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NPSNET: A 3D Visual Simulator for Virtual World Exploration and Experience

Submitted as virtual reality.

NPSNET is a multi-player, real-time, 3D visual simulation system capable of displaying vehicle movement over the ground or in the air. Displays show on-ground cultural features such as roads, buildings, soil types and elevations. The system supports a full complement of vehicles, houses, trees, signs, watertowers, cows, and attack tomatoes, and it generates environmental effects such as Monterey-like fog or Los Angeles brown haze.

With a mouse, the user selects a vehicle to drive on a command-and-control screen. Vehicle movement is controlled by a six-degree-of-freedom spaceball or button/dialbox. Up to 500 vehicles can be in interactive motion at any one time. They are controlled by a prewritten script or driven interactively from other workstations communicating through Ethernet. Autonomous players can be introduced into the system via a programmable network "harness" process.

For the last six years, the Graphics and Video Laboratory of the Naval Postgraduate School has been developing low-cost, three-dimensional visual simulation systems on Silicon Graphics IRIS workstations. A number of visual simulators have been developed at the laboratory, including the FOG-M missile simulator, the VEH vehicle simulator, the airborne remotely operated device (AROD), the Moving Platform Simulator series (MPS-1, MPS-2 and MPS-3),

NPSNET is a multi-year project that began in early 1990. It includes integration of databases developed for a low-cost tank simulator (SIMNET), hierarchical data structures for real-time display generation, software structures for world modeling and interaction, SIMNET network integration, semi-automated forces via a network harness process, physically-based modeling for displaying the results of interaction, 3D icon production, representation and abstraction, and aural cues for 3D visual simulation.

The current *NPSNET* system runs on a variety of platforms. The laboratory's highest-performance system is the Silicon Graphics IRIS 4D/240 VGX with 64MB CPU memory, which is capable of some one million triangles per second, z-buffered and Gouraud-shaded. On that system, *NPSNET* shows two to three frames per second with texturing on and many trees in the display. When there are no trees visible, the system runs from seven to nine frames per second with texturing on. The system has a switch to turn off texturing of the terrain, and the comparable numbers are 10-12 frames per second with many trees in the display and 15-17 frames per second with no trees in the display. Current efforts to improve this performance are focused on modifications to the hierarchical data structures employed.

There is a broad range of potential applications for *NPSNET*: training, planning, gaming, and other purposes, especially those in which actual participation may be too hazardous, expensive, or frivolous. It is an ideal system for visualization of 3D environments, such as housing or commercial developments, and its high degree of interaction and low cost provide an efficient method for small unit leadership and coordination training, and mission and route planning.

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Thesis Students
Carl Cecil, Joe Cook, Randy Mackey, Greg Monahan, Bill Osborne, Hyun Park, Jane Polcrack, Phil West, and Kalin Wil

Hardware
Silicon Graphics IRIS workstat in all its incarnations (Persona IRIS, GT, GTX, VGX), Silicon Graphics SpaceBall and Butto Dial Box

Software
Custom

Network
Ethernet

Application
Engineering simulation, aerosp

Type of System
Player, multi-user

Interaction Class
Desktop/vehicle

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