Demo Reel Breakdown

Technical Work

Note- All the projects here are individual projects, unless specified.

1) **GPU Based Path tracer-:**
   I did this is as my class project where I started off by creating a GPU based Ray tracer. We know that Ray tracing is an embarrassingly parallel problem so I parallelized the whole Ray tracer system on the basis of each pixel initially since each pixel is independent from other pixel.
   Then I extend the ray tracing algorithm to a recursive path tracer which includes the following features-:
   Depth of Field, Fresnel Refraction, Reflections, Global Illumination.

   I also later parallelized the whole system by Rays instead of pixels using stream compaction and that increased the system performance because with that at each ray bounce I only created the threads for rays which were still alive. For the rays which hit the Light source or the ones which hit the background were not allocated the thread in the next bounce.

   More information on this project can be found on my blog.
   http://raytracerpathtracer.wordpress.com/

2) **Jell-O-Cube Simulation-:**
   This is physics based real-time simulation of a Jell-O-cube. Here I started off by creating various kinds of spring on cube structure eg, the bend springs and the shear springs. These spring are responsible for the deformation of the Jello. Cube interacts with the ground in two ways, one is when It just comes into contact with the surface, in which case it slides and second is when it intersects with the surface, in which case is bounces back in the direction in which it hits.
   I also ported the simulation into Maya by mapping the vertices of the cube in the simulation to the cube in Maya. Finally I rendered it using the mental ray renderer.

3) **Smoke Simulation-:**
   This was one of my favorite projects in which I implemented a Semi-Lagrangian based smoke simulator. I used a staggered grid in which is stored the pressure values on the grid center and velocity and temperature on the edges. I also used an “Incomplete Cholesky Preconditioner” which eased the matrix multiplication.
   Then I also did my final project on Target Driven smoke simulation in which was based Raanan Fattal et al paper “Target driven smoke animation” 2004.
   This essentially modifies the original Navier Stokes equation but adding a few terms to it like, Smoke gathering, momentum attenuation, driving forces.

This allows us to set a bunch on source and target states which the smoke is forced to pass through using above forces.

More details on implementation of this project can be found at the project blog.
http://targetsmoke.wordpress.com/

4) **Rigid Body Simulation-:**
This RBD solver handles sphere and cube interactions. Whenever any of the two collide a repulsive force is generated in the opposite direction.
One of the major part of this project was to implement an broad phase collision detection method for which I implemented the sweep and prune method.

5) **Maya Plugin L-system-:**
This was the Maya plugin that I created to generate procedural trees using simple grammar and the Lindenmayer system. The plugin was implemented as a Maya Node as well as a MEL Command. The video shows the use of both of them.

6) **Volumetric Render-:**
This is a voxel based renderer in which I did a simple Ray Cast into the voxel structure. Later I used the Perlin noise to get the pyroclastic type effect.

7) **Ray Tracer-:**
This Ray Tracer was created in C++ where I first started off by creating primitive structures like cube, sphere, cylinder etc. in OpenGL. Then I created a scene graph in which I created a scene hierarchy to create more complex furniture using the basic primitives. Then finally I performed the Ray Tracing on my scene graph taking into account specular highlights, specular reflections.

8) **Behavioral Animation-:**
We did different kinds of group behavior like flocking, separation, follow, etc. based on the Noids paper by Craig Reynolds. Different mechanisms have different algorithms, which included detection of collision and moving away to avoid obstacles etc. Consider the motion of the leader and then just try to replicate that.

Artistic Work-:

a) **Interior Visualization-:** These visualizations were done as a part of my freelance project. Some of the models were created and textured by me and some of them were brought online, depending the complexity and availability of time.

The rendering was done in V-Ray Renderer and 3ds Max. I created more than 100 different renders for the company with different room settings.

Here I also used the 3ds Max backburner and took the advantage of network rendering to speed up render times.

b) Character Animation-:

I was part of the team that created “Cric X”. I was working in the team of 15 people which were doing solely the character animation for short film which was later broadcasted on Disney channel in India.

c) Facial Rigging and Animation-:

This was my final project for my Facial rigging and animation class. The 30 sec movie clip from the movie is used. Key things to note are the saccadic movement of eyes and Lip Sync with the dialogue. This project was completed in 3 days.