute with more or less effusively depending on the time that has been since the last salute.

The user has the possibility of asking for information about the pictures of the museum to one avatar. In that moment, the selected avatar will get out of its autonomous condition, it will come near of the picture that the user is asking for, and it will start the explanation about the picture.

5. REFERENCES

[Ale00a] Alexa, M., Behr, J., and Müller, W. The Morph Node. Proc. Web3d/VRML 2000, Monterey, CA., pp.29-34. 2000

[Car04a] Carretero M.P., Oyarzun D., Aizpurua I., and Ortiz A. Animación Facial y Corporal de Avatares 3D a partir de la Edición e Interpretación de Lenguajes de Marcas. Congreso Español de Informática Gráfica CEIG,pp.139-150.2004

[Eur04a] Eurocitizen: a web-based game of knowledge &collaboration for Europe. Retrieved on October 2004; from: http://eurocitizen.mls.gr

[Mar03a] Marques Soares, J., Horain, P., and Bideau, A. Sharing and immersing applications in a 3D virtual inhabited world. Laval Virtual 5th virtual reality international conference. pp. 27-31.2003

[Oli00a] Oliveira, J.C., Shen, X. and Georganas, N.D. Collaborative Virtual Environment for Industrial Training and e-Commerce", Proc. Workshop on Application of VirtualReality Technologies for Future Telecommunication Systems, IEEE Globecom. 2000

[Wel89a] Welman, C. Inverse kinematics and geometric constraints for articulated figure manipulation B. Sc. Simon Fraser University, 1989