CeBIT
Join the vision
HANNOVER
15.–21.3.2007
cebit.com

TRAVO

Heinz Nixdorf Stiftung
Stiftung Westfalen

TRAVO – Transfer and Visualization of Mobile Graphical 3D Objects

Marcus Hoffmann, Martin Knuth, Tatiana Tekušová

German Abstract

TRAVO (Transfer und Visualisierung mobiler graphischer 3-D-Objekte) ist ein von der Heinz Nixdorf Stiftung gefördertes Forschungsprojekt, dessen Schwerpunkt die Übertragung von dynamischen 3-D-Daten auf unterschiedlichste Endgeräte wie Smartphones, PDAs, PCs oder Notebooks darstellt. Dabei wird der Ansatz, der bereits im WAP Projekt entwickelt wurde, weiterverfolgt und erweitert. Der Focus von TRAVO liegt vor allem auf der Visualisierung von graphischen 2-D- und 3-D-Daten auf mobilen Endgeräten wie Smartphones oder Pocket PCs. Im Projekt wurde ein generisches System entwickelt, das eine hohe Portierbarkeit und flexible Möglichkeiten der Einbindung in unterschiedlichste Applikationen erlaubt.

Introduction

The TRAVO project – transfer and visualization of mobile graphical 3D objects – aims to enable real-time 2D/3D visual communication for multiple end user devices using dynamic 3D datasets. The range of devices includes Smartphones and pocket devices as well as desktop computers and notebooks. The project especially targets the development of high quality visualization possibilities on very slim mobile devices. The system is created in a generic way that allows the easy integration into a large number of target applications. The project is funded by the Heinz Nixdorf Foundation. TRAVO enables the communication of mobile devices in 3D content connected in a real-time graphics environment to multiple users. Sharing the dynamic 3D data sets constitutes a large step towards the mobile online society where everyone is connected online.

Technical Approach

The main goal of TRAVO was to enable a visualization of graphical content on mobile devices. Here, the challenge was to handle the very restricted resources of such devices. For example, a usual Smartphone nowadays runs with a 220 Mhz processor and 30 Mbytes of available internal memory. Obviously, this restriction is the biggest handicap for the transmission and visualization of graphical content. TRAVO aims at the visualization of large 3D datasets, like city models or 3D content creation data as well as 2D graphical content, on a slim device in a very high quality. The slim device itself can not handle such large amounts of data. Therefore, we implemented an approach that outsources the calculation for rendering, visualization and dynamic representation of the scene to a render server that pre-calculates all rendering data. This server receives its data directly from a data server or the target application. The target application can be at least every graphical application that can integrate the interface of the render server for the communication to the mobile client. The results of the render server – the completely rendered and transformed images – are transmitted to the mobile device. The transmission can be done using either an image sequence or a coded video stream. Mostly all Smartphones available today are able to process video streams in real time. This fact enables the slim devices to show rendered scenes of a scalable quality and of 3D scenes that are larger than the technical properties of the device itself would allow handling. The limitation of the size and quality is now attached to the abilities and resources of the render server and no longer to the resources of the device itself.

Realizing the approach described so far would only allow the user to passively participate in the graphical 2D or

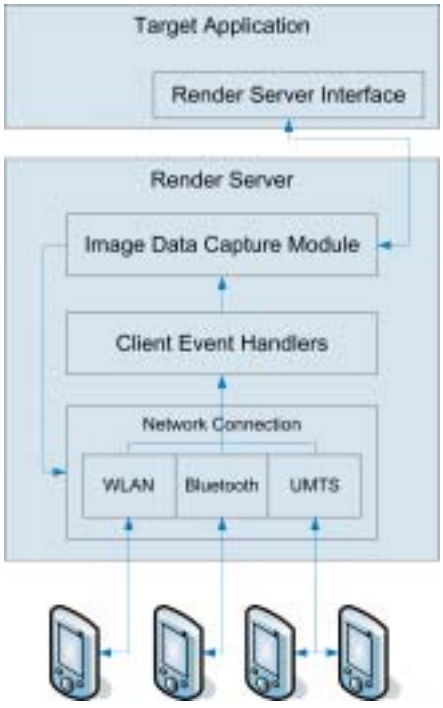

Figure 1: Basic System Layout

3D content. To enable interactivity, the control commands of the pocket device are back-loaded to the render server enabling a basic interactivity. For example, the user can now pick objects and get information on them or navigate through the scene. The render server will react on the command input from the mobile client and can adapt the scene rendering concurrently or tell the target application to do so. The new information will be rendered immediately and will be transmitted to the client using the described streaming technology. Using these input abilities, it also becomes possible to steer defined parts of the target application.

When connecting a large number of clients to such a render server, this server can reach its computational limits very quickly. To avoid this result, more than only one render server can be established. Handling only a limited number of clients by each server allows a constant and stabile performance for bigger numbers of clients. This modularity makes the system very flexible to use and easy to port.

Fields of Application

Mobile Financial Analysis

To be able to observe the progression of the market, analysts and portfolio managers need to access their data at every time and everywhere. For this reason, a mobile connection to their tools is of high importance. Market information can be visualized as scatter plots and transmitted to mobile clients. The technology developed in TRAVO was used to integrate a mobile component into the financial application FinMotion. The application provides a system for the visual analysis of financial time-dependent data with an extensive number of data elements. For example, the development of multiple stock indicators can be visualized and analyzed graphically over a period of time. It uses a scatter plot framework to display various stock variables also encoded by a suitable glyph design of the data. The glyphs are animated in order to show the dynamics of the data. Further features include, for example, focus and zoom, details on demand and time period selection.

More informations about financial analyses applications you can find at the article »Visual Analytics for Financial Institutions« on page 23-24 in this topics.

Steering Large Presentation Installations or External Hardware

Using the TRAVO system, a mobile client can be used to steer large presentation installations like the HEyeWall®.

The image data for the mobile client can be captured from the cluster rendering system for the HEyeWall®. Then, the renderer can be steered using the steering protocol with the mobile device. The mobile device then acts as a remote control for the installation including a real-time remote visualization. This scenario enables new possibilities for interaction and presentation. The steering must not be limited to presentation devices. If hardware is connected to the back end of the renderer, the 3D gearing information from the mobile client can be sent over the rendering device to the real hardware to be interpreted there. The system is designed to be open to a wide range of application areas. For example, it can be used to control a vehicle remotely with the mobile device using the visualized virtual 3D environment information on the mobile phone to direct the vehicle through a landscape.

Mobile Collaborative Virtual Environments

Real-time collaboration with other users on the same graphical content or in the same virtual graphical environment becomes more and more important. The access of the latest design data sets using a mobile device to show internal and external customers the latest developments and products opens up new possibilities in marketing and sales. Our system provides the potential for mobile participation in such environments. The collaborative online gaming market has strongly grown in the last few years. Most of these applications are using 3D rendering technologies to provide the users with realistic 3D environments and playgrounds. A streaming possibility is already a requirement for these applications. The introduced system will be able to additionally connect mobile devices to such environments and start interacting with other participants in these virtual worlds independent from a specific location (see figure 2). The scenario can be extended to the serious games sector where training and learning processes can be advanced using mobile devices.

Figure 2: High quality interactive mobile visualization of a virtual game environment on a smartphone.

Note

TRAVO will be presented on the Fraunhofer-Forum (see page 33-34) and the »future talk« at the CeBIT 2007.

Point of Contact

Dr.-Ing. Jörn Kohlhammer
Fraunhofer IGD, Darmstadt, Germany
E-mail:
joern.kohlhammer@igd.fraunhofer.de