How Real Can We Be? Experiencing the Virtual Reality: A Dynamic 3D Model of the Calit2 Building

Overview

"How close to real can we be in virtual reality?"

Building on a 3ds-Max built static model with two floors and the exterior of the Calit2 building, this project completed the building skeleton and in addition, added dynamic elements such as automatic doors, operational elevators, indoor lighting, and sunlight so that it offers a more realistic experience to users navigating the model using the Cave Automatic Virtual Environment (CAVE).

Significance

Users can walk throughout the building without physically moving. This benefits:

- Architects studying building structures
- Neuroscientists researching relationships between way-finding and brain activities
- Other users who can further explore and apply the possibilities of virtual reality.

General Structure

As dynamic elements were added, a more object-oriented structure was needed to maintain the model files.

The entire model was saved as one 3ds Max file, then from individual or multiple layers, smaller files were saved separately for final export. Currently, the entire model is organized into the following parts:

- Animated doors (Obj + VR)
- Elevator Installation (VR + JS)
- Sunlight effects (Obj + VR + JS)
- Indoor lighting (Obj + VR + JS)
- Elevator prototype (Obj + VR + JS)
- Main Model (Obj)

Dynamic Elements

Compared to a ordinary model to be perceived only with the eyes, a dynamic model provides more interactions between the model and the user, giving a more realistic feel.

Max + VRML + JavaScript

- Autodesk 3ds Max – Model objects
- Manual VRML – Link logic to objects
- JavaScript – Logic (esp. elevator & sunlight)

Final Model

Automatic Doors

- Add Proximity Sensors
- Add Time Sensors
- Export & Add Routing Code

Operational Elevators

- Two files control the elevator:
  - Prototype (user-defined type) file defines all essential parts (objects & logic) for 1 elevator
  - Initializing file creates and positions 3 instances of the prototype elevator and links them to the main model.

Indoor Lights

Simulating the building’s orange lights in the upper floors, an orange light source controlled by switches is placed in the fifth floor coffee area. A weak spot to lighting is that VRML lacks support for shadows due to the demand for real-time calculations on the fly; thus, no real shadows can be seen.

Sunlight

Two sunlight effects can be accessed:

- 24-hour looped sunlight animation (key: light object, circular spline, time sensor, and touch sensors)
- Positioning the sun according to current system clock (key: touch sensor, JavaScript Data object, light object’s key() & keyValues() animation arrays, VRML Route commands)

Optimization

For a real-time interactive model, the frame rate (speed) must remain reasonable in order to achieve smooth navigation.

To raise frame rate, the following methods were used to decrease render (drawing) time:

- Reduce render time
- Reduce texture memory
- Reduce file size

Problems Encountered & Solved

- Faces of objects appear transparent
- Polygons continuously generated
- Light properties not fully supported by browser

Future Work - How Real Can We Be?

- Stylized people walking along specified paths
- Sound effects e.g. detected talking when pass by conference rooms
- Play movie in areas with TV screens
- ... and let imagination fly...

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