**C++ 3D RENDERING AND LABELLING SOFTWARE**

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**Section :** B

**Type of Project**  
Processing System

**Basic data structure used**

Classes-

1. Vertex Class containing data members and functions pertaining to object vertices and coordinates of projection of vertex onto screen.
2. Triangles Class containing data members and functions pertaining to data of triangles formed linking of vertices.
3. Objects Class containing data pertaining to characteristics and colour of triangles linked to the same respective objects.
4. Labels Class containing data pertaining to position and text content of labels placed in 3D Space

File contains data that pertains to the data members of the above classes and thus each file stores data for one 3D model.

**Names of data members**

File stores following data-

1. Vertex coordinates.
2. Index positions of groups of 3 vertices that constitutes triangles.
3. Type of object (in 3D space) that is hollow/solid, colour and index positions of triangles constituting an object.
4. Labels text content and position in 3D space.

**Type of file used**

Text File

**Type of queries & functions**

1. Selection of which file to open.
2. Importing of data from file into objects of classes.
3. Rendering of shapes onto screen based on imported data.
4. Taking user input for motion of view, rotation of orientation, zoom, etc.
5. Appending file to create and editing of labels.

**Project Explanation**

The aim of the project is to create an executable software that allows user to select and open a 3D model whose data is stored in a file and then process data to create rendering of model onto screen of user.

Firstly, data imported from file and is allocated into data members of respective classes that consist of methods to further process data during execution of program and to calculate and allocate values into other data members based on imported data.

The method of rendering the 3D model is as follows.

Any 3D object consists of a number of vertices. Its surface is formed by linking respective vertices to form a plane surface and groups of surfaces create the object.

The program calculates the coordinates of where a vertex would appear to be, on an imaginary screen that the vertex being looked through i.e. its projection. These are then mapped to user’s monitor’s screen. A triangle is drawn between the 3 points whose coordinates are defined by the calculated projection of vertices. When all triangles constituting object are drawn an illusion of the 3D object on a 2D screen is created.

Triangles drawn have brightness and colour characteristics this also giving the illusion of a shaded object.

User has various inputs such as direction they wish to move in the 3D space and the orientation of their view (both of which changes where 3D object will be drawn and what can be seen or not seen). Other inputs including zooming in or zooming out.

Special function known as “Vertex Coordinate Highlighter” highlights the coordinate of vertex clicked on by user.

The rendering software also consists of text labels placed in the 3D space useful for labelling various parts of models. The user can edit existing labels or add new labels and save the formatted file.

The software provides a useful menu for closing and opening of different 3D models along with instructions of use.