

Furqan Ullah

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Research Interests

3D Computer Vision, Computer Graphics, 3D Reconstruction, 3D Measurement Systems, 2D to 3D Conversion, Structured Light Technology, 3D Intraoral Scanning, Real-time 3D (Rendering, Visualization, and Applications), Computational Geometry, Geometric Modeling and Processing, Physics Based Modeling, Medical Image Rendering and Processing, Musculoskeletal Modeling, Virtual Reality, Haptic Rendering, Software Development

Work Experience

- May, 2016 - **Assistant Professor**, Faculty of Information Technology, Univ. of Central Punjab, Pakistan.
Current Department: Computer Science (CS) / FOIT
BS Courses: Object Orientated Paradigm (C++), Computer Graphics
MS Courses: Visual Computing
- 2015–2016 **Postdoctoral Scholar**, Univ. of California, Berkeley, CA, USA.
Department: Electrical Engineering and Computer Sciences (EECS)
Project: Development of a dynamic human musculoskeletal modeling platform
Supervisor: Prof. Ruzena Bajcsy
- 2014–2015 **Manager, Vision Team**, Daemyung TS Co., Ltd., Ulsan, S. Korea. (Hyundai Motors)
Responsibilities: Development of 2D-3D vision inspection systems, development of Micro-scale 3D scanning systems
- 2013–2014 **Software Engineer**, Orapix Co. Ltd, Seoul, S. Korea.
Responsibilities: Development of 3D scanning systems including software and hardware, development of dentistry applications
- 2011–2014 **Lab Instructor**, Intelligent Manufacturing Lab, Myongji University, South Korea.
Responsibilities: 3D Computer Vision, Computer Graphics
- 2009–2010 **CAD/CAM/CAE Engineer**, Marriala Technologies Pvt. Ltd., Lahore, Pakistan.
Responsibilities: Software development, 3D scanning, CAD/CAM softwares and simulations, RP manufacturing

Education

- 2010–2014 **PhD in 3D Computer Vision & Computer Graphics**, Myongji Univ., South Korea
Research field: Structured-light based 3D shape measurement systems, 2D to 3D conversion, Computational geometry, Geometric modeling and processing, Image processing, ...
Degree: Mechanical Engineering.
- 2007–2009 **MS in 3D Computer Graphics & Virtual Reality**, Myongji Univ., South Korea
Research field: Computer graphics, Virtual reality, Haptic rendering, Computational geometry, Geometric modeling and processing, Real-time 3D rendering and visualization, ...
Degree: Mechanical Engineering
- 2002–2006 **BS in Engineering**, Univ. of Agriculture, Faisalabad, Pakistan
Research field: Computer aided design and manufacturing, ...
Degree: Engineering

Honors & Awards

- Jan–2014 Nomination in the **2013 Young Scientist Award**.
- Feb–2014 Received the **“Best Thesis Award”** at Myongji University.
- Dec–2013 Received the **“Bronze Paper Award”** at the IEEE Seoul Section Student Paper Contest 2013.
- Aug–2013 Received the **“Best Journal Paper of 2012”** Award by Trans. of the Society of CAD/CAM Eng.
- Feb–2013 Received the **“Best Paper Award”** at the Society of CAD/CAM Engineers Conference 2013
- Dec–2012 Received the **“Bronze Paper Award”** at the IEEE Seoul Section Student Paper Contest 2012.

- Aug–2012 Received the “**Best Paper Award**” at the Society of CAD/CAM Engineers Conference 2012
- May–2012 Received the “**Best Paper Award**” at the 2012 International Conf. on Info. Sci. & App. (ICISA)
- 2007–2009 Pakistan Govt. **HEC Scholarship Award** for MS from Myongji Univ. South Korea.
- Nov–2005 Received “**Student of the Year 2005 Award**” in B.Sc. Engineering awarded by Vice-Chancellor.

Developed Softwares & Projects

1. REAL3D SCANNER (*an extensible mesh and points processing system with a real-time SL 3D scanner*)
2. REAL3D VIEWER (*an advanced volume, mesh, points processing system*)
3. Real-Time Virtual 3D Scanner (*a perfect simulator to analyze and perform structured-light 3D scanning*)
4. 3D Intraoral Scanning System (*optical 3D scanner for dentistry, 3D reconstruction of human jaws*)
5. Volume VaS (*visualization/rendering of medical images, 3D reconstruction, processing, analyzing*)
6. Musculoskeletal Modeling & Motion Capture Viewer (*amc and bvh file formats*)
7. Virtual Dental Treatment Simulator (*simulator to perform dental treatment operations using haptics*)
8. CNC Simulator (*highly similar to the real-world wood cutting machining center with 3D Laser Scanning*)
9. FL-Essentials (*consists of C++ class library and gives parallel processing support in image processing*)
10. System Information Retriever (*a handy tool to quickly view system information on any computer*)

Programming Languages & Experience:

C/C++/OOP (10 yrs) OpenGL (10 yrs) OpenCV (8 yrs)
 VTK, ITK (8 yrs) PCL (8 yrs) OpenHaptics (5 yrs)
 FLTK, Qt, Win32 (8 yrs) OpenAL (2 yrs) CUDA
 Computer Graphics (10 yrs), 3D Scanning/Reconstruction (8 yrs), Virtual Reality (7 yrs), Computer Programming (10 yrs)

Author of several mesh, point cloud, and image processing algorithms such as filtering, cleaning, smoothing, fairing, subdivision, decimation, triangulation, registration, reconstruction, phase wrapping and unwrapping, and image filtering, etc.

Research Projects

- 2013–Current Worked on various projects with US, UK, Korean, and Chinese based startups.
- 2015–2016 Dynamic musculoskeletal modeling for potential clinical applications such as non-invasive assessment of joint function (*collaboration with UC Davis, UCSF, and Stanford*).
- 2010–2014 Development of the Digital Fusion Artificial Tooth Treatment Supporting System under Grant of the Strategic Technology Development Project on Biomedical Supplier (*3D Intraoral Scanner*).
- 2010–2013 High tech Urban Development Program funded by Ministry of Land, Transport and Maritime Affairs of Korean government (*Development of a Rafter Processing CNC Machine*).
- 2007–2009 Development of Virtual Dental Treatment Training System using Haptic Interface.

Engineering Softwares

MasterCAM X (CNC), Pro-Engineer, ANSYS, SolidWorks, Solid Edge, Catia, ESI ProCAST, Simufact, Altair HaperWorks, Magics, Matrix 6.0, CIMCO, MATLAB, AutoCAD

Expertise

Technologies:

- Structured-light fringe projection based 3D shape measurement systems
- Research and development of 3D laser scanning systems

- Some knowledge of confocal technology which is being used for 3D dental scanning and micro-scale 3D reconstruction
- 3D computer vision for optics based hardware and software
- 3D intraoral scanning for dentistry
- Machine vision for 3D inspection systems
- 3D graphics for both mesh and volume rendering engines
- 2D and 3D image processing include medical DICOM images
- Virtual reality for physics based 3D simulations
- Haptic display for realistic sense of touch
- Dynamic musculoskeletal modeling and motion capturing
- Robotic Kinematics
- Computer programming and languages

Knowledge and skills (*but not limited to...*):

- Optics and optical systems — knowledge of camera and projector based systems
- 3D scanning/reconstruction — 3D vision, 2D image processing, synchronization, retrieval, geometric modeling and processing, calibration, 3D registration, merging, smoothing, filtering, texturing, rendering and visualization, phase-shifting methodology
- Laser scanning — knowledge of dental and industrial laser scanners
- Confocal optics — knowledge of dental scanning and micro-scale reconstruction
- Machine vision — knowledge of industrial 2D-3D inspection systems
- 3D graphics and tools — visualization and rendering, mesh and volume rendering engines, real-time 3D applications, computational geometry, geometric modeling and processing, author of many mesh and image processing algorithms such as filtering, cleaning, smoothing, fairing, subdivision, decimation, triangulation, registration, reconstruction, phase wrapping and unwrapping, and image filtering, etc.,
- Skills of C/C++/OOP, OpenGL, OpenCV, OpenHaptics, VTK, ITK, FLTK, Qt, Win32, etc.
- Experience of tens of 3D programming libraries
- Image processing — image analysis, 3D information retrieval from 2D images, 3D volume and mesh rendering from medical images such as CT scan DICOM format
- Algorithms — design, development, analysis of 2D, 3D, geometry algorithms
- Virtual and haptic realities — development of various kind of simulators
- Musculoskeletal modeling — development of a dynamic human skeleton modeling platform for static, dynamic and kinematic scenarios
- Kinematics — analysis of human skeleton kinematics and motion capturing
- Software development — design, develop and modify GUI based software systems using scientific analysis and mathematical models

Under-Graduate Final Year Projects

- 3D shape measurement using active stereo vision technology
- Development of a software application for medical imaging analysis and visualization
- Development of a survival 3d game using virtual reality
- Development of platform independent text extraction software application
- Development of a virtual reality based magnifier application for android

Selected Publications (31)

Journal Publications

1. Irfan U., **Furqan Ullah**, Qurban U., Seoyong S., “**Integrated Tracking and Accident Avoidance System for Mobile Robots,**” *International Journal of Control, Automation, and Systems*, vol. 11, no. 6, 2013. [IF: 1.065]

2. **Furqan Ullah**, Lee, G. S., Park, K., “**Collimating Illumination and Piezoelectric Transducer based 3D Intraoral Scanner**,” *International Journal of Precision Engineering and Manufacturing*, vol. 14, no. 4, pp. 567-576, 2013. [IF: 1.500]
3. **Furqan Ullah**, Park, K., “**Development of a Surface-based Virtual Dental Sculpting Simulator with Multimodal Feedback**,” *International Journal of Precision Engineering and Manufacturing*, vol. 14, no. 4, pp. 577-587, 2013. [IF: 1.500]
4. **Furqan Ullah**, Lee, G. S., Park, K., “**Analysis and Performance Comparison of 3D Measurement Systems based on Fringe Projection Profilometry**,” *Telecommunication Systems*, vol. 0, no. 0, pp. 0-0, 2012. [IF: 1.163] (Accepted)
5. Hong S., **Furqan Ullah**, Lee, G. S., Park, K., “**Development of Rafter Processing Machine and Simulation Verification**,” *Transactions of the Society of CAD/CAM Engineers*, vol. 18, no. 2, pp. 148-154, 2013.
6. **Furqan Ullah**, Lee, G. S., Park, K., “**Development of a Real-time 3D Intraoral Scanner based on Fringe-Projection Technique**,” *Transactions of the Society of CAD/CAM Engineers*, vol. 17, no. 3, pp.156-163, 2012. **(Selected as the "Best Journal Paper of 2012 Award")**
7. Irfan U., Ullah, Q., **Furqan Ullah**, Shin, S., “**Sensor-based Autonomous Robot Navigation with Distance Control**,” *Journal of Computational Intelligence and Electronic Systems*, vol. 1, no. 2, pp. 161-168, 2012.
8. Irfan U., **Furqan Ullah**, Ullah, Q., Shin, S., “**Sensor-Based Robotic Model for Vehicle Accident Avoidance**,” *Journal of Computational Intelligence and Electronic Systems*, vol. 1, no. 1, pp. 57-62, 2012.
9. Irfan U., **Furqan Ullah**, Ullah, Q., Shin, S., “**Object Following Fuzzy Controller for a Mobile Robot**,” *Journal of Computational Intelligence and Electronic Systems*, vol. 1, no. 1, pp. 86-90, 2012.
10. **Furqan Ullah**, Park, K., “**Surface-Based Virtual Dental Surgical Simulator using Haptic Display**,” *Computer-Aided Design and Applications*, vol. 8, no. 6, pp. 841-848, 2011. [IF: 0.560]

Conference Publications

1. **Furqan Ullah**, Hong, S., Lee, G. S., Park, K., “**A Novel CNC Machine for Processing Curved Rafters**,” *Proceedings of the 2012 IEEE Seoul Section*, pp.16, Dec 14, 2013. **(Selected as the "Bronze Paper Award")**
2. **Furqan Ullah**, Park, K., “**Digital Fringe Projection based Real-time 3D Shape Measurement System**,” *Proceedings of the Society of CAD/CAM Engineers Conference 2013*, pp. 31-36, Feb 2013. **(Selected as the "Best Paper Award")**
3. Hong, S., **Furqan Ullah**, Lee, G. S., Park, K., “**Matching the Rafter CAD Model with Timber for Measuring Processability of Curved Rafters**,” *Proceedings of the Society of CAD/CAM Engineers Conference 2013*, pp. 495-500, Feb 2013.
4. **Furqan Ullah**, Lee, G. S., Hong, S., Park, K., “**A Novel 3D Intraoral Scanner for Dentistry**,” *Proceedings of the 2012 IEEE Seoul Section*, pp.40, 1st Dec 2012. **(Selected as the "Bronze Paper Award")**
5. Ullah, I., Ullah, Q., **Furqan Ullah**, Shin, S., “**Integrated Collision Avoidance and Tracking System for Mobile Robot**,” *Proceedings of 2012 International Conference on Robotics and Artificial Intelligence (ICRAI)*, pp. 68-74, Rawalpindi, Pakistan, Oct 20-23, 2012.
6. Ullah, I., Ullah, Q., **Furqan Ullah**, Shin, S., “**Mobile Robot Navigation with Distance Control**,” *Proceedings of 2012 International Conference on Robotics and Artificial Intelligence (ICRAI)*, pp. 61-67, Rawalpindi, Pakistan, Oct 20-23, 2012.

7. Hong, S., Park, K., **Furqan Ullah**, Lee, G. S., “**Development of Rafter Processing Machine and Simulation Verification**,” *Korean Society of CAD/CAM Engineers 2012*, pp. 225-230, 22-24 Aug 2012. **(Selected as the “Best Paper Award”)**
8. **Furqan Ullah**, Hong, S., Park, W., Park, K., “**Design of a 3D Laser Scanning System based Rafter Processing CNC Machine**,” *Design Engineering Workshop (DEWS)*, pp. 160-165, 25-26 June 2012.
9. **Furqan Ullah**, Hong, S., Park, K., “**Development of Rafter Processing Machine for Korean Traditional Houses**,” *2012 IEEE 16th International Conference on Intelligent Engineering Systems (INES)*, pp. 229-234, 13-15 June 2012.
10. **Furqan Ullah**, Lee, G. S., Park, K., “**Analysis and Performance Comparison of 3D Measurement Systems based on Fringe Projection Profilometry**,” *2012 International Conference on Information Science and Applications (ICISA)*, pp. 62-67, 23-25 May 2012. **(Selected as the “Best Paper Award”)**
11. **Furqan Ullah**, Park, K., “**Visual, Haptic, and Auditory Realities based Dental Training Simulator**,” *2012 International Conference on Information Science and Applications (ICISA)*, pp. 106-111, 23-25 May 2012.
12. **Furqan Ullah**, Lee, G. S., Park, K., “**Piezoelectric Transducer based 3D Intraoral Scanner**,” *2012 International Conference on Information Science and Applications (ICISA)*, pp. 118-123, 23-25 May 2012.
13. **Furqan Ullah**, Park, K., “**Model Analysis of fringe-projection-based 3D Measurement Systems using Real-time 3D Virtual Scanner**,” *Korean Society of CAD/CAM Engineers 2012*, pp. 252-257, 1-3 Feb 2012.
14. **Furqan Ullah**, Lee, G. S., Park, K., “**Development of a Real-time 3D Intraoral Scanner based on Fringe-Projection Technique**,” *Korean Society of CAD/CAM Engineers 2012*, pp. 260-265, 1-3 Feb 2012. **(Selected as one of the Best Papers)**
15. **Furqan Ullah**, Park, K., “**Surface-based Virtual Dental Sculpting Simulation with Multimodal Feedback**,” *Asian Conference on Design and Digital Engineering*, pp. 548-555, 2011, Shanghai, China.
16. **Furqan Ullah**, Park, K., “**Calibration of a 3-D Camera-Laser Scanning System using a Virtual Setup**,” *Korea Society for Precision Engineering 2011*, pp. 539-540, 26-28 Oct 2011, Gyeongju, South Korea.
17. Ullah, I., **Furqan Ullah**, Ullah, Q., “**A Sensor based Robotic Model for Vehicle Collision Reduction**,” *2011 International Conference on Computer Networks and Information Technology (ICCNIT)*, pp. 251-255, 11-13 July 2011.
18. Ullah, I., **Furqan Ullah**, Ullah, Q., “**Real-time object following fuzzy controller for a mobile robot**,” *2011 International Conference on Computer Networks and Information Technology (ICCNIT)*, pp. 241-244, 11-13 July 2011.
19. **Furqan Ullah**, Park, K., “**Virtual Dental Sculpting Simulation using a Surface-based Tooth Model and a Haptic Device**,” *Korean Society of CAD/CAM Engineers 2011*, pp. 838-851, 26-28 Feb 2011.
20. Ullah, I., **Furqan Ullah**, Park, K., “**Sensor Based Robotic Navigation and Distance Control**,” *International Conference on Intelligence and Information Technology (ICIIT)*, vol. 2, pp. 59-63, 28-30 Oct., 2010.
21. **Furqan Ullah**, Park, K., “**Virtual Dental Treatment Training System using a Haptic Device**,” *Korean Society of CAD/CAM Engineers 2009*, pp. 115-121, 4-6 Feb 2009.

Covered Areas:

3D reconstruction (*3D vision, optics, 2D image processing, synchronization, retrieval, geometric modeling and processing, calibration, 3D registration, merging, smoothing, filtering, texturing, rendering and visualization*), structured light phase-shifting methodology, camera-projector systems, 3D shape measurement systems, real-time data capturing and processing, development of 2D-3D algorithms, analysis of geometry algorithms, computer graphics, rendering engine, development of real-time virtual systems, robotics, software development, programming libraries and languages

MS Thesis

Furqan Ullah, “Virtual Dental Treatment Training System using a Haptic Device,” *MS Thesis, 2009, Dept. of Mechanical Engineering, Myongji Univ. S. Korea.*

Covered Areas:

Virtual reality, haptic display, computer graphics, rendering and visualization, volume rendering, analysis of geometry algorithms, 3D collision detections, mesh processing, signal processing, software development, programming libraries and languages

Professional Talks

Posters

- Nov–2015 Dynamic Human Musculoskeletal Modeling. Berkeley Vision & Learning Center Fall 2015 Retreat at Sutardja Dai Hall, UC Berkeley Campus, California, US.
- Oct–2015 Dynamic Human Musculoskeletal Modeling. Computer Vision Symposium at Amazon, Seattle, Washington, and A9/Amazon, Silicon Valley, California, US.

Conference Presentations

- Dec–2013 A Novel CNC Machine for Processing Curved Rafters. IEEE Seoul Section Student Paper Contest, Yonsei Univ., Seoul, S. Korea.
- Aug–2013 Techniques for Developing a Structured Light Technology based 3D Scanning System. KSCCE, Dongguk Univ., Seoul, S. Korea.
- Jan–2013 Digital Fringe Projection based Real-time 3D Shape Measurement System. KSCCE, Phoenix Park, S. Korea.
- Dec–2012 A Novel 3D Intraoral Scanner for Dentistry. IEEE Seoul Section Student Paper Contest, Yonsei Univ., Seoul, S. Korea.
- May–2012 Analysis and Performance Comparison of 3D Measurement Systems based on Fringe Projection Profilometry. ICISA, Suwon, S. Korea.
- May–2012 Visual, Haptic, and Auditory Realities based Dental Training Simulator. ICISA, Suwon, S. Korea.
- May–2012 Piezoelectric Transducer based 3D Intraoral Scanner. ICISA, Suwon, S. Korea.
- Feb–2012 Model Analysis of fringe-projection-based 3D Measurement Systems using Real-time 3D Virtual Scanner. KSCCE, Phoenix Park, S. Korea.
- Feb–2012 Development of a Real-time 3D Intraoral Scanner based on Fringe-Projection Technique. KSCCE, Phoenix Park, S. Korea.
- Oct–2011 Calibration of a 3-D Camera-Laser Scanning System using a Virtual Setup. KSPE, Gyeongju, S. Korea.
- Jun–2011 Surface-Based Virtual Dental Surgical Simulator using Haptic Display. CAD&A, Taipei, Taiwan.
- Feb–2011 Virtual Dental Sculpting Simulation using a Surface-based Tooth Model and a Haptic Device. KSCCE, Phoenix Park, S. Korea.

Feb–2009 Virtual Dental Treatment Training System using a Haptic Device. KSCCE, Phoenix Park, S. Korea.

Seminar Presentations

Aug–2013 Micro-scale 3D measurement using a pico-projector.

Jan–2013 Development of Real-time 3D measurement system based on Digital Fringe Projection Method. IML Seminar. Myongji Univ. S. Korea.

Jun–2013 Development of a CNC Machine for Curved Rafters. IML Seminar. Myongji Univ. S. Korea.

May–2012 Development of an Intraoral Scanner. IML Seminar. Myongji Univ. S. Korea.

Mar–2012 System Calibration of an Intraoral Scanner. IML Seminar. Myongji Univ. S. Korea.

Business Trips

Korea, Taiwan, Germany, Swiss, USA (California, Oregon, Philadelphia, Seattle, Pennsylvania)

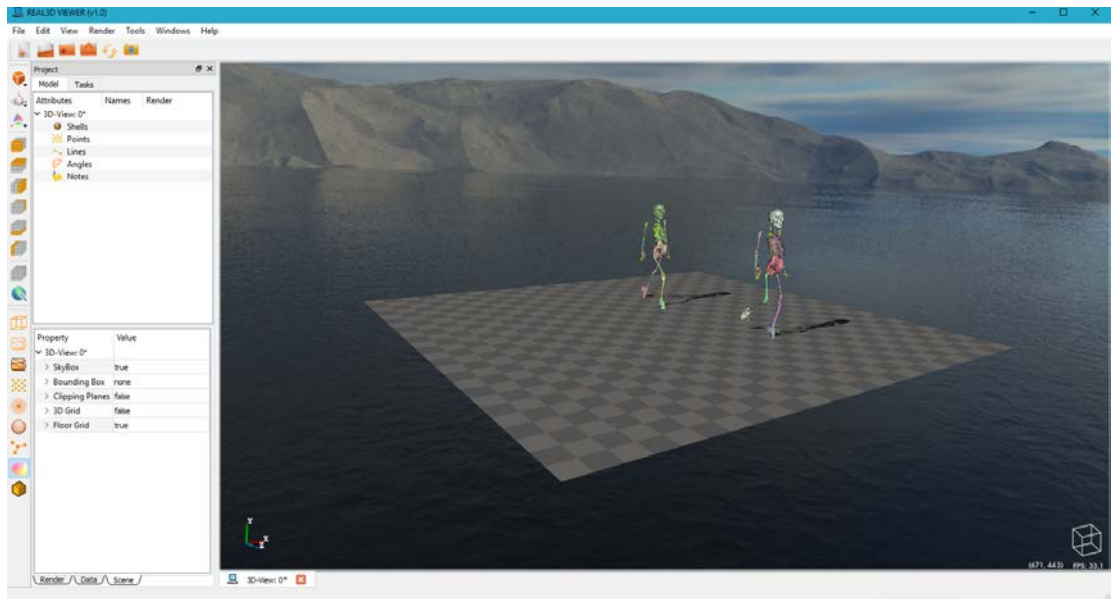
Courses that I have studied in Computer Science Domain

- Computer Graphics
- Computer Vision
- Advanced Algorithms
- Advanced Image Computing
- Image Understanding
- Data Structures and Algorithms
- Introduction to C++
- Programming Languages C/C++
- Object Oriented Programming
- Advanced Topics in Programming Languages
- Machine Vision System
- Computer Aided Design
- Haptics and Virtual Reality
- Introduction to Robotics

Selected Projects Descriptions

1. REAL3D VIEWER (<http://real3d.pk/r3dv.html>)

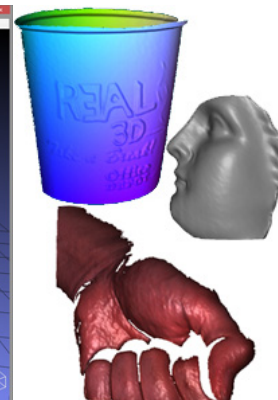
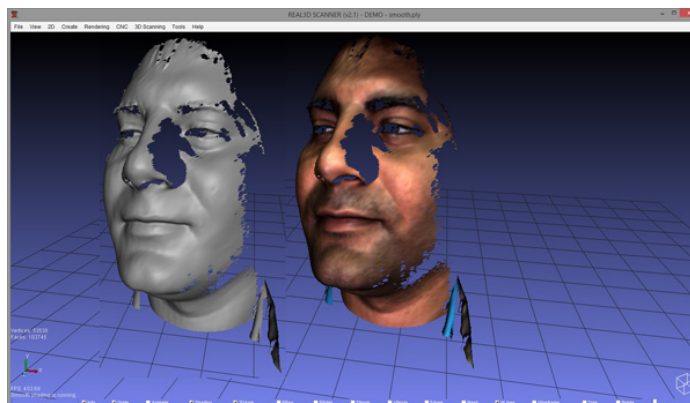
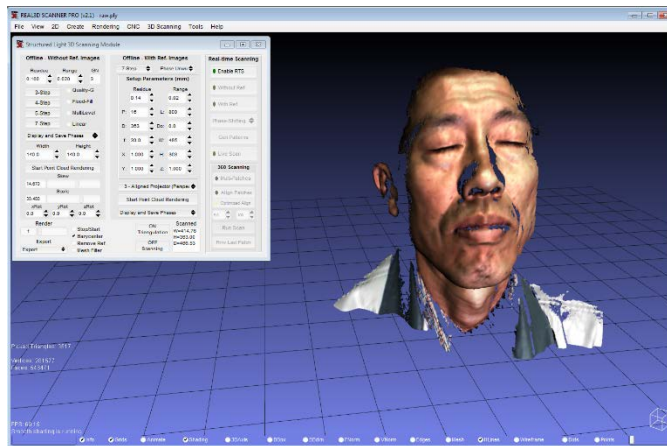
REAL3D VIEWER is an advanced volume, mesh, and pointcloud processing system designed for 3D scanning/reconstruction, 3D geometric modeling and filtering, medical image analysis, rendering, and processing. It is written in my own REAL3D Engine which is C++/OpenGL based 3D rendering library and Qt.



2. REAL3D SCANNER (<http://real3d.pk/3dracs.html>)

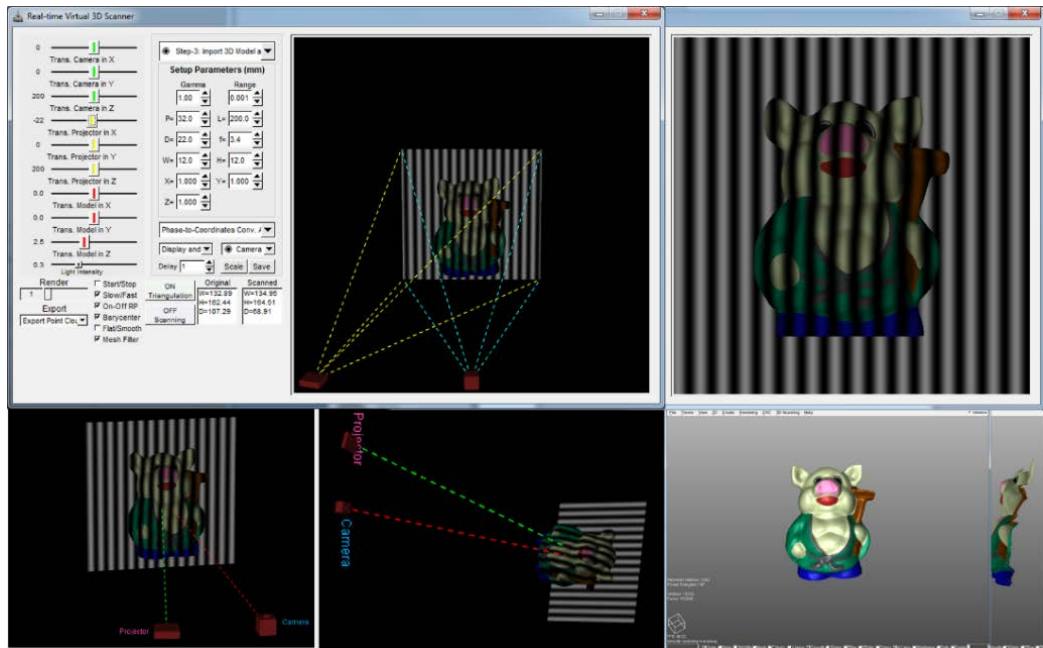
REAL3D SCANNER is an advanced piece of software designed to help you create and edit 3D models with only a camera and a video projector. (says softpedia.com)

It is being used by thousands of researchers, professionals, and startups, in America, Korea, Turkey, Germany, Italy, India, Australia, Slovakia, Spain, UK, etc. etc. Downloaded more than 50,000 times. (written in C/C++, OpenGL, OpenCV, VTK, ITK, FLTK, and tens of 3D geometric libraries.)



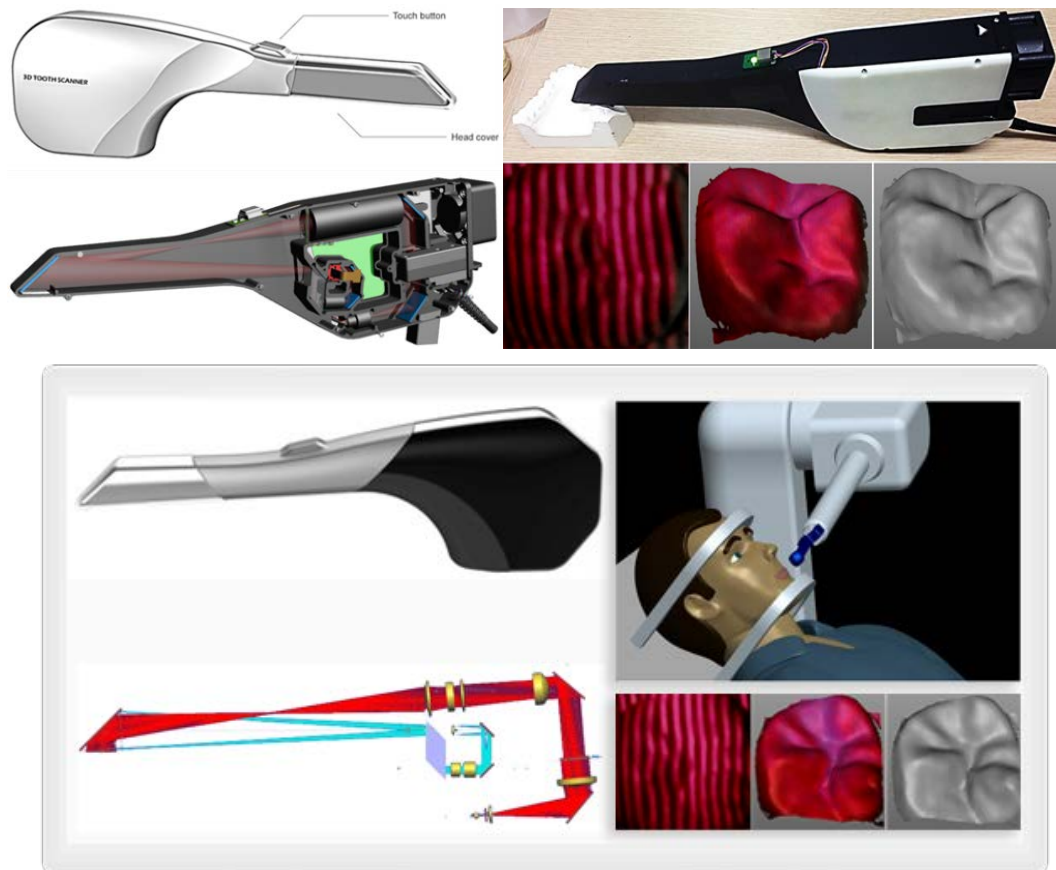
3. Real-Time Virtual 3D Scanner (<http://real3d.pk/virtual3dscanner.html>)

This is a high resolution real-time Virtual 3D Scanner that scans a virtual object in the virtual environment. It performs coordinate acquisition, reconstruction, and display processes simultaneously.



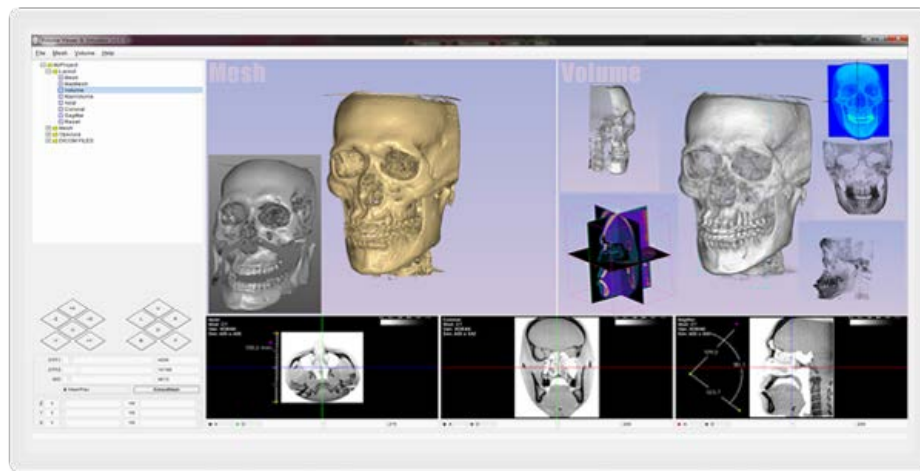
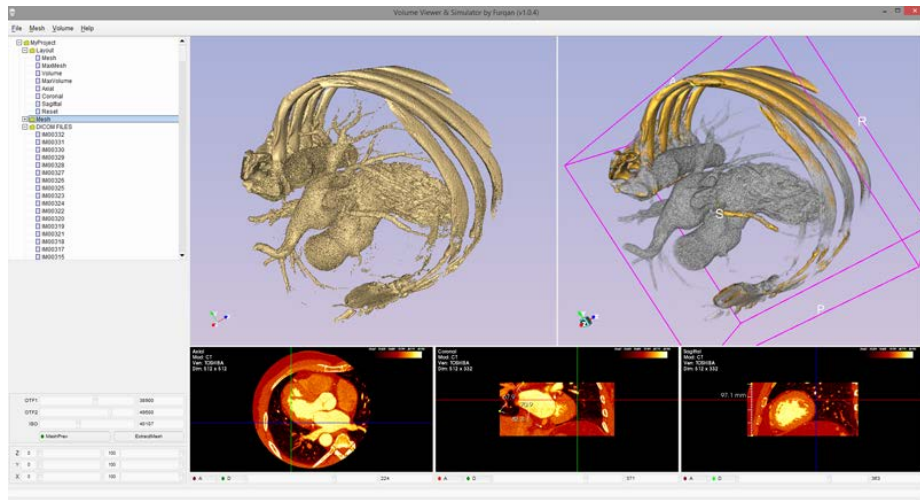
4. 3D Intraoral Scanning System (<http://real3d.pk/intraoralscanner.html>)

A system was developed for an intraoral scanning that can be used for the measurement of tooth profiles in the mouth cavity. Structured-light Technology was utilized for 3D surface acquisition.



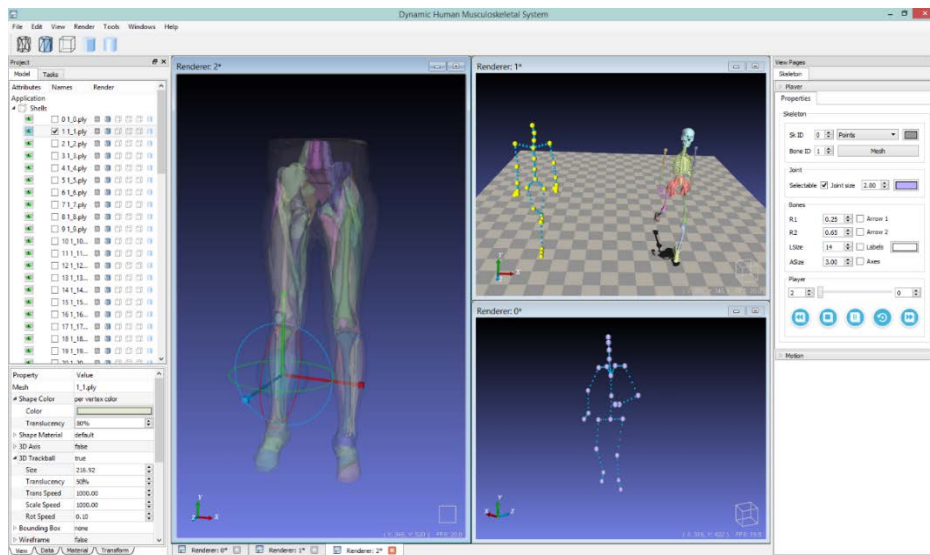
5. Volume VaS (<http://real3d.pk/volviewer.html>)

Volume Viewer & Simulator is an advanced medical application for simulate the DICOM (CT/MR scan) images and reconstructed meshes. (written in C++, OpenCV, VTK, ITK, FLTK)



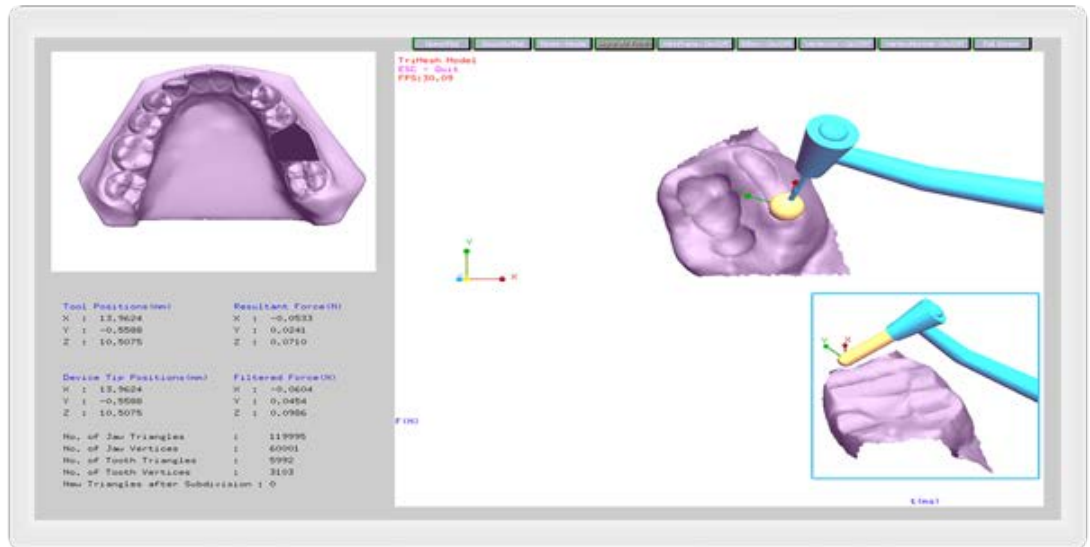
6. Musculoskeletal Modeling & Motion Capture Viewer

This platform is written in my own developed C++/OpenGL based FVK library which includes a 3D renderer engine with a lot of 3D widgets and shaders.



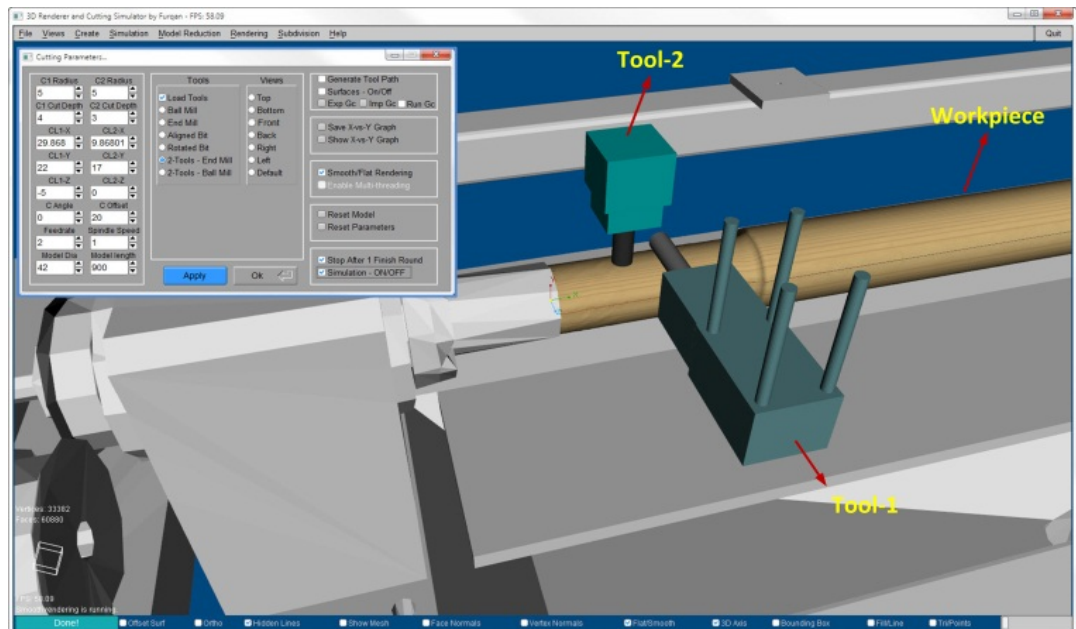
7. Virtual Dental Treatment Simulator (<http://real3d.pk/dentalsculptingsimulator.html>)

This is a surface-based Virtual Dental Sculpting Simulator based on auditory, visual, and tactile realities. It can be used to perform different dental procedures such as grinding, drilling, or scrubbing, etc. Haptic Omni was utilized for realistic sense of touch. (written in C/C++, OpenGL, OpenUI, OpenHaptics)



8. Machining Simulator (http://real3d.pk/3dracs_cnccs.html)

Tried to develop world's first CNC machine with 3D Laser Scanning for curved rafter processing, this simulator is highly similar to the real-world rafter machining center. (written in C/C++, OpenGL, FLTK, and 3D geometric libraries)



9. FL-Essentials (<https://github.com/dfurqan/FL-Essentials.git>)

FL-Essentials (FLE) is a FLTK based software system which provides extreme easiness in building (responsive) GUI applications. It consists of C++ class library and gives thread-safe image processing support for OpenCV. It also provides OpenGL based 3D classes to create computer graphics applications with fully featured GUI.

(I wrote this library to make FLTK a lot easier for real-time image and camera handlings, responsive GUI applications as well as OpenGL based 3D graphics applications)

- Animated RGB Plot (<http://real3d.pk/software.html>)

It's a portable tool that can be used for plotting the RGB columns of any image. It is written in FLE.

- Real3D Photo Viewer (<https://github.com/dfurqan/FL-Essentials/tree/master/examples>)

It's a cross-platform application (inspired by Windows Photo Viewer) that can be used as a default photo viewer. It is written in FLE and its source code is available on Github.



10. System Information Retriever (<http://real3d.pk/sir.html>)

SIR is a handy portable tool to carry on a USB stick to quickly view system information on any computer.

