

# Furqan Ullah

CAAS(135-D), Dhofar University,  
Salalah, Oman  
Cell # +968 9398 7004  
furqan797@gmail.com  
furqan@real3d.pk  
<http://www.real3d.pk>



## Research Interests

3D Computer Vision, Computer Graphics, 3D Reconstruction, Optical 3D Measurement Methods and Systems, Structured Light Technology, 3D Scanning, Real-time 3D (Rendering, Visualization, and Applications), Computational Geometry, Geometric Modeling and Processing, Virtual and Haptic Realities, Medical Image Rendering and Processing, Software Development

## Work Experience

- 2017–current **Postdoctoral Fellow**, *Dhofar University, Salalah, Oman.*  
Department: Computer Science (CS)  
Project: Intelligent Monitoring Systems
- 2016–2017 **Assistant Professor**, *University of Central Punjab (UCP), Lahore, Pakistan.*  
Department: Computer Science (CS)  
BS Courses: Object Orientated Paradigm (C++), Computer Graphics  
MS Courses: Visual Computing
- 2015–2016 **Postdoctoral Scholar**, *University of California Berkeley (UCB), USA.*  
Department: Electrical Engineering and Computer Sciences (EECS)  
Project: Development of a dynamic human musculoskeletal modeling platform  
Supervisor: Prof. Ruzena Bajcsy
- 2014–2015 **Vision Team Manager/Head**, *Daemyung TS Co., Ltd., 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 Renderer (*an advanced volume, mesh, points processing system*)
2. Real3D Scanner (*an extensible mesh and points processing system with a real-time SL 3D scanner*)
3. The Fast Visualization Kit (*is a software package for 3D computer graphics, image processing, and visualization.*)
4. FL-Essentials (*is a FLTK based software system which provides extreme easiness in building (responsive) GUI applications and gives parallel processing support in handling images*)
5. Real-Time Virtual 3D Scanner (*a perfect simulator to analyze and perform structured-light 3D scanning*)
6. 3D Intraoral Scanning System (*optical 3D scanner for dentistry, 3D reconstruction of human jaws*)
7. Volume Viewer & Simulator (*visualization/rendering of medical images, 3D reconstruction, analyzing*)
8. Musculoskeletal Modeling & Motion Capture Viewer (*amc and bvh file formats*)
9. Virtual Dental Treatment Simulator (*simulator to perform dental treatment operations using haptics*)
10. CNC Simulator (*highly similar to the real-world wood cutting machining center with 3D Laser Scanning*)

## 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

- 2017–current Intelligent Monitoring Systems for Cooperating Objects using 6LowPAN (6-IMS).
- 2015–2016 Dynamic musculoskeletal modeling for potential clinical applications such as non-invasive assessment of joint function (*collaboration with UC Davis, UCSF, and Stanford*).
- 2014–current 3D vision projects with US and UK based startups.
- 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
- Intelligent monitoring systems
- GUI based software development with latest tools and methods
- 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 *(as advisor)*

- 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

---

## Publications (30)

### 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. 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.
5. **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")**
6. 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.
7. 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.
8. 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.
9. **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, 1<sup>st</sup> 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.

**Ph.D.  
Dissertation**

**Furqan Ullah**, “**Analysis of 3D Shape Measurement for Fringe Projection Profilometry based Intraoral Scanner**,” *Ph.D. Dissertation*, 2014, *Dept. of Mechanical Engineering, Myongji Univ. S. Korea*



**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

---

## 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

- Feb–2015 Visual computing in dental and medical industry. UC, Berkeley
- May–2014 Structured-light based 3D inspection system for automobile industry. Daemyung TS Co., Ltd., Ulsan, S. Korea
- Jan–2014 How 3D measurement systems work and Methodologies to develop. Daemyung TS Co., Ltd., Ulsan, S. Korea

- Aug–2013 Micro-scale 3D measurement using a pico-projector. Orapix Co. Ltd, Seoul, S. Korea
- Jan–2013 Development of Real-time 3D measurement system based on Digital Fringe Projection Method. Myongji Univ. S. Korea.
- Jun–2013 Development of a CNC Machine for Curved Rafters. Myongji Univ. S. Korea.
- May–2012 Development of an Intraoral Scanner. Myongji Univ. S. Korea.
- Mar–2012 System Calibration of an Intraoral Scanner. Myongji Univ. S. Korea.

---

## **Business Trips**

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

## Selected Projects Descriptions

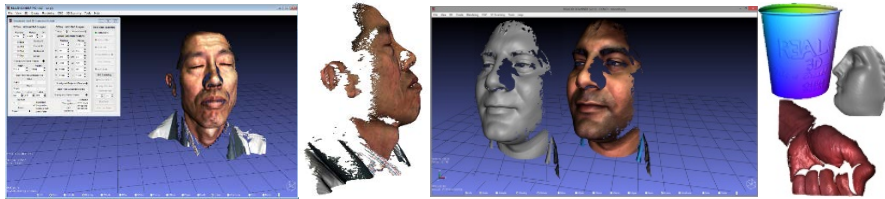
1. Real3D Renderer (<http://real3d.pk/rend.html>)

Real3D Renderer 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/Qt based 3D rendering library.

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 hundreds of researchers, professionals, and startups, in all over the world, includes America, Korea, Turkey, Germany, Italy, India, Australia, Slovakia, Spain, UK. Downloaded more than 70,000 times. *(written in C/C++, OpenGL, OpenCV, VTK, ITK, FLTK, FL-Essentials, 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, FL-Essentials)*

6. Musculoskeletal Modeling & Motion Capture Viewer

This platform was developed in Teleimmersion Lab, University of California, Berkeley under the project of dynamic musculoskeletal modeling for potential clinical applications such as non-invasive assessment of joint function.

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](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/drifurqan/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)*

10. FVK-CAMERA (<https://github.com/drifurqan/FVK-CAMERA>)

The Fast Visualization Kit (FVK) is a software package for 3D computer graphics, image processing, and visualization. It consists of a C++ class library with several 3D geometric as well as vision algorithms. It provides C++ classes for 2D-to-3D conversion algorithms specifically for DFP based structured light technology, various algorithm for mesh and pointcloud processing, and a complete software interface for developing fast 3D graphics and vision based applications. FVK supports visualization algorithms including scalar, vector, texture, and volumetric methods, as well as advanced modeling techniques such as implicit modeling, polygon reduction, mesh smoothing, cutting, contouring, and Delaunay triangulation.

The FVK-CAMERA is one of its modules that gives multithreading based camera handlings using OpenCV. It can be utilized with any GUI based library to handle multiple cameras with multithreaded interface.