Lecture 2

Classes, Objects & Templates (Application)

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Standard Triangle Language

- A formal definition for a 3D mesh
  - A collection of triangles.

```
solid Mesh
facet
outer loop
vertex 0.0666225 -0.00713973 -0.0520612
vertex 0.0695272 -0.00912108 -0.0509354
vertex 0.0659653 -0.00814601 -0.052367
endloop
endfacet
facet
outer loop
vertex 0.0762163 -0.00201969 -0.0587023
vertex 0.0769302 -0.00441556 -0.0564184
vertex 0.0760299 -0.00791856 -0.0610091
endloop
endfacet
```
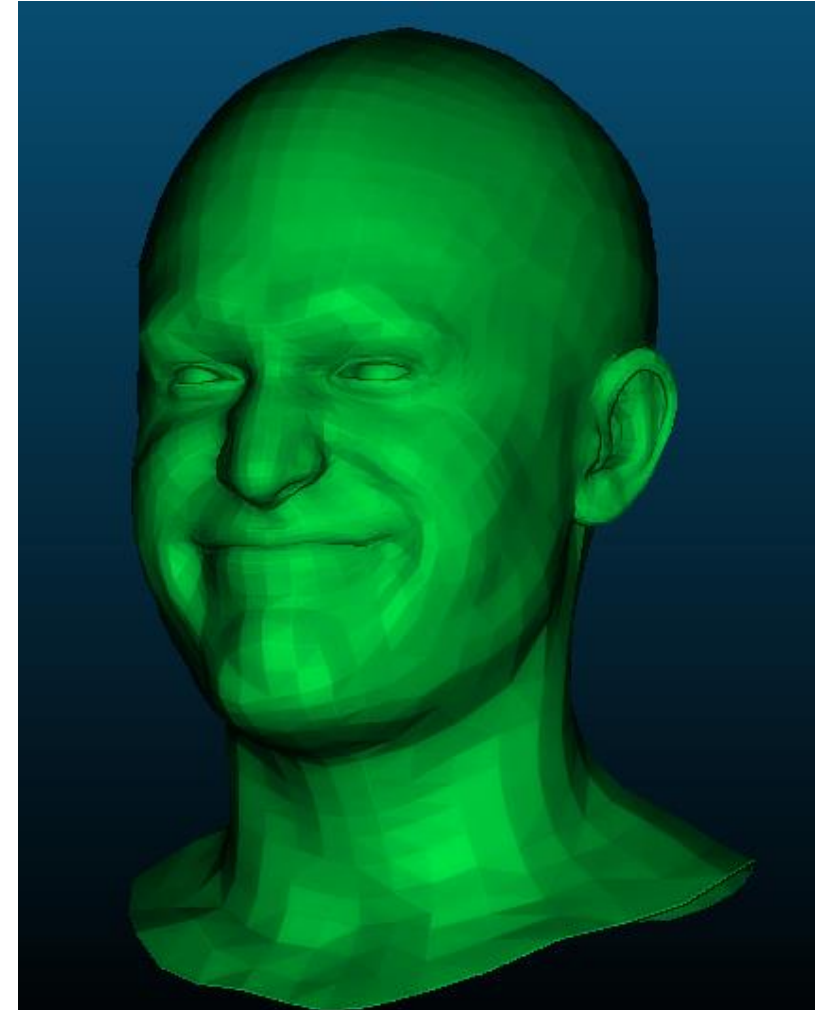
Task: 3D Mesh Manipulation

- Create a data structure to keep point positions: x,y,z

- Create another data structure to store the triangles.

- Create a list of triangles.

- Implement three different manipulation functions:
  - x_limit, y_limit, z_limit

  - Delete the trianges according to x, y and z axis.

Skeleton Code

- The first part of the code reads the STL file line by line and take the point positions.

- String functions are highly used to splitting & comparison.

```cpp
ifstream infile("rec1_mesh.stl");

string line;
while (true) {
    getline(infile, line);

    if (infile.eof()) {
        break;
    }
    if (strncmp(line.c_str(), "vertex", 6) == 0)
    {
        cout << line << endl;

        int space_positions[4];
        int pos_counter = 0;

        for (int i=0; i<strlen(line.c_str()); i++)
        {
            if (line[i] == ' ')
            {
                space_positions[pos_counter] = i;
                pos_counter++;
            }
        }
        float x = stof(line.substr(space_positions[0], space_positions[1]));
        float y = stof(line.substr(space_positions[1], space_positions[2]));
        float z = stof(line.substr(space_positions[2], strlen(line.c_str())));

        cout << x << " " << y << " " << z << endl;
    }
}
```

Skeleton Code

- The save_stl function in the skeleton code creates some triangle positions and save them inside an STL.


```cpp
void save_stl(char* filename)
{
    ofstream outfile(filename);

    outfile << "solid Mesh" << endl;

    int triangle_count = 5;

    for(int i = 0; i < triangle_count; i++)
    {
        float x1= 0.0, x2= 0.0, x3=0.0;
        float y1= 0.0, y2= -5.0, y3=5.0;
        float z1= 10.0 + i*10, z2= 0.0 + i*10, z3=0.0 + i*10;

        outfile << "facet" << endl;
        outfile << "outer loop" << endl;
        outfile << "vertex " << x1 << " " << y1 << " " << z1 << endl;
        outfile << "vertex " << x2 << " " << y2 << " " << z2 << endl;
        outfile << "vertex " << x3 << " " << y3 << " " << z3 << endl;
        outfile << "endloop" << endl;
        outfile << "endfacet" << endl;

    }

    outfile << "endsolid Mesh" << endl;

}
```