

COMP3201 – Computer Graphics

Assignment 3: “Prairie Dog Tagging”

Assignment Due: electronic submission by 6pm on Monday 29 May 2006

Task:

Construct a 3D environment for the prairie dog tagging.

Objectives:

- To understand how to create an animated 3D scene in Computer Graphics.
- In particular, to understand the basics of Computer Graphics, including
 - Texturing
 - Blending
 - Lighting and Materials
 - Fog
 - Culling
 - Antialiasing
 - Animation and Double Buffering
 - Fractals (COMP7204 only)
 - OpenGL Picking

Submission

Assignments are to be submitted electronically via the web at <http://submit.itee.uq.edu.au/> . Code must **not** be compressed (e.g. zipped) for submission.

Code Style

Code must be written in ISO C90 and conform to the coding style available from <http://www.itee.uq.edu.au/~comp3201/ c coding style.html> . Code must compile under Solaris with the Makefile available for download from <http://www.itee.uq.edu.au/~comp3201/Makefile> .

Remarking of Assignments

Any request for an assignment to be re-marked must be made in writing (not e-mail) to the lecturer (and not to the tutors). The request must contain details of why a re-mark should be granted (e.g. you believe there has been an error in marking a particular section of the code). Such requests must be made within 2 weeks of the assignment-feedback being sent to the students.

Demo Executable

A demo version of this assignment can be downloaded from the web site (choose your platform) and run, to allow verification of the functionality of this program.

Program Functionality:

- This assignment will extend Assignment 2. You must use the supplied base code and not the code that you submitted for Assignment 2. The compulsory base code is available from the course web site.

Lighting

- There is a global ambient lighting of colour { 0.09, 0.09, 0.09, 1.0 }
- The light model should have a local viewer.
- Lighting calculations can be toggled on/off by pressing the 'l' key
- Remember to define material properties and normals for the objects in the scene. GLUT solid objects have normals automatically defined.
- Normals for each vertex are to be face normals. This will produce sharp edges.
- Remember to renormalise your normals if you use a glScale* operation.
- The scene will have one directional light which is positioned at infinity in the direction that the sun appears on the side wall texture. The light colour is defined by
 - Ambient = { 0.21, 0.21, 0.21, 1.0 }
 - Diffuse = { 0.41, 0.41, 0.41, 1.0 }
 - Specular = { 0.31, 0.31, 0.31, 1.0 }

Materials

- The prairie dog will have material parameters as follows
 - **Everything except nose and eyes:**
 - Ambient and diffuse follow current colour setting
 - Specular = { 0.4, 0.4, 0.4 }
 - Shininess is 7.
 - **Nose and Eyes:**
 - Ambient and diffuse = { 0.02, 0.02, 0.02 }
 - Specular = { 0.6, 0.6, 0.6 }
 - Shininess is 50.
 - **Burrow**
 - Ambient and diffuse follow current colour setting
 - Specular = { 0.2, 0.1, 0.1 }
 - Shininess is 5.
- The cacti (COMP7204 only) will have material properties as follows
 - Colour = { 0.3, 0.45, 0.2 }
 - Ambient and diffuse follow current colour setting
 - Specular = { 0.2, 0.6, 0.1 }
 - Shininess is 8.

Prairie Dog Animation

- Each prairie dog should move up and down at the entrance of the burrow.
- The speed at which an individual prairie dog moves is independent of all other prairie dogs.
- A mouse click increases the speed of the selected prairie dog by 10%. The picking of objects is to be performed by OpenGL picking.
- When a prairie dog is picked the HUD is updated to reflect the total number of pickings that have occurred.

Camera Animation

- The camera should move in the direction that it is oriented in.
- The camera should move at the speed indicated on the HUD.
- The world should have circular boundary conditions so that when the camera flies off one edge of the world it reappears on the opposing edge.

Texturing

- The ground, walls and roof are textured using the textures available for download from the course web site. The textures are in the SGI RGBA format. Code for loading these images into memory is supplied as part of the base code.
- The coordinates used can be obtained from the annotation functionality in the demo program.
- The texture environment should be set to simply replace the underlying colour of a vertex by the texture.
- Mipmapping must be used.
- The minification filter is `GL_LINEAR_MIPMAP_LINEAR`.
- The magnification filter is `GL_LINEAR`.

Fog

- Fog can be toggled on/off via the 'f' key.
- Use an exponentially decaying fog.
- The fog density is 0.00015.
- The fog colour is the same as the background colour.

Heads Up Display (HUD)

- Lighting calculations and depth testing should be temporarily disabled for the heads up display
- The HUD should always display
 - Camera speed
 - Number of tagged prairie dogs
- Depending on the toggled state of the key 'F1' the keyboard bindings should be displayed as part of the HUD.

Keyboard

In addition to the functionality provided in the base code

- 'f' – toggle fog
- 'l' – toggle lighting calculations
- 'b' – toggle backface culling
- 'd' – toggle depth testing

glHint's

- choose GL_NICEST for the fog hint.
- choose GL_NICEST for the line smooth hint.
- choose GL_NICEST for the perspective correction hint.

Cacti (COMP7204 only)

- There are 20 cacti in the scene.
- The cacti are randomly located on the ground and do not move or change after generation.
- The cacti are fractals created by recursion.
- There are a maximum of two branches and a minimum of one generated at each recursion level.
- There are 6 levels of recursion.

Other

- Backface culling must be enabled.
- In general, depth buffering must be enabled but may be disabled if appropriate. Reasons for disabling must be documented in the code.
- Line antialiasing must be enabled during wire frame mode
- There is no collision detection or avoidance.
- Display lists are used for all static drawing
- OpenGL errors must be checked for once per frame.