



University of Illinois
at Chicago

Simulator Providing Combined Visual And Tactile Feedback for Medical/Dental Procedures

A virtual reality immersion system to allow medical professionals and students to learn and improve their skills. Can be used over the Internet for Education and for Telemedicine Applications

Technology Reference

CW072

Contact

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Inventors

Arnold Steinberg, DDS
James Drummond, DDS
Prashant Banerjee, PhD
Milos Zefran, PhD

Field

Medical/Dental simulation

Key Words

- Medical simulation
- Dental simulation
- Education
- Remote diagnosis
- Haptics
- Deployed via the Web

Stage of Development

- Demonstration available

Status

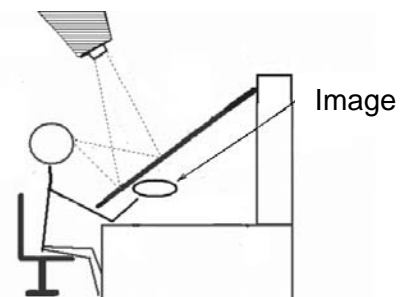
- Patent Application submitted.
- Seeking Licensing Partner

Application

This system provides a haptic force feedback, tactile sensitive guidance system for interaction with a projected, immersive 3D virtual reality (VR) human model for medical and dental applications. The current version displays teeth with their supportive oral tissues in a full mouth model. It is being produced with the ability to respond to painful actions (by head movement and sounds) when a procedure is considered too aggressive.

The computer-generated model is viewed as a three dimensional object suspended in space (see figures below). Users are able to immerse both hands directly into the projected image without blocking the view of the model, while interacting and feeling the surrounding components realistically as if an actual mouth is present. Haptic guidance provides tactile feedback enabling a user holding a dental instrument to evaluate abnormal tissue conditions by feeling the texture of the tooth surfaces and tissues. Furthermore, the user will be able to use a VR or real instrument to alter the surface texture until it feels "correct". An instructor can adjust the textures to represent different situations and can guide the user with the correct technique.

The system may be used in the training, practicing, honing and procedural development of tactile skills associated with diagnostics and therapies used in medical and dental procedures. It can also be developed for remote training and diagnosis applications. This application provides methods for the development of tactile skills that are felt by the user and physically guided by the expert. Diagnostic and procedural components can be directly introduced into the program by the instructor for directed, physical guidance in a variety of clinical procedures. The system allows for unlimited practice, recording of the users' sessions for later review and for testing. Users are able to see and feel procedures, without a manikin, animal head or patient while training or practicing clinical procedures.





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Previous Knowledge

Haptics-based medical simulators are currently available that require use of a physical manikin. These are single procedure systems and have little or no ability to be adjusted by site personnel to provide the user with a range of physical situations.

The simulator available from others for dental applications provides only a single procedure and does not provide the user with a projected, 3D visual image or the ability to receive tactile feedback. The instructor cannot easily adjust the procedure's level of difficulty to challenge students of varying skill levels and ability. Also the instructor and user cannot review the user's technique and thus improve their skills.

Application Areas

This technology can be applied to any area of medicine including dentistry for learning new procedures, honing previous skills or exploring the development of new techniques.

This application can be deployed via the Web to allow teams of users in multiple locations to work together or to allow an instructor to interact with multiple users.

It can also be used to administer standardized clinical board examinations in a variety of medical fields.

Status

Hardware and software are available for the dental application of root planing.

Inventors

Arnold D Steinberg

Research Interests:

Information technology in Dentistry, creating interactive courses on CD-ROM, use of robotics and haptics (touch and force-feedback) technology in computer based dental simulation programs and early wound healing at root/soft-tissue and implant/tissue interface.

Current research involves developing a dental simulator to teach dental and hygiene students to scale and root plane teeth (see <http://www.uic.edu/classes/dadm/dadm396/ADSresearch/Contents.htm>). Currently this simulator has been developed into a portable unit using virtual reality, haptics, robotics and projection technology. This project is being developed with the collaboration of Jim Drummond (College of Dentistry and Engineering), Milos Zefran (Robotics-Electrical and Computer Engineering) and Pat Banerjee (Haptics-Mechanical Engineering).

Inventors

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DDS., Northwestern, 1954
MS (Biochemistry) UIC, 1964

Web Page:
<http://www.uic.edu/classes/dadm/dadm396/ADSresearch/Contents.htm>



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Awards: Fellow International College of Dentists, Fellow American College of Dentists, Fellow Academy of General Dentistry, Fellow Academy of Dentistry for the Handicapped, Listed in Personalities of the West and Midwest, Who's Who in Dentistry Listed in Who's Who in Frontier Science & Technology, Listed in International Directory of Distinguished Leaders (1986), Listed in Personalities of America, Listed in Who's Who in Science and Engineering, Listed in Who's Who in the Mid-west, Listed in Who's Who In Medicine and Healthcare, 1998 received the Harold Berk Award for Excellence in the Field of Oral Health Care to the disabled. Received Instructional Computing in Dentistry Award for a CD-ROM developed to aid in training dental and hygiene students in root planing and scaling. Presented at the American Dental Education Association meeting, March 4, 2001, Chicago, IL.

James Drummond

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James L. Drummond, DDS, Ph.D., Professor of Restorative Dentistry, College of Dentistry, Department of Civil and Materials Engineering Department of Bioengineering, College of Engineering, Department of Environmental and Occupational Health Sciences, School of Public Health, University of Illinois at Chicago

Scholarly interests: characterization of biomaterials in terms of their fracture properties, the effect of aging on biomaterials *in vitro* and *in vivo*, the effect of biomaterials on their aging environment, clinical testing of dental materials, surface analysis of biomaterials, and dental wastewater analysis. Additional interests are in haptics, dental simulation programs, CAD-CAM and laser technology.