

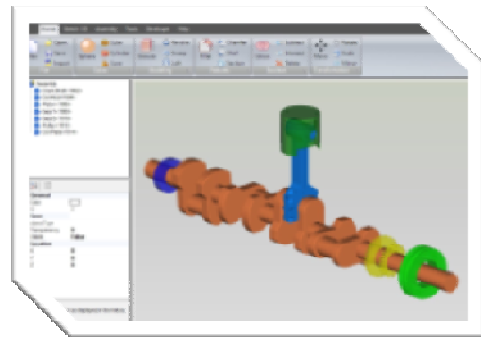


CADVertex Solutions: A-16 . Whispering Wind . Pashan-Baner Link Road . Pune . 411021
www.CADVertex.com eMail: info@cadvertex.com Phone :+91 9890611694

cMayoCAD come – **Make Your Own 3D CAD System**

Components of the CAD program you develop:

- Part, Sketcher, Assembly environments.
- A native binary file format for the CAD program.
- Data Exchange - Import and Export with other CAD programs via a neutral format.
- A Plugin system that allows third parties to extend the core functionality of your CAD system.
- A script editor and an interpreter to enable automation of your CAD system via scripting.



Detailed Course Contents (18 modules, 194 topics)

WinForms and GUI techniques for CAD using C# (Algorithm and code for each topic)

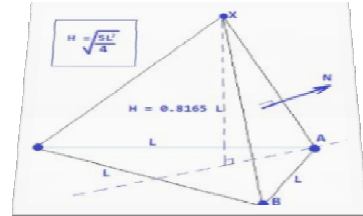
- Panel.
- Property Table.
- Toolbar.
- Treeview.
- Splitters.
- Pull down and context menus.
- Ribbon Bar.
- Passing data across forms.
- File dialogs - basics and advanced techniques.
- Mouse programming - Getting points and distance input via mouse.
- Extensions.
- Dictionary object.
- DataTable object.

OOPS

- OOPS concepts are explained and implemented as and when needed throughout the project.
- Some important OOPS techniques illustrated multiple times are:
 - Inheritance
 - Polymorphism
 - Operator overloading
 - Encapsulation.

Vector and Matrix Algebra (Algorithm and code for all topics)

- Take out all academic stuff and learn what is practically useful for CAD.
- What are vectors.
- What are various vector operations.
- What are dot and cross products.
- What is a normalized vector.
- What are the applications of dot and cross products in CAD.
- Algorithm and program to calculate dot and cross products.
- How to make use of vector cross product in CAD.
- Writing a vector class and utilizing it in the CAD program.
- Applying OOPS concepts in designing the vector class.



What is RADS or Rapid Application Development System (Theory Only)

- Component based.
- Extensible through plugins.
- Royalty free.
- No need to subscribe to or upgrade the proprietary CAD system.
- Faster than CAD automation since interacts directly with Kernel.
- Automatable via scripting.

RADS Capabilities (Theory only)

- Import and Export 3D models.
- Import of common data formats.
- Fully-featured 3D viewer.
- Tree-view for data representation.
- Tab-docking, User preferences and global application options.

MayoCAD - Geometry Creation (Algorithm and code for all topics)

- Creating a RADS with a CAD Component using CSharp.
- How to assemble GUI components.
- How to set up the application and the 3D graphics view.
- What is a SceneGraph and what are Scene Nodes.
- Functions to create 2D and 3D topological shapes.
- How to create primitives viz. sphere, box, cone, cylinder, etc.
- What are color values and what is color clamping.
- How to apply color and transparency to objects using display styles.
- How to use the vector class.
- How to use a SceneManager to find and select objects in the 3D space.
- How to show and hide objects in the 3D space.
- How to delete objects and nodes from the 3D scene.
- How to create wires, faces and extruded objects.
- How to create shape groups.
- How to extrude wires and faces and interpret the results.
- How to create revolved solids by specifying a profile and an axis.
- How to control creation of open ended and capped revolved solids.
- Implement sweep feature - along straight and curved paths.
- Implement lofting, creating lofts between multiple cross-section profiles.

- Implement fillet and chamfer features.
- Create shell feature.
- Special use of shell.
- How to define a plane in 3D space and create section geometry from solids using planes.
- Implement boolean operations on solids viz. Union, Subtract and Intersect.

MayoCAD - Geometry Manipulation (Algorithm and code for all topics)

- How to move objects in 3D space along X-, Y- and Z-Axis.
- How to define and manipulate the 4 x 4 transformation matrix.
- Components of a 4 x 4 transform matrix.
- Applying a transform matrix to an object.
- How to dynamically move objects using mouse.
- How to change the axis of movement on the fly.
- How to rotate objects along different axes using a 4x4 transform matrix.
- How to transform rotation angles to a 4x4 matrix element values using trigonometry.
- How to scale 3D objects.
- How to scale uniform and non-uniformly using 4x4 scale matrix.
- How to mirror objects about planes using mirror matrix.
- How to shear or skew objects using a skew matrix.
- How to show and hide XYZ Triad and axes during object transformations.
- How to orient objects using a coordinate system.

MayoCAD - More Geometry and Utilities (Algorithm and code for all topics)

- How to create circular and rectangular patterns of 3D objects.
- Creating sketches - 3D line, 3D circle, ellipse and arcs.
- Importing STL data.
- How to export image of 3D models to common graphics formats viz. BMP, JPG, PNG, etc.
- How to calculate the 2D rectangular bounds of the 3D space for image exporting.
- How to create the bitmap and save it to an image file.
- How to create a print preview from the CAD application.
- How to print the 3D models using printers installed in the system.

MayoCAD - Bounding Box (Algorithm and code for all topics)

- How to calculate extreme values.
- How to calculate bounding points.
- How to display the bounding box for a selected object.
- How to calculate common bounding box of multiple objects.

MayoCAD - Building the Assembly environment (Algorithm and code for all topics)

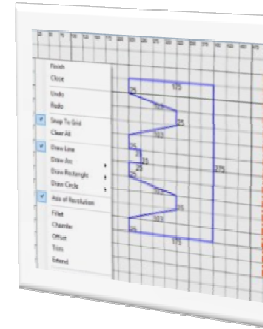
- How to import native and neutral data.
- How to move components relative to each other.
- How to rotate components for placing.
- How to sync placed components with the history tree.

MayoCAD - Custom objects (Get your hands dirty with pure geometry)

- How to make a new 3D geometry object type.
- How to define and specify parameters.
- How to extend the geometry kernel by integrating new object type into the core.
- How to make the new object API available as built-in feature of the kernel.
- How to store BRep and Facet data for the custom object.
- How to integrate custom object with kernel viz. properties, translation and boolean operations.
- How to export custom object to neutral format.
- How to store the custom object to the native file format.

Sketcher (Algorithm and code for each topic in this section)

- How to detect mouse events.
- How to calibrate the sketcher.
- How to draw a static grid in the sketcher area.
- How to allow user to draw shapes like line, circle, arc, rectangle, ellipse, etc. using mouse.
- How to dynamically display dimensions of the sketch as the mouse cursor moves.
- How to snap the mouse to nearest grid points in the sketcher.
- How to automatically close an open sketch.
- How to check for sketch validity:
 - Check for open profile.
 - Check closed but non-unidirectional sketch segments.
 - Check intersecting sketch segments.
 - Check overlapping sketch segments.
 - Check if null lines i.e. line start and end point are same.
 - Specifying axis for revolved feature.
 - Check if axis is intersecting profile segments for revolved feature
- How to create profiles in the sketcher and transfer into the 3D space.
- How to implement extrusion and revolution of 2D profiles to create 3D objects.



MayoCAD - Tessellation (Algorithm and code for all topics)

- How to calculate facet data.
- What are surface normals.
- What is the use of surface normals in CAD.
- How to calculate surface normals from facet data.

MayoCAD - Architecture (Algorithm and code for each sub-topic listed below)

- What is architecture for a CAD program.
- How to create components or blue print for the architecture.
- How to build relationships between components and define data flow.
- How to define and implement new components so they adhere to same data flow pattern.
- What is an **MVC Pattern** or Model-View-Controller pattern.
- How to implement the MVC pattern in CAD.

MayoCAD - Native file format (Algorithm and code for each sub-topic listed below)

- How to create binary data from CAD geometry.
- How to assemble geometric data, positional, color & transparency information.
- How to write the binary data to file.
- How to compact files by compressing binary data when storing to file.
- Steps to create the architecture of the native file format for the CAD application.
- How to create header and body info and write to file.
- How to create a layered structure of information.
- How to write CAD data in binary format to file.
- How to read back binary data from file and display both native and custom objects.
- How to synchronize the 3D SceneGraph with the history tree.
- How to update object properties from the properties window.

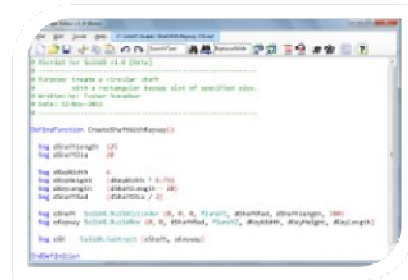
MayoCAD - Adding Automation Capability Through Scripting (Code for all topics)

- How to create a script editor from scratch.
- Choosing keywords for the new scripting language.
- Choosing a comment character or keyword for the new language.
- How to automatically color code keywords, numbers and commented lines as you type.
- How to implement standard features viz. New, Open Save, Save As, Cut, Copy, Paste, Undo, Redo, etc.
- How to implement Search, Search Next, Replace, Replace All features in the editor.

- How to implement 'Match Case' and 'Match Whole Word' options for Search and Replace.
- How to highlight searched text.
- How to implement commenting and uncommenting of lines.
- How to implement indent and un-indenting lines.
- How to implement a syntax checker for the script code.
- How to build a cache of declared variables and their values from the script.
- How to evaluate expressions and store values against variables from the script.
- How to differentiate if a variable is assigned value or an expression.
- How to evaluate nested expressions.
- How to evaluate nested expressions mixed with numerical values and variable names.
- How to safely ignore commented lines.
- How to evaluate commands for the CAD application.
- How to parse arguments from the function calls of the script.
- How to pass commands from editor to the CAD application and execute them.
- How to check if document is saved, unchanged or modified.
- How to directly run a script from the CAD application without opening it in the editor.

MayoCAD - Plugin Architecture (Algorithm and code for topic 3 onwards)

- What are plugins.
- How do plugins extend the core functionality of the CAD program.
- How to create a plugin for your CAD program.
- How to display all available plugins.
- How to let users selectively load plugins.
- How to let users run plugins for the CAD program.
- How to create utility plugins for your CAD program.
- How to create data exporter plugins for your CAD program.



What you get as part of the training project

- Full source code for several programs discussed during the project.
- Source code for the sketcher.
- Source code for the script editor.
- Our custom CAD program - latest version and all subsequent updates.

What you gain from the training project

- Several advanced concepts regarding CSharp and project handling.
- Techniques and know-how gained are not limited to a CAD application, but can be applied to any project.

Other training programs from CADVertex:

<ul style="list-style-type: none"> ❖ CATIA CAA <ul style="list-style-type: none"> ➤ VBScript/VB 6.0 ➤ Visual C# ➤ VB.Net ➤ C++ ➤ MFC 	<ul style="list-style-type: none"> ❖ SolidWorks and Inventor Customization <ul style="list-style-type: none"> ➤ VB 6.0 ➤ VB.Net ➤ Visual C# ➤ C++ ➤ MFC
<ul style="list-style-type: none"> ❖ NXOpen.Net <ul style="list-style-type: none"> ➤ VB.Net ➤ C# ➤ C++ ➤ Knowledge Fusion (KF) ➤ Product Template Studio 	<ul style="list-style-type: none"> ❖ Solid Edge Customization <ul style="list-style-type: none"> ➤ VB 6.0 ➤ VB.Net ➤ Visual C# ➤ C++ ➤ MFC