

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

1. Ames, Andrea L., Nadeau, David R. and Moreland, John L., *VRML 2.0 Sourcebook*, second edition, John Wiley and Sons Inc., New York, 1997.
2. Extensible 3D (X3D) specifications online <http://www.web3d.org/x3d/specifications>

Optional text

3. Hartman, Jed and Wernecke, Josie, *The VRML 2.0 Handbook: Building Moving Worlds on the Web*, Addison-Wesley Publishing Co., Reading Massachusetts, 1996.

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

MV 3204 Computer Graphics using X3D/VRML

Week	Chapter		Assignment	Example scenes weekly
1 January 5-6	1, 2, 3, 4	Intro, key concepts, shapes & groups, Text	Install/run X3D-Edit, X3D Specification	
2 January 10-13	5, 6, 7, 29	Transform: translate rotate and scaling. WorldInfo and header/metadata conventions.	Discuss projects	
3 January 18-20	26, 8, 9	Viewpoint control and NavigationInfo. Interpolator animation and sensing viewer.		Instructors Curt Blais and Duane Davis
4 January 24-27	10, 11, 12, 28,	Materials, Grouping nodes, Inlines, Anchors,		
5 January 31 February 3	13,14, 15	Indexed points/lines/faces. Triangle nodes. ElevationGrid, Extrusion.		Midterm demos
6 February 7-10	30 review	Event utilities. Scripts. Review topics, SAVAGE projects.		
7 February 14-17	22	Background and Universal Media panoramas. KeySensor and StringSensor.		
8 February 22-24	16, 17, 18	binding Colors, mapping Textures	Final project plans	preliminary demos
9 February 28 March 3	20, 19, 21	Lighting, Normals & shading, shiny Materials		
10 March 7-10	23-25, 27	Fog, Sound, Level of Detail, Proximity sensing		
11 March 14-17	31	Prototypes, advanced techniques		
12 March 21-24	-	Finals week: class project	Coolness!	Final demos

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

- Ships, aircraft, vehicles. Help populate periscope training, submarine collision and amphibious invasion projects. <http://web.nps.navy.mil/~brutzman/Savage>
- Autonomous underwater vehicle (AUV) dive site, telemetry playback, sonar visualization
- NPS Beach lab facility: real estate, buildings, tanks, photo textures
- Kelp Forest! <http://web.nps.navy.mil/~brutzman/kelp>
- 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