MV 3204 Computer Graphics using X3D/VRML (4-0)

Synopsis
An introduction to the principles of hardware and software used in the production of computer-generated images. Focus of the course is design projects using X3D/VRML.

Instructors
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Office hours are anytime you find me there. Usually I am available as indicated by my online schedule in Outlook. Make an appointment if you want to be sure to see me. If necessary you may call me at home (but earlier than 2200 please).

Schedule
Monday through Thursday 1400-1450, ME Annex 285. Exams are project demos. ME 267 Savage Lab is normally available for your use.

Curt Blais, Duane Davis or Jeff Weekley will instruct during my travel days.

January 17-28 New England & Europe: NUWC, NATO, W3C Binary group
February 28–March 4 W3C Technical Plenary, Boston
March 28-31 Web3D Symposium, Bangor Wales UK

Software
X3D-Edit authoring tool. Free. We will use online examples matching the textbook.
http://www.web3d.org/TaskGroups/x3d/translation/README.X3D-Edit.html
http://www.web3d.org/TaskGroups/x3d/translation/examples
http://www.web3d.org/TaskGroups/x3d/translation/examples/Vrml2.0Sourcebook

Textbook
2. Extensible 3D (X3D) specifications online http://www.web3d.org/x3d/specifications

Optional text

No other textbooks are required for successful completion of this course. There are numerous online references available on the course home page at http://web.nps.navy.mil/~brutzman/vrml

Guidelines
1. You must devote time to reading and programming to succeed in this course.
2. Students are encouraged to study together. However every assignment submitted must be your own work. Group solutions to project assignments are only acceptable when specified. As in any endeavor your individual integrity is essential. If in doubt, ask.
3. I am designing this course to significantly help you in your thesis and other courses. Your comments, questions and suggestions are always welcome.
4. Dialog occurs via the class mailing list: mv3204@nps.edu. Please use “MV3204” somewhere in the subject line so that mail filters might work satisfactorily.
Course Objectives

1. Gain a broad view of interactive Web-based 3D computer graphics.
2. Learn to properly design and structure X3D and VRML 97 scene graphs.
3. Learn Extensible 3D (X3D) scene graphs and also rudimentary Extensible Markup Language (XML).
4. Extend your programming skills using animation techniques, Script code and ROUTEs.
5. Support your thesis work and projects in other classes.
6. Use (and contribute to) 3D model archives, online tutorials and public-domain software.
7. Provide tools, techniques and a repeatable methodology that you can use later in your career.

Class Policy and Study Recommendations

1. You are learning new ideas and a new language. Thinking and writing in a new language requires fluency. Don't be reluctant to think new thoughts or work hard. Persistence pays.

2. You will get a LOT more out of class by reading assigned material beforehand. Keep ahead of me in your reading. Read each section at least twice. This is a challenging and ambitious course that is well worth your while.

3. Discussion and dialog will make class a lot more immediate.

4. Projects make up your entire grade, just like the real world. Exams are boring.

5. Grading is based on merit and performance. I expect everyone to work hard and get an A.

6. You learn how to program solutions to problems by doing. Thus we do lots of projects. Each weekly project (or projects, if you prefer) should incorporate and demonstrate the use of VRML nodes we are studying. Your final project should pass the “quantitatively cool” test.

7. Students are expected to hand in projects on time. It is your responsibility to contact me in advance for assistance if you are unable to meet an assignment date. I prefer that you hand in something late which is correct, rather than something on time which is broken. Don't get behind, we will follow a fast pace!

8. I recommend that you subscribe to Web3D Consortium working groups x3d-public mail list via http://www.web3d.org/contact/public_lists.html
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<thead>
<tr>
<th>Week</th>
<th>Chapter</th>
<th>Assignment</th>
<th>Example scenes weekly</th>
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<tr>
<td>1 1</td>
<td>1, 2, 3, 4</td>
<td>Intro, key concepts, shapes &amp; groups, Text</td>
<td>Install/run X3D-Edit, X3D Specification</td>
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<td>January 5-6</td>
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<td>2 2</td>
<td>5, 6, 7, 29</td>
<td>Transform: translate rotate and scaling. WorldInfo and header/metadata conventions.</td>
<td>Discuss projects</td>
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<td>January 10-13</td>
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<td>3 3</td>
<td>26, 8, 9</td>
<td>Viewpoint control and NavigationInfo. Interpolator animation and sensing viewer.</td>
<td>Instructors Curt Blais and Duane Davis</td>
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<td>January 18-20</td>
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<td>4 4</td>
<td>10, 11, 12, 28,</td>
<td>Materials, Grouping nodes, Inlines, Anchors,</td>
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<td>January 24-27</td>
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<td>5 5</td>
<td>13, 14, 15</td>
<td>Indexed points/lines/faces. Triangle nodes. ElevationGrid, Extrusion.</td>
<td>Midterm demos</td>
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<td>January 31</td>
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<td>February 7-10</td>
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<td>7 7</td>
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<td>Background and Universal Media panoramas. KeySensor and StringSensor.</td>
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<td>February 14-17</td>
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<td>8 8</td>
<td>16, 17, 18</td>
<td>binding Colors, mapping Textures</td>
<td>Final project plans preliminary demos</td>
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<td>February 22-24</td>
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<td>9 9</td>
<td>20, 19, 21</td>
<td>Lighting, Normals &amp; shading, shiny Materials</td>
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<td>February 28</td>
<td>March 3</td>
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<td>10 10</td>
<td>23-25, 27</td>
<td>Fog, Sound, Level of Detail, Proximity sensing</td>
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<td>March 7-10</td>
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<td>11 11</td>
<td>31</td>
<td>Prototypes, advanced techniques</td>
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<td>March 14-17</td>
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<td>12 12</td>
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<td>Finals week: class project</td>
<td>Coolness! Final demos</td>
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<td>March 21-24</td>
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MV 3204 Computer Graphics using X3D/VRML - Class Projects

Your grade will be based on various individual programming projects, contributions to the class project and a final report. Some will be individual projects, some will be a group effort.

Graded projects weighting:

- 8 weekly projects at 5% each. Demonstrate use of nodes in current chapters of study.

- 1 mid-term demo at 10%. Demonstrate cool reworkings of kelp-forest content in X3D, plus some new contributions to the models.

- 1 final project at 50%. New models for the kelp forest, for the SAVAGE models library, or on a previously agreed-upon project (such as thesis work).

Here are final project and report attributes:

- Individually designed & executed, or group approach. We have numerous interesting and ongoing projects that can benefit from your improvements and extensions.

- Best approach is work related to thesis, if possible. Think of project as a prototype.

- Topic mutually agreed upon.

- Project outline and methodology proposal, updates due as scheduled

- Deliverables:
  
  - Two pages of prose in report (I prefer that you write a draft thesis chapter)
  
  - at least five references from text bibliography included and evaluated
  
  - abstract, table of contents, problem statement & solutions, screen snapshots
  
  - appendices: software source code, user guide, session log
  
  - provide HTML page and links to source code to remain online

- 10 minute presentation / demonstration to class during exam week
Candidate Projects

- Autonomous underwater vehicle (AUV) dive site, telemetry playback, sonar visualization
- NPS Beach lab facility: real estate, buildings, tanks, photo textures
- NPS campus with terrain, water features, simple buildings
- MBARI’s remote operated vehicle *Ventana* and cold-seep dive site, other Acoustic Oceanographic Sampling Network (AOSN) II projects
- What is your challenge of interest? Let’s discuss it.

Advanced Ten Nine-Foot-Tall Projects

- DIS-Java-VRML humanoids, electronic emission entities
- SOSUS sonar array, beach facility, lighthouse and terrain at Point Sur
- Scientific visualization of sonar beams
- GeoVRML terrain textures, modeling for Monterey Bay or Fort Irwin terrain datasets, Java3D-X3D-VRML interoperability: open-source software, NPS cave, etc.
- Autogeneration of virtual environment components from XML operations orders