

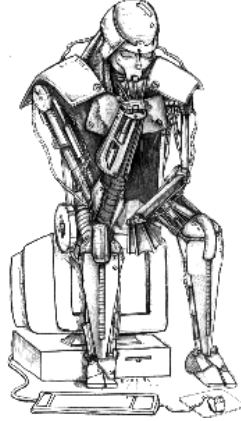
Intelligent Machines Laboratory

Department of Computer Science

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The focus of research projects in the Intelligent Machines Laboratory (IML) has varied over the years from Robotics in the 1980's to Artificial Intelligence in the 1990's to 3D Graphics, Surgical Simulation, and Video Game Programming in the 2000's, but always our thrust is state-of-the-art, internally and externally funded computer science research with undergraduate student involvement. Today the Intelligent Machines Laboratory performs research into such emerging technologies as 3D game programming, real-time game physics, computer animation, virtual reality, and virtual surgical simulation. Out of the work performed in the IML laboratory a new course has been developed: CSCI475 – 3D Game Programming and Computer Animation. This course and related research projects will provide students with the skills necessary to design, develop, and deploy 3D games and related entertainment technology applications. The intent of this area of study and research is to provide the student with a solid technical foundation for developing, animating, and controlling articulated systems used in interactive computer games, virtual reality simulations, and high-end animation applications. Research topics include 3D game programming architectures, 3D graphics, video game programming, collision detection algorithms, force and motion calculations, software for networking multiplayer games, manipulating sound objects, physical modeling, projectiles, physical constraints, particle systems, surface deformation, computer animation techniques, forward and inverse kinematics; key frame, motion capture and procedural animation; skinned meshes, quaternion interpolation; soft- and rigid-body game physics; Bayesian networks for character learning, and deformation of virtual 3D objects.

Many of the projects in the IML laboratory are funded, in part, by grants from the National Science Foundation, Penn State University College of Medicine, Pennsylvania Lions Sight Research fund, the William O. and Dr. Katherine Gibson Havemeier fund, the MU Noonan fund, the MU Neimeyer-Hodgson Grants Program, and by the Faculty Grants Committee of Millersville University. A detailed list of research funding and publications resulting from the research is provided below.

IML Laboratory External Grants and Research Projects:

1. Telemedicine and Advanced Technology Research Center (TATRC) Phase II STTR award (\$30,000) entitled "*Continuation of The Development of an Intracranial Hematoma (ICH) Surgical Simulator*", a joint project with Verefi Technologies Incorporated and Millersville University (June 2008 – December 2008). Awarded to Dr. Gary Zoppetti (MU) and Dr. Roger Webster (MU).
2. National Science Foundation (NSF CCLI) Course, Curriculum, and Laboratory Improvement Program grant (\$148,030) entitled "*A Computer Graphics and Game Development Track in Computer Science*" (June 2007 – August 2009). The goal of this grant project is to implement an exemplary curriculum track called [Computer Graphics and Game Development](#) (CGGD) that combines Computer Science with mathematics, physics, art, and digital media classes. NSF awarded to Dr. Roger Webster, Computer Science principle investigator.
3. Telemedicine and Advanced Technology Research Center (TATRC) Phase II Small Business Technology Transfer (STTR) grant (\$786,000) entitled "An Intracranial Hematoma/Burr Holes Simulation System", in collaboration with Verefi Technologies Inc (December 2006 – November 2008). Awarded to Dr. Randy Haluck (Verefi Technologies PI) and Dr. Gary Zoppetti (Millersville University PI).
4. Pennsylvania Keystone Innovation Zone (KIZ) summer grant (\$10,000) entitled "Development of an Application Program Interface (API) for SimPod, a Multiapplication Simulator for Training Healthcare Professionals", a joint project with Millersville University and [Verefi Technologies Inc](#), (June 2007 – August 2007). This grant provides summer funding for the development of an API software module for the SIMPOD surgical simulator. Awarded to Dr. Roger Webster (MU).
5. Lions Club Research Grant, (\$30,000) entitled "*Continuation of the Development of a Surgical Simulator for the Capsulorhexis Procedure during Cataract Surgery*", (June 2006 – January 2007). This grant provides continuation funding for the development of software modules for a virtual surgical simulator for skills training in cataract surgery. Awarded to Dr. Joseph Sassani (PSU), Dr. Roger Webster (MU) and Matt Harris (MU).
6. Pennsylvania Keystone Innovation Zone (KIZ) grant (\$10,000) entitled "*Development and Commercialization of a Capsulorhexis Cataract Surgical Simulator for Ophthalmology*", a joint project with Millersville University, Verefi Technologies Inc, and the Pennsylvania State University College of Medicine Department of Ophthalmology", (June 2006 – August 2006). This grant provides summer funding for the development of a software module for a surgical simulator for capsulorhexis skills training in cataract surgery. Awarded to Dr. Roger Webster (MU) and Matt Harris (MU).
7. Lions Club Research Grant, (\$25,000) entitled "*Development of a Surgical Simulator for the Capsulorhexis Procedure during Cataract Surgery Joint Project with the Pennsylvania State University College of Medicine Department of Ophthalmology*", (June 2005 – January 2006). This grant provides funding to complete the development of software modules for a virtual surgical simulator for skills training in cataract surgery. Awarded to Dr. Joseph Sassani (PSU) and Dr. Roger Webster (MU).
8. Telemedicine and Advanced Technology Research Center (TATRC) grant (\$186,681) entitled: "*Development of RapidFire – A Dynamic Smart Tutor*

- Surgical Simulation Trainer*", (April 2004 – April 2006), awarded to Dr. Randy Haluck and Dr. Roger Webster of Verefi Technologies Incorporated, Elizabethtown, Pennsylvania.
9. Pennsylvania State University College of Medicine, Department of Ophthalmology Medical Research grant (\$10,000) entitled "*Development of a Surgical Simulator for the Capsulorhexis Procedure during Cataract Surgery on the EYESI System*", (November 2004 – January 2005). This grant provides funding to develop software modules for a virtual surgical simulator for skills training in cataract surgery. Awarded to Dr. Roger Webster, Computer Science principle investigator.
 10. Life Sciences Greenhouse of Central PA (LSGPA) grant (\$98,681) entitled: "*Development of Novel Medical and Surgical Simulation Trainers*", (April 2003 – April 2004), awarded to Dr. Randy Haluck and Dr. Roger Webster of Verefi Technologies Inc. Hershey, Pennsylvania.
 11. Pennsylvania State University College of Medicine, Department of Ophthalmology Medical Research Innovation grant (\$10,000) entitled "*The Development of a Virtual Surgery Simulator for the Capsulorhexis Procedure during Cataract Surgery*", (July 2003 – December 2003). This grant provides funding to develop software modules for a virtual surgical simulator for skills training in cataract surgery. Awarded to Dr. Roger Webster, Computer Science principle investigator.
 12. National Science Foundation Major Research Initiative (NSF MRI) Program (\$242,075) matching grant entitled "*Development of Haptic Instrumentation for Computer Science Research and Training Using Surgical Simulation as the Application*" (September 2001 – August 2004). This grant provides faculty release time, high performance graphics computers, and haptic force feedback equipment for research in 3D Computer Graphics, Virtual Reality, Haptic Surgical Simulation, and Human-Computer Interaction. NSF number EIA-00116616 awarded to Dr. Roger Webster, Computer Science principle investigator.
 13. Pennsylvania State University College of Medicine, Department of Surgery and Eberly Medical Research Innovation grant (\$32,050) entitled "*The Development of a Laparoscopic Virtual Surgery Simulator*", (July 2000 – December 2001). This grant provides continued funding to develop software modules for a virtual surgical simulator for skills training in laparoscopic surgery. Awarded to Randy Haluck, M.D., Penn State University College of Medicine, Department of Surgery, and Dr. Roger Webster, Computer Science principle investigator.
 14. Pennsylvania State University College of Medicine, Department of Surgery feasibility grant (\$72,280) entitled "*The Development of Computer-Based Visuospatial Skills Trainer for Laparoscopic Surgery*", (February 2000 – January 2001). This grant provides funding to develop software modules for skills training in laparoscopic surgery using the Immersion Virtual Laparoscopic Interface simulation hardware. Awarded to Randy Haluck, M.D., Penn State University College of Medicine, Department of Surgery, and Dr. Roger Webster, Computer Science principle investigator.
 15. Pennsylvania State University College of Medicine, Department of Surgery feasibility grant (\$46,020) entitled "*Analysis of Surgical Skills in Haptic Virtual Surgery and its Transfer to Physical Surgery*" (July 1999 - July 2001). This grant provides funding for focused investment in instrumentation and software development to investigate skill acquisition in haptic virtual surgery and its transfer to physical surgery. The experimental goal of the project is to provide a proof-of-concept software development system to be able to measure the skills of

- expert surgeons against novice surgeons. Awarded to Randy Haluck, M.D., Penn State University College of Medicine, Department of Surgery, and Dr. Roger Webster, Computer Science principle investigator.
16. National Science Foundation (NSF CCLI) Course, Curriculum, and Laboratory Improvement Program matching grant (\$56,030) entitled "*Integrating Haptics into an Undergraduate Computer Science Curriculum*" (July 1999 – July 2002). This grant provides haptic force feedback equipment for Computer Graphics, Virtual Reality, Scientific Visualization, and Human-Computer Interaction. NSF number DUE-9950742 awarded to Dr. Roger Webster, Computer Science principle investigator.
 17. National Science Foundation (NSF) Instrumentation and Laboratory Improvement Program matching grant (\$97,969) entitled "*A Virtual Reality and Scientific Visualization Laboratory for Undergraduates in Computer Science*" (January 1996 - 1998). This grant has provided greatly improved, modern research equipment for Computer Graphics, Virtual Reality, and Scientific Visualization. Scientific Visualization research is focused on high-performance 3D computer graphics for scientific modeling, virtual world modeling, and virtual reality simulations for research training and experimentation in the natural and physical sciences. NSF number DUE-9651237 awarded to Dr. Roger Webster, Computer Science principle investigator.
 18. National Science Foundation ARI Grant. Principle Investigator in project entitled: "*Replacement and Renovation of Computer Science Research and Research Training Laboratories*". Awarded \$141,827 from the National Science Foundation's Academic Research Infrastructure Program (February 1995 - 1999) to provide funds for focused investment in the revitalization of facilities for undergraduate research in computer science. NSF number 93-166 awarded to Dr. Albert Hoffman, Dean, Donald Stollenwork Facilities Manager, and Dr. Roger Webster, Computer Science principle investigator.
 19. National Science Foundation Grant. Co-participant in project entitled: "*Providing and Integrating Educational Resources for Faculty Teaching Artificial Intelligence*", National Science Foundation Grant (\$81,115), Summers 1994 and 1995, NSF Faculty Enhancement Program - Collaborative grant project with Temple University, Drexel University, Villanova University and Millersville University. Awarded to: Dr. Giorgio Ingargiola and Dr. Robert Aiken, Temple University, Philadelphia, Pennsylvania.
 20. National Science Foundation Grant. NSF Instrumentation and Laboratory Improvement Program (\$53,039) matching grant entitled "*A Real-Time Systems Laboratory to Improve Undergraduate Instruction in Computer Science*", Awarded to Dr. Roger W. Webster and Dr. Paul Ross, Millersville University, Grant No. DUE-9350841 (June 1993 to November 1995). Project Director.
 21. National Science Foundation Grant. Co-participant in project entitled: "*FLAIR - Flexible Learning with an Artificial Intelligence Repository* ", National Science Foundation (\$410,000), September 1991- February 1995, NSF Grant # CDA-9115254, Collaborative research project with Temple University, Drexel University, Villanova University and Millersville University. Awarded to: Dr. Robert Aiken and Dr. Giorgio Ingargiola, Temple University, Philadelphia, Pennsylvania, USA.
 22. National Science Foundation Grant. NSF Instrumentation and Laboratory Improvement Program (\$86,600) matching grant entitled "*A Workstation Laboratory to Improve Undergraduate Instruction in Artificial Intelligence*",

- Awarded to Dr. Roger W. Webster, and Dr. Paul Ross, Millersville University, Grant No. USE-9050371 (July 1990 to December 1992). Project Director.
23. ISC Research and Development Project. Awarded for research project entitled: "*A Computer Vision System to Locate and Track Moving Objects in 3-Space*". Sponsored by the International Signal and Control Corporation, Lancaster, PA. This project used a binocular stereo computer vision system to compute the location of practice missiles in 3-space in real time. Academic year 1990/91.

IML Laboratory Publications and Presentations:

1. Roger Webster, Joseph Sassani, M. Harris, R. Shenk, "A Didactic Training Simulation System for the Capsulorhexis Procedure on the EYESI™ System", Poster Presentation at the Association for Research in Vision and Ophthalmology (ARVO '2007) conference in Ft. Lauderdale, Florida, May 5-9, 2007.
2. Roger Webster, R. Haluck, R. Shenk, "EndoTower™, RapidFire™, and LapFast - Developing Surgical Simulators for the 21st Century", Presentation and Software Demonstration for TATRC, The Telemedicine and Advanced Technology Research Center which is a subordinate element of the United States Army Research and Materiel Command (USAMRMC) at the 15th Annual Medicine Meets Virtual Reality Conference, (MMVR '2007), Long Beach, California, Sponsored by Aligned Management Association and the University of California at Irvine, February 5-7, 2007.
3. Joseph Sassani, M. Harris, R. Webster, "A Didactic Training Simulation System for the Curvilinear Capsulorhexis Cataract Procedure on the EYESI™ System", Demonstration and Presentation at the Annual American Association of Ophthalmology (AAO '2006) conference in Las Vegas, NV, November 10-12, 2006.
4. Chad Billman, G. Land, M. Bush, M. Harris, J. Holinger, S. Waldon, G. Zoppetti, R. Webster, "Research into Developing 3D Game Programming Toolkits Using OpenGL and DirectX ", Poster Presentation at the 17th Annual Student Research Poster Symposium and 60th Annual Eastern Colleges Science Conference, Philadelphia, PA, Sponsored by the Saint Joseph's University Chapter of Sigma Xi, April 22, 2006.
5. Matt Harris, C. Billman, M. Bush, J. Holinger, Greg Land, S. Waldon, G. Zoppetti, R. Webster, "A Simulation of the Curvilinear Capsulorhexis Cataract Procedure", Poster Presentation at the 17th Annual Student Research Poster Symposium and 60th Annual Eastern Colleges Science Conference, Philadelphia, PA, Sponsored by the Saint Joseph's University Chapter of Sigma Xi, April 22, 2006.
6. Roger Webster, J. Sassani, R. Haluck, R. Shenk, M. Harris, J. Blumenstock, J. Gerber, C. Billman, A. Benson, "Simulating the Curvilinear Capsulorhexis Cataract Procedure on the EYESI™ System", Poster Presentation and Proceedings of the Annual Medicine Meets Virtual Reality Conference, (MMVR '2005), Long Beach, California, Sponsored by Aligned Management Association and the University of California at Irvine, January 24-29, 2005, pps. 592-595.
7. Thai Pham, L. Roland, A. Benson, R. Webster, A. Gallagher, R. Haluck, "Smart Tutor: A Pilot Study of a Novel Adaptive Simulation Environment", Proceedings of the Annual Medicine Meets Virtual Reality Conference, (MMVR '2005), Long Beach, California, Sponsored by Aligned Management Association and the University of California at Irvine, January 24-29, 2005, pps. 385-389.
8. Roger Webster, R. Haluck, R. Shenk, M. Harris, J. Blumenstock, J. Gerber, C. Billman, A. Benson, "Using an Approximation to the Euclidean Skeleton for Faster Collision Detection and Tissue Deformations in Surgical Simulators", Poster Presentation and Proceedings of the Annual Medicine Meets Virtual Reality Conference, (MMVR '2005), Long Beach, California, Sponsored by Aligned Management Association and the University of California at Irvine, January 24-29, 2005, pps. 596-598.
9. Roger Webster, J. Sassani, R. Shenk, G. Zoppetti, "Simulating the Continuous Curvilinear Capsulorhexis Procedure During Cataract Surgery", Proceedings of

- the Annual IASTED International Conference on Modeling and Simulation (MS 2004), Marina Del Rey, California, March 1-3, 2004, pps. 262-265.
10. Roger Webster, J. Sassani, R. Shenk, N. Good, "*A Haptic Surgical Simulator for the Continuous Curvilinear Capsulorhexis Procedure During Cataract Surgery*", Proceedings of the Annual Medicine Meets Virtual Reality Conference, (MMVR '2004), Newport Beach, California, Sponsored by Aligned Management Association and the University of California at Irvine, January 15-17, 2004, pps. 404-406.
 11. Roger Webster, R. Haluck, G. Zoppetti, A. Benson, J. Boyd, N. Charles, J. Reeser, S. Sampson, "*A Haptic Surgical Simulator for Laparoscopic Cholecystectomy Using Real-Time Deformable Organs*", Proceedings of the IASTED International Conference on Biomedical Engineering (BioMED 2003), June 25-27, 2003, Salzburg, Austria, pps. 219-222.
 12. Roger Webster, R. Haluck, D. Hutchens, G. Zoppetti, A. Benson, J. Boyd, N. Charles, D. DeSanto, J. Reeser, S. Sampson, "*Integrating Haptics into an Undergraduate Computer Science Curriculum*", National Science Foundation (NSF-CCLI) Course, Curriculum and Laboratory Improvement Program Poster Exhibit, National ACM SIGCSE Conference (ACM/SIGCSE '2003). Sponsored by the Association of Computing Machinery and the Special Interest Group on Computer Science Education (ACM/SIGCSE), Reno, Nevada, February 19-22, 2003.
 13. Roger Webster, R. Haluck, B. Mohler, J. Boyd, J. Reeser, A. Benson, D. DeSanto, "*A Haptic Surgical Simulator for Operative Setup and Exposure for Laparoscopic Cholecystectomy*", Poster Presentation at the Medicine Meets Virtual Reality Conference, (MMVR '2003), Newport Beach, California, Sponsored by Aligned Management Association and the University of California at Irvine, January 21-25, 2003.
 14. Brian Minarcik, W. Bosseau Murray, R. Webster, "*Measuring Human Tissues Forces: Developing a Haptic Surgical Simulator*", Proceedings of the Fifth Annual Medical Education Conference on Using Simulation for Education and Assessment, sponsored by University of Rochester School of Medicine, Rochester, New York, May 4-6, 2002.
 15. Roger W. Webster, R. Haluck, B. Mohler, R. Ravenscroft, E. Crouthamel, T. Frack, S. Terlecki, J. Sheaffer, "*Elastically Deformable 3D Organs for Haptic Surgical Simulators*", Proceedings of the Medicine Meets Virtual Reality Conference, (MMVR '2002), Newport Beach, California, Sponsored by Aligned Management Association and the University of California at Irvine, IOS Press, January 23-26, 2002, pps. 570-572.
 16. Randy Haluck, A. Gallagher, R. Satava, R. Webster, T. Bass, C. Miller, "*Reliability and Validity of Endotower, A Virtual Reality Trainer for Angled Endoscope Navigation*", Proceedings of the Medicine Meets Virtual Reality Conference, (MMVR '2002), Newport Beach, California, Sponsored by Aligned Management Association and the University of California at Irvine, IOS Press, January 23-26, 2002.
 17. Brian Minarcik, W.B. Murray, R. Webster, "*Developing a Haptic (Force Feedback) Virtual Reality Epidural Simulator: Measurement of Forces Required to Simulate Human Tissues*", Poster presentation (won first prize) for the International Meeting on Medical Simulation, Sponsored by the Society for Technology in Anesthesia, Santa Clara, CA, January 11-13, 2002.
 18. Roger Webster, D. Zimmerman, B. Mohler, M. Melkonian, R. Haluck, "*A Prototype Haptic Suturing Simulator*", Proceedings of the Medicine Meets Virtual

- Reality Conference, (MMVR '2001), Newport Beach, California, Sponsored by Aligned Management Association and the University of California at Irvine, IOS Press, January 24-27, 2001, pps. 567-569.
19. Randy Haluck, R. Webster, A. Snyder, M. Melkonian, B. Mohler, M. Dise, A. LeFever, "A Virtual Reality Surgical Trainer for Navigation in Laparoscopic Surgery" , Proceedings of the Medicine Meets Virtual Reality Conference, (MMVR '2001), Newport Beach, California, Sponsored by Aligned Management Association and the University of California at Irvine, IOS Press, January 24-27, 2001, pps. 171-176.
 20. Roger W. Webster, "Developing a Haptic Medical Simulator", Panel presentation for the International Meeting on Medical Simulation, Sponsored by the Society for Technology in Anesthesia and the Rochester Simulation Symposium, Phoenix, Arizona, January 12-14, 2001.
 21. W.Bosseau Murray, R. Webster, C. Venable, R. Haluck, K. Underberg, "Haptic Applications for Medical Simulation: State of the Art", Report prepared by the Simulation Development and Cognitive Science Laboratory, Departments of Anesthesia, Nursing, and Surgery, Penn State University College of Medicine for the Medical Education Technologies Incorporated, Sarasota, Florida, December 20, 2000.
 22. Lanniece Freeman, W.B. Murray, S. Vaduva, R. Webster, J. Boyd, D.Jensenius, "3D Anatomy Tutorial Template: A New Teaching Method Using Virtual Reality", Poster presentation at the Annual Society for Education in Anesthesia Conference, Washington, D.C., May 19-20, 2000.
 23. Hutchens, David, R. Webster, B. Mohler, M. Smith, D. Zimmerman, M. Dise, A. LeFever, R. Haluck, W. Wang, A. Synder, "Integrating Haptics into an Undergraduate Computer Science Curriculum", National Science Foundation (NSF-CCLI) Course, Curriculum and Laboratory Improvement Program Exhibit, National ACM SIGCSE Conference (ACM/SIGCSE '2000). Sponsored by the Association of Computing Machinery and the Special Interest Group on Computer Science Education (ACM/SIGCSE), Austin, Texas, March 8 - 12, 2000.
 24. Gorman, Paul, T. Krummel, R. Webster, M. Smith, D. Hutchens, "A Prototype Haptic Lumbar Puncture Simulator", Proceedings of the Medicine Meets Virtual Reality Conference *Envisioning Healing: Interactive Technology and the Patient-Practitioner Dialogue*, (MMVR '2000), Newport Beach, California, Sponsored by Aligned Management Association and the University of California at Irvine, IOS Press, January 27-30, 2000, pps. 106-109.
 25. Diana P. Mahoney, "Getting the Feel of Virtual Surgery - A Smart Haptic Simulator will Help Novice Surgeons Learn", Computer Graphics World Tech Watch section, an interview with Randy Haluck, M.D. and Roger Webster, Ph.D., pps. 19-20, October 1999.
 26. Webster, Roger, P. Ross, T. Bailey, S. Conrad, M. Fiorill, J. Flinchbaugh, E. Velkly, "Controlling a Java Enabled Pepsi Vending Machine over the World Wide Web", Proceedings of the 25th Annual Conference of the IEEE Industrial Electronics Society IECON '99 Conference, San Jose, California, November 30-Dec. 4, 1999, Vol. 1, pps. 86-90, Presenter.
 27. Webster, Roger, "Haptic 3D Bricks Demonstration Software", National ACM SIGGRAPH '99 Conference in Sense8 Corporation's Exhibit Area, Sponsored by the Association of Computing Machinery Special Interest Group on Computer Graphics (ACM SIGGRAPH), Los Angeles, CA, August 8-12, 1999.

28. Webster, Roger, Mary Klaus, Tim Bish, "*A Laboratory Platform to Control a Digital Model Railroad Over the World Wide Web Using Java*", Proceedings of the International Conference on Simulation and Multi-Media in Engineering Education (ICSEE '99), San Francisco, California, pps. 19-24, January 17-21, 1999, Presenter.
29. Webster, Roger, Paul W. Ross, T. Bailey, S. Conrad, M. Fiorill, J. Flinchbaugh, E. Velkly, "*Controlling a Pepsi Vending Machine over the World Wide Web Using Java - work in progress*", (Short Paper), Proceedings of the International Association for the Advancement of Computers in Education AACE WebNet '98 Conference, Orlando, Florida, Vol. 2, pps.1227-1228, November 7-12, 1998.
30. Webster, Roger, Mary Klaus, Tim Bish, "*Controlling a Digital Model Railroad Over the World Wide Web Using Java - work in progress*", (Short Paper), Proceedings of the International Association for the Advancement of Computers in Education AACE WebNet '98 Conference, Orlando, Florida, Vol.2, pps.1225-1226, November 7-12, 1998.
31. Badler, Norm, Roger Webster, and Holly L. Mohler, "*SIGGRAPH VRML 3D Ph.D. Conetree*", Computer Graphics, Quarterly Journal, Association of Computing Machinery Special Interest Group on Computer Graphics (ACMSIGGRAPH), pps. 43, 44, 97, August 1998.
32. Webster, Roger, Norm I. Badler, and Holly L. Mohler, "*VRML 3D Conetree - SIGGRAPH History Project Number A2961-14 Family Tree Exhibit*", National ACM SIGGRAPH '98 Conference. Sponsored by the Association of Computing Machinery Special Interest Group on Computer Graphics (ACM SIGGRAPH), Invited Exhibitor, Orlando, Florida, July 21-24, 1998.
33. Webster, Roger, "*National Science Foundation (NSF) Instrumentation and Laboratory Improvement Program Exhibit*", National ACM SIGCSE Technical Symposium (ACM/SIGCSE '98). Sponsored by the Association of Computing Machinery and the Special Interest Group on Computer Science Education (ACM/SIGCSE), Invited Exhibitor, Atlanta, Georgia, March 27 - 29, 1998.
34. Davis, Ronald L., and Webster, Roger W., "*Questioning Proposed Knowledge Units*", Forum Section of the Communications of the Association of Computing Machinery (ACM) Journal, pps. 20-21, Vol. 40, No. 4, April 1997.
35. Webster, Roger, Wayde, Steve, and Auvil, Nathaniel, "*A Laboratory for Teaching Undergraduate Engineering Students Software Development Skills for Building Virtual Reality Applications and Simulations*", Proceedings of the ICSEE '97 International Conference on Computer Simulation, sponsored by the Society for Computer Simulation International, Vol. 29, no. 2, pps. 177-182, Phoenix, Arizona, January 12-15, 1997. Presenter.
36. Webster, Roger, Wayde, S., "*A Virtual Backhoe Simulation and Training System*", Proceedings of the Frontiers in Education Conference (FIE'96), sponsored by IEEE Committee on Education, CAEME Center for Multimedia, ASEE Educational Research Division, Vol. II, pps. 818-822, Salt Lake City, Utah, November 6-8, 1996.
37. Webster, Roger, Wayde, Steven, "*A Virtual Reality Laboratory for Undergraduates in Computer Science*", Proceedings of the Sixth International Conference on Computer Graphics and Visualization, sponsored by ACM SIGGRAPH, IEEE Technical Committee on Computer Graphics, EuroGraphics, Vol. 2, pps.143-152, St. Petersburg, Russia, July 1-5, 1996. Presenter.
38. Webster, Roger, Wayde, Steven, "*A Virtual Reality and Scientific Visualization Laboratory for Undergraduates in Computer Science -Work-in-Progress*", (Short paper) Proceedings of the Annual American Society for Engineering Education

- (ASEE) Conference, sponsored by ASEE and DELOS (Division of Laboratory Oriented Studies, Vol. I, Washington, D.C., June 24-27, 1996. Poster Presentation.
39. Webster, Roger, "*A Workstation Laboratory to Improve Undergraduate Instruction in Artificial Intelligence*", The International Journal for Engineering Education, Tempus Publications, Hamburg, Germany, November 1995, Vol. 11, No. 4-5, pp.101-110.
 40. Ingargiola, Giorgio, N. Hoskin, R. Aiken, R. Dubey, J. Wilson, M. Papalaskari, R. Webster, "*A Repository that Supports Teaching and Cooperation in the Introductory AI Course*", Proceedings of the national ACM SIGCSE Technical Symposium (ACM/SIGCSE '94). Sponsored by the Association of Computing Machinery and the Special Interest Group on Computer Science Education (ACM/SIGCSE), Vol. 26, No.1, pps.36-40, Phoenix, Arizona, March 10-12,1994.
 41. Webster, Roger. "*Two Combinatoric Problems in Discrete Mathematics*", IEEE Potentials Journal, Problems no. 4 and 5 in the GamesMan Section, April 1994, Vol. 13 No. 2, pp. 48.
 42. Webster, Roger, G. Ingargiola, R. Aiken, "*Augmenting Undergraduate Instruction in Artificial Intelligence using Software Demonstration Modules and ToolKits*", Proceedings of the 1993 International Conference on Computers in Education Applications of Intelligent Computer Technologies, Sponsored by the Artificial Intelligence in Education Society, American Association of Artificial Intelligence, IEEE Computer Society - Taipei Section, and National Central University of Taiwan, pps. 306-311, Taipei, Taiwan, December 15-17,1993. Presenter.
 43. Webster, Roger and David Hess. "*A Real-Time Software Controller for a Digital Model Railroad System*", Proceedings of the First IEEE International Conference on Real-Time Applications, New York City, N.Y., May 11-12, 1993, pp. 126-130, Sponsored by the IEEE Technical Committee on Real-Time Systems, Office of Naval Research, Naval Surface Warfare Center, and New Jersey Institute of Technology, Presenter.
 44. Webster, Roger and Y. Wei. "*An Intelligent Mobile Robot Golfing System Using Binocular Stereo Vision*", Proceedings of the IAPR 11th International Conference on Pattern Recognition ICPR'92 , The Hague, The Netherlands, August30 - September 4, 1992, pp. 603-607. Sponsored by the International Association for Pattern Recognition Society (IAPR), Presenter.
 45. Webster, Roger and Y. Wei. "*ARNIE P - A Robot Golfing System Using Binocular Stereo Vision and an Heuristic Feedback Mechanism*", Proceedings of the IEEE International Conference on Intelligent Robots and Systems IROS'92 , Raleigh, North Carolina, July 7-10, 1992, pp. 2027-2034. Sponsored by the IEEE Robotics and Automation Society and the Robotics Society of Japan, Presenter.
 46. Webster, Roger and Paul Ross, "*A Workstation Laboratory to Improve Undergraduate Instruction in Artificial Intelligence*", Proceedings of the Annual American Society for Engineering Education (ASEE) Conference, Toledo, Ohio, June 21-25, 1992, pp.448-455. Sponsored by the ASEE Division of Experimentation and Laboratory Oriented Studies (DELOS). Poster Presentation.
 47. Webster, Roger and Y. Wei. "*A Robot Golfing System Using Binocular Stereo Vision - Work in Progress*", Proceedings of the Canadian Image Processing and Pattern Recognition Society's Vision Interface International Conference, Vancouver, British Columbia, Canada, May 11-17, 1992, pp.195-202. Sponsored by the Canadian Image Processing and Pattern Recognition Society, Presenter.

48. Webster, Roger, P. LaFollette, and R.L. Stafford. "*Isthmus Critical Points and Solving Jigsaw Puzzles in Computer Vision*", IEEE Transactions on Systems, Man and Cybernetics, September/October 1991, Vol. 22, No. 5, pp. 1271-1278.
49. Webster, Roger. "*Useful Artificial Intelligence Tools - A Review of Heuristic Search Methods*", IEEE Potentials Journal, October 1991, Vol. 10 No. 3, pp. 51-54.
50. Webster, Roger, P.W. Ross, P. LaFollette, and R.L. Stafford. "*A Computer Vision System that Assembles Canonical Jigsaw Puzzles Using the Euclidean Skeleton and Isthmus Critical Points*", Proceedings of the International Association of Pattern Recognition Workshop on Machine Vision Applications (IAPR MVA'90), Tokyo, Japan, November 28-30, 1990, pp. 421-426, Presenter.

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