ELSEVIER

Visualizing processes on the web

Delfina Malandrino*, Giuseppina Palmieri, Vittorio Scarano

Dipartimento di Informatica ed Applicazioni "R.M. Capocelli", Università di Salerno, Fisciano, Salerno, Italy

Abstract

In this paper, we describe 3WPS, a framework to build distributed systems that are able to monitor and interact with a process through a 3D interface that is accessible via the World Wide Web (WWW). The 3WPS is easily configurable, easily adaptable to different processes with high reuse of its software components and its distributed architecture leverages on off-the-shelf components of the WWW infrastructure such as Java applets and Virtual Reality Modeling Language (VRML) browsers. We describe the characteristics of 3WPS framework by mainly focusing on the issue of programmability and by contextually providing an example tour of its usage.
© 2006 Elsevier Ltd. All rights reserved.

Keywords: Visualization systems; Monitoring; VRML

1. Introduction

The role of multimedia in the process control industry keeps growing: it is important for supervisors and other personnel to be quickly informed of the behavior of a process so that further investigations and/or appropriate actions can be taken to keep the process along the required trail. In this field, multimedia visualization is an appealing tool for this kind of users that need to be updated on several processes (sometimes quite a handful) only through a quick glimpse. It is, in fact, recognized that multimedia allows an increased amount of information to be communicated and an improved way of drawing the operators' attention to high-priority information [1]. In some critical applications multimedia role is crucial since it avoids that high-volume data either delay the appearance

---

*Corresponding author. Tel.: +39 089 969308; fax: +39 089 969600.
E-mail address: delmal@dia.unisa.it (D. Malandrino).

of a failure or possible malfunctioning in the so-called *user's universe* [2] or make the faults completely transparent for the operator altogether [3]. A non-negligible aspect of multimedia is also that its ease of assimilation leads to more efficient and effective operations [4] and that an engaging interface increases operators' satisfaction therefore improving their efficiency on the job [1].

The 3D visualization techniques can be indeed a powerful technique to show large amount of information compactly and, moreover, in such a way to suggest behavior and affinity among different entities because of their placement in the virtual world. Other techniques that use sounds to represent behavior of processes ("sonification") are currently studied and research is very active in this area. Examples for monitoring a World Wide Web (WWW) server in real-time by sounds and graphical icons can be found in [5,6] as well as experience with Simple Network Management Protocol (SNMP) [7].

Unfortunately, in the recent past, several specific systems for information visualization were designed, each one with a definite realm of application. The always growing availability of high-performance client workstations and the widespread diffusion of the Internet and the WWW demand for a well-established platform that can be used to build 3D visualization systems, and that can be efficiently deployed with the minimal resource of work from programmers, engineers and designers. A nicely built framework has been proposed by Bender [8] that takes into account all the technologies available on the Web to design a 3D visualization system. Their framework is, nevertheless, intended exclusively to the task of visualization of static data sets and neither dynamically changing data (necessary in process monitoring) nor interaction with the underlying system by the 3D representation are taken into account. Another interesting project, CyberNet, has been proposed by Abel et al. [9]: its goal is to provide a metaphoric 3D representation of network data and network services. Unfortunately, it lacks an explicit programming layer that allows the manager to modify the configuration of the 3D representation without (re)writing part of the system itself.

In this paper we present a distributed system called 3WPS [18,19] (pronounce "threewops") that provides a framework to build Web-based 3D visualization systems of processes. Our framework allows to build a highly programmable client–server interface to a process to be monitored via a 3D representation. Furthermore, our framework allows interaction with the process via the 3D representation: it is possible to program client and server in such a way that user's actions on the 3D representation are then conveyed to the process. In fact, 3WPS allows, besides navigation of static data sets, to assemble a 3D monitor of a process, i.e. a 3D abstract representation to the behavior of the process, and (with little effort from the programmer) a 3D interface to the process, allowing the user to interact with it by using and navigating its 3D representation.

In the rest of the paper we briefly present the system and then propose several applications that substantiate our claim of easy design and implementation of 3D monitors and interfaces to processes.

2. System design and architecture

The 3WPS is designed to offer an easily configurable and adaptable framework to provide 3D dynamic monitoring and interaction with software processes. Our system is directly interfaced with the data generated by the software process that can be the originator of the data or, in case of monitoring of external devices, can be simply a process