The God Core
A video game engine and video game developed in C++

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1 Abstract

This project consists of a video game engine developed in C++ and a short video game developed on it. My goal throughout this project was to strengthen my software development skills and prepare me for a career. I developed skills not necessarily part of an ordinary Computer Science curriculum, such as the research, evaluation, and implementation of various APIs, creating a deployment module, and simply developing and maintaining a project for an extended amount of time. Developing this project also served to strengthen the programming principles that have been instilled in me throughout my undergraduate Computer Science experience.

2 Development Tools

2.1 APIs

API's, or *Application Programmer Interfaces*, are a set of methods and tools to allow a programmer to access a piece of software through code. They are useful when developing more complex applications, as you can incorporate useful, quality tools rather than spending time developing tools that have already been created.

2.1.1 OpenGL

OpenGL (Open Graphics Library) is one of the most widely used graphics libraries available. It provides access to matrix manipulation, keyboard and mouse input, windowing, and vector graphics. It provides the ability to draw in both 2D and 3D and gives access to primitives such as rectangles, triangles, and lines. With GLUT (OpenGL Utility Toolkit), OpenGL can also draw simple spheres and cylinders. It is the graphical backbone of both the Unity and Unreal Engines for Mac OS and Linux.

I chose to use OpenGL over its stronger competitor, Microsoft's DirectX, because it is cross platform which would reduce the amount of work needed to port the engine to a different operating system, and because there is a great deal of documentation easily available for OpenGL.

2.1.2 SOIL

SOIL (Simple OpenGL Interface Library), is a small extension to OpenGL that provides an easy to use interface for using textures in OpenGL, including saving images, loading and binding textures, and resizes textures. A *texture* is an image on the hard disk, such as a JPG or PNG file, that is loaded into memory and rendered over an OpenGL primitive, such as a rectangle. I use textures for the main menu and as part of the background for Terminals to make them look nicer, everything else rendered in game is an OpenGL or glut primitive.

The images used for the textures can be found in section 7.3

2.1.3 FMOD

FMOD is a sound effects engine developed by Firelight Technologies that can play many different files types on numerous Operating Systems including but not limited to: Windows, OSX, IOS, Playstations and Xboxes, and Android; and it is is the primary audio system for many game engines including Unity, Unreal, CryEngine, and Havok. I decided to use FMOD because I was impressed with its flexibility and diversity, no other API that I looked at could read as many different sound files, particularly MP3 files which was the format of the sound files that I had acquired.

2.1.4 SQlite

Rather than store game data in a text file, I chose to store the data in a SQL database to use make full use of the SQL queries, which make it easy to request all data for specific levels and to parse the data that is received.

I decided to use SQLite over other implementations of SQL because it is a lightweight and simplified, stripping out features of SQL that I do not need in order to make queries faster and the database size smaller.

2.1.5 Windows API

The Windows API is distrubted with the Microsoft Software Development Kit and provides access to many features of the Windows operating system.

The game engine only utilizes one of its eight modules, the Shell Object module, which gives access to the operating system shell. Since programs do not have write permissions to their install folder in Windows,

the Shell Object module can be used to used to locate the user's personal documents folder, where both the save file and the log file are written.

2.2 Development Environment

2.2.1 Microsoft Visual Studio

Microsoft Visual Studio is an IDE (Integrated Development Environment) developed for Windows that supports a variety of programming languages, and it is where I wrote all of the code for the game engine. I chose Visual Studio as my IDE because it give access to an Installer package, which allows me to create a windows installer for my game so that it can be installed on any Windows computer. The Installer packages together the executable source code, any resources that I have developed, as well as system resources such as the Microsoft C++ redistributes necessary to run programs developed in Visual Studio. Visual Studio also provides powerful analytic tools to monitor memory usage to avoid creating memory leaks.

I chose to develop my project in C++ because it is an extremely fast language, and speed is one of the most important qualities in real time software like video games. C++ also allows low level memory access with pointers and the ability to use typeless pointers, which are of great use in sections 3.1.4 and 3.1.3.

2.2.2 SQLite Studio

SQLite Studio is a third party GUI for SQLite that allows information to be analyzed and edited quickly and easily. It also provides utilities to export a database to a number of different file formats, allowing me to easily include the database for reference in section 7.2.

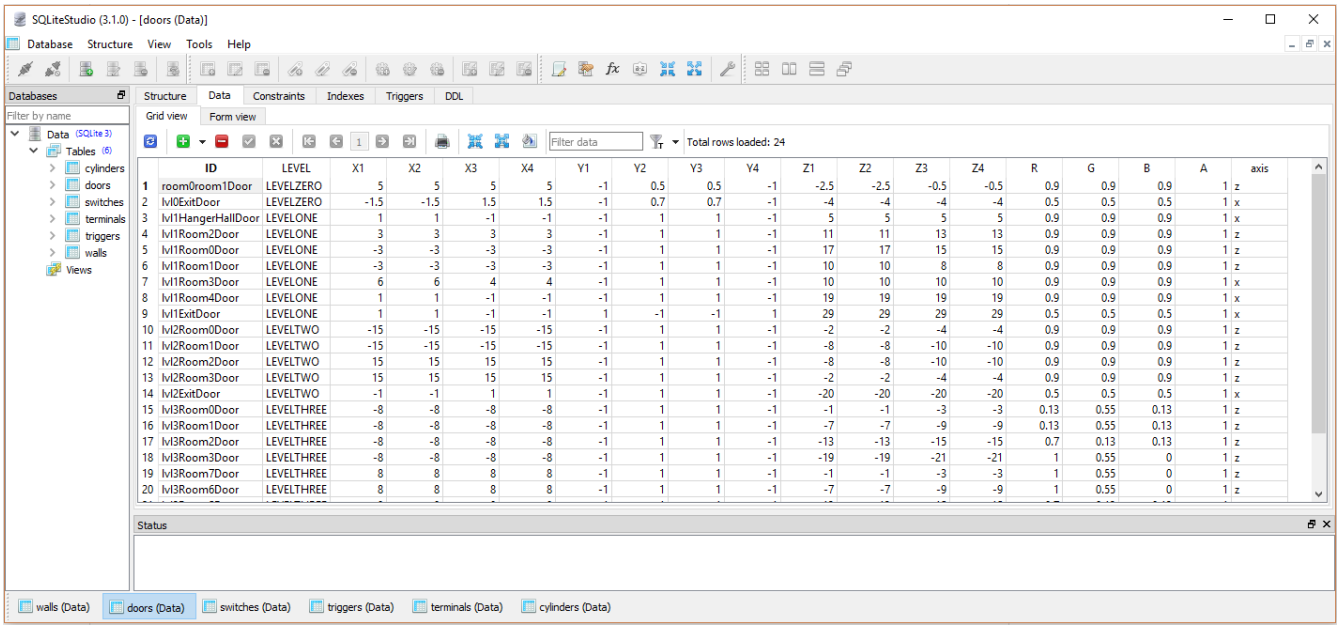

Figure 1: A picture of the *doors* table in the SQLite Studio editor.

2.2.3 GitHub

GitHub is an online Git repository that houses many open source projects. It also provides a great source control and branching system, where multiple branches can be created from a single point in the project to experiment with new features without any fear of damaging your code if they do not work out.

3 The Project

The project consists of two entities: the game engine and the game itself, which was developed on the engine. The engine and game are not two fully seperated entities as discussed in section 4.2.2.

3.1 The Game Engine

I developed the engine of my game in C++ during two, years starting in spring of 2015 and ending in fall of 2016. It consists of 49 C++ files, in which there are 3,308 lines of code and 1,122 lines of comments. The code can be found in the section 7.1, and it as also located on GitHub [1].

The engine reads a SQLite database (Data.db) that is housed in the same directory as the game executable, and it recognizes six tables in the database that correspond to six different types of in game objects—Walls, Doors, Cylinders, Terminals, Switches, and Triggers. Due to limitations discussed in 4.2.2, it will only properly work with a game that has five levels.

3.1.1 Walls and Doors

Walls are, at their heart, an OpenGL rectangle with a wrapper for additional functionality. In the same vein, Doors are simply Walls with the ability to open and close.

Internally they consist of two arrays: a four dimensional array containing the $rgba$ values and a twelve dimensional array containing the 4 xyz coordinates of the rectangle's corners.

The rectangles contain the most complex mathematics needed for collision, as the necessary calculus to correctly determine whether or not the player has collided with a rectangle involves determining if a sphere has collided with a plane in 3 Dimensional space.

In the constructor of a rectangle, after all values are initialized, the equation of the plane (Figure 2) is immediately calculated for future reference in collision detection.

$$aX + bY + cZ + d = 0$$

Figure 2: The equation of a plane.

This equation is calculated using the any three corners of the rectangle (A, B, and C) and then creating two vectors (B-A and C-a) using their dot product as show in Figure 3.

$$\vec{AB} = \begin{vmatrix} Bx - Ax \\ By - Ay \\ Bz - Az \end{vmatrix} \vec{AC} = \begin{vmatrix} Cx - Ax \\ Cy - Ay \\ Cz - Az \end{vmatrix}$$

$$\begin{aligned} a &= \vec{AB}_2 * \vec{AC}_3 - \vec{AB}_3 * \vec{AC}_2 \\ b &= \vec{AB}_3 * \vec{AC}_1 - \vec{AB}_1 * \vec{AC}_3 \\ c &= \vec{AB}_1 * \vec{AC}_2 - \vec{AB}_2 * \vec{AC}_1 \\ d &= -(aAx + bAy + cAz) \end{aligned}$$

Figure 3: Given three points of a rectangle (A, B, and C), the equation of the plane can be derived with the cross product of two vectors. [2]

The norm of the plane can then be derived using the equation $\sqrt{a^2 + b^2 + c^2}$.

3.1.2 Terminals

Terminals are an in-game computer that the player can access to read parts of the stories lore, as well as unlock new doors for them to explore.

Each terminal is bound to a unique *terminal file* that is heavily structured and contains its data. An example is show in Figure 4

```
<FILES>
[01] Name1 -- TAG
[02] Name2 -- TAG2
[03] Name3 -- TAG3

<TAGS>
$HELP$
Type Read <num> to read the corresponding file
Type Clear to clear a file from the screen
Type Exit to exit the terminal
Type Help to see this message again
$END$

$TAG$
Content 1
$END$

$TAG2$
Content 2
$END$

$TAG3$
Content 3
$END$
```

Figure 4: An example Terminal file

Figure 5: One the terminal file is parsed, this is how it appears in game.

The program parses the file by first separating the in game content (the bracketed number and name) that should be displayed to the user from it's tag. The tags are stored in an array, where its index is equal to the bracketed number. The help display is always stored at the 0th index.

The terminal recognizes a number of commands:

- Help—Displays the help prompt.
- Read X—Reads the requested tag. If X is zero or greater than the highest number, an error is returned.
- Quit or Exit—Removes the player from the terminal and back into the world.

The terminal also stores a history of what the player types, and the up and down arrows can be used to cycle through previous commands.

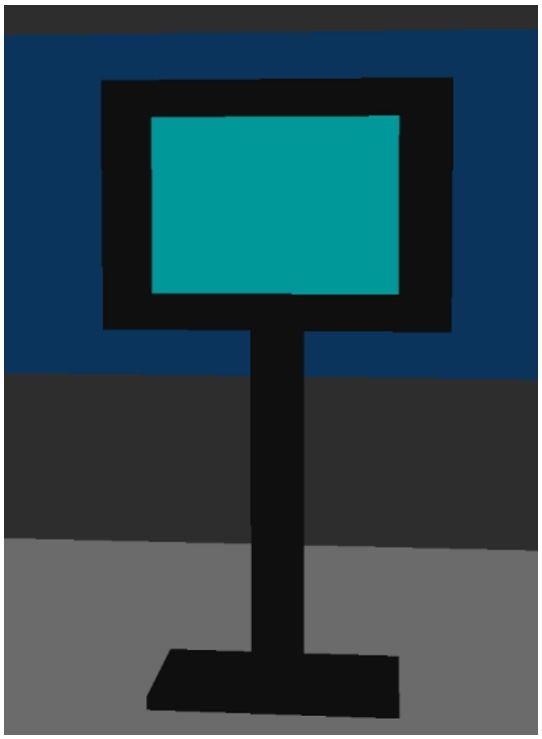

Figure 6: The 3D terminal object.

3.1.3 Switches

A switch is a button that is attached to a wall and is visible on either side. Switches are primarily bound to doors and terminals and are used to open/close a door or power on/off a terminal. Switches are also the mechanism to change levels, each level except for the last contains a switch that, when activated, will trigger a level change. Switches serve as the primary means of progress, as the level change switch and many door switches will initially be off, and the player must navigate through the level to power on more switches and progress through the level.

Internally a switch consists of two three dimension vectors, one containing its xyz center and the other containing its xyz rotation. It also contains a void pointer to its target and an identifier as to what type of object the target is so that the pointer can be properly typecast.

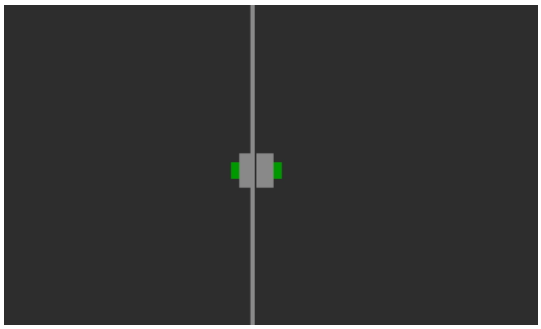

Figure 7: A switch that is embedded in a wall.

3.1.4 Triggers

Triggers are not a tangible object in the game, rather, they serve as an event. Triggers are a more sophisticated form of interaction between two different objects. The implementation was designed to be abstracted away from object types so that any arbitrary object could activate another.

The trigger holds two void pointers, one for a triggering object and one for the target object, as well as identifiers for which object type they are. Whenever an object is interacted with, every trigger in the game is tested and if the object is the same as the trigger pointer (no referencing needed as the pointers will always be equal), the target is dereferenced according to the appropriate type and activated.

3.1.5 Cylinders

Cylinders solely exist as decoration. Internally it contains the radius of each base, the height, an xyz center, the $rgba$ values, and the number of "slices" or how smooth it should appear.

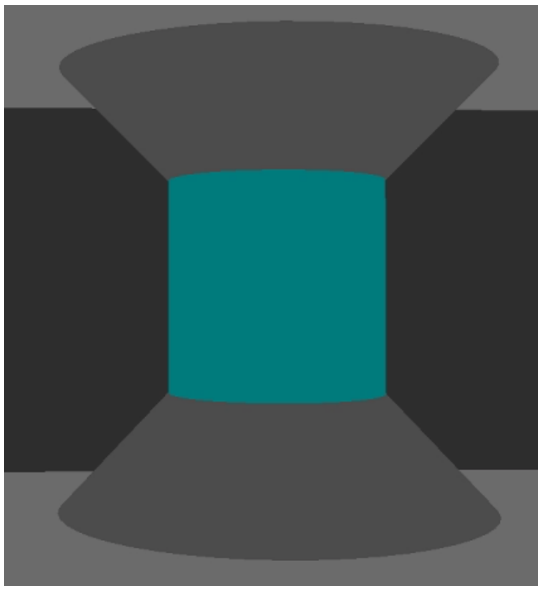

Figure 8: An object composed of three cylinders.

3.1.6 Level Management

Loading each level involves a series of operations through the SQLite API. First a connection with the database is opened, and then a series of queries are made to the database for each table in the database in turn. All important data from the database is stored in a class of the appropriate type, unnecessary data is discarded, and in the end each class is pushed into a vector of the appropriate type.

The data is loaded in a strict order, due to some objects having dependencies on others (that is, some objects require other objects to already exist). Thus the first things that are loaded are purely independent objects, all doors, walls, cylinders, terminals. Next switches are loaded, because they require both doors and terminals to already exist. Finally, the triggers are loaded, because they require both switches and terminals.

When loading switches and triggers, the objects also need to be *bound* to their appropriate required object(s). This is why doors, switches, and terminals all carry their ID's into the program with them, while triggers and walls discard their ID. Once all of the objects that need to be bound are loaded into the game, the game proceeds to bind them to their target. For each switch that needs to be bound, the game loops through the list of possible target objects and creates a pointer to the correct object inside of the switch, thus ensuring that the switch can toggle its target instantly without needing to search every time it is triggered. The triggers are bound similar, with the difference that each object must perform two searches, one for the triggering object and one for the target object.

If there is any data error in regards to binding — that is, an object attempts to bind to an object that does not exist, the error is considered fatal and the game immediately shuts down after logging the error.

The OpenGL display function calls upon the Level class to display all in game objects. This is a simple matter, because each object knows how to display itself. Thus it is a simple matter to loop through each vector and tell each object to display itself.

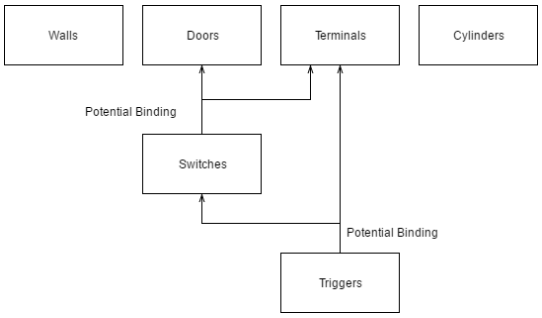

Figure 9: An Entity-Relation Diagram shows the dependencies of certain objects.

3.1.7 Camera Controller

The camera control describes how the player looks around and moves. Internally it contains the xyz rotation, which describes the direction that the player is looking, and the xyz coordinates where the player is physically located. The x rotation corresponds to left/right movement, the y coordinate refers to up/down movement, and z rotation would be similar to a barrel roll.

The player can move forwards and backwards, as well as strafe left and right, in respect to the direction that they are facing. The equation to determine movement is the formula to determine a point on the circumference of a circle as seen in Figure 10. Only the angle of x rotation is necessary for the formula, as looking left and right are the only things that impact where one would move. Given the formula, it is equally easy to implement other directions of movement by adding and subtracting $90°$ from the x angle.

$$z := z \pm moveSpeed * \cos(radian(\theta))$$
$$x := x \mp moveSpeed * \sin(radian(\theta))$$

Figure 10: This equation finds an arbitrary point on a circle's circumference in relation to a specified angle. [3]

Following that formula, it's simple to implement movement to the left, right by adding or subtracting 90°, and backwards movement by adding 180°.

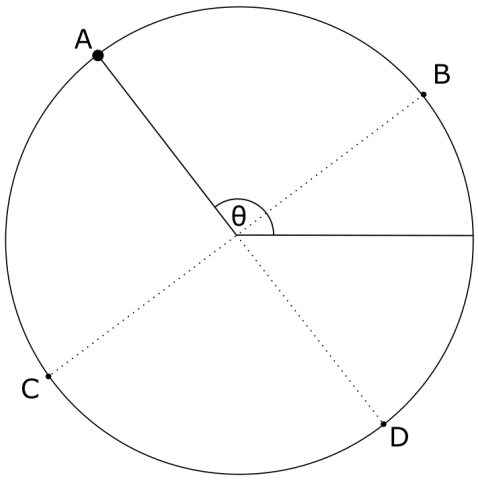

Figure 11: A graphical representation of movement. With the player at the center of the circle and θ = x rotation, point A would represent forward movement, B and C would represent strafing left and right, and point D would represent backwards movement.

3.1.8 Keyboard Controller

The Keyboard class primarily serves to encapsulate the OpenGL callbacks that receive keystrokes: the normal function that accepts all alphanumeric and punctuation keys, and the special function that handles function keys and arrows. The keyboard function acts differently depending on what mode the player is currently in.

Under normal circumstances, the only normal keystrokes accepted are the WASD keys for movement, the E key for interaction, the '~' key for toggling the development console, and the escape key which will return the player to the main menu.

When in either a terminal or the development console, all keys are immediately concatenated to an input string with the exception of the '~' which will close the development console, or the enter key which will send the input string to it's appropriate destination to be parsed and interpreted, after which the input string is cleared so that a new command can be entered.

Also accepted are the up and down arrow keys, which will cycle through the console/terminals command history.

When the user is in the main menu, no keyboard keys are accepted other than F2, which will close the game under any circumstances.

3.1.9 Music Controller

To play background music, I created a class that uses the FMOD Low Level API that knows the directory that all sound files are stored and will play a designated one on infinite repeat until the prompted to change songs.

Each song in game is mapped to an integer. On each level change, the song number is incremented and a boolean flag is tripped, which signals the music controller to play the next song. Each song is dynamically allocated, so it is important to properly deallocate the songs before the next one is played. Considerations on how to change the Music Controller are noted in section 4.2.2.

3.1.10 Text Controller

The Text Engine handles displaying all text to the screen, from prompts on the HUD to each Terminal screen. It uses OpenGL's glutBitmapCharacter function to display clear, concise text.

Every function to display text takes the xy coordinates for where on the screen to start printing, and the RGB color values for the text. There are two functions for displaying text, the simpler one merely takes in a string and prints it on the corresponding location on the screen. The more complex function takes in a file and a content tag which needs to be parsed. The text files are similar to terminal files as seen in Figure 12.

```
1 $TAG 1$
2 Content 1
3 $END$
4
5 $Tag 2$
6 Content 2
7 $END$
```

Figure 12: An example text file, very similar to a terminal file

The Text Engine searches through the designated file line by line until it discovers the line containing the proper tag. Then, until it reaches the closing 'END' tag, it stores every line inside of a vector. Once it has retrieved all of the necessary content, it will print the vector line by line.

3.1.11 Collision Engine

A *collision* occurs when two or more objects in game attempt to occupy the space. The collision engine handles detecting and preventing any collision between the player and all objects in the level. In this engine there are two types of collisions: player-object collisions and player-wall collisions.

Player object collisions are simple to detect, as both the player and the object can be placed within imaginary "bounding spheres" that extend around the player and object, the collision can be detected easily using the distance formula and the radii of the spheres as seen in Figure 13.

$$\sqrt{(x_2 - x_1) + (y_2 - y_1) + (z_2 - z_1)} < r_2 + r_1$$

Figure 13: If the distance between the sphere is shorter than the combined radii of the spheres, a collision has occurred.

Player-wall collisions were much harder to reconcile. Because walls tend to be long and thin, you can't simply place one within a bounding sphere, the resulting sphere would simply be too massive and usually encompass the player entirely.

To rectify that, the collision is split into two phases. In the first phase, we use the plane equation that is derived in the section 3.1.1. Using the equation from Figure 14. If the resulting value is less than the radius of the player's bounding sphere, the player is close enough to collide with that plane. However, a plane is an infinite length, and relying solely on this method would induce false collisions if the player was close to the wall but beyond it.

$$\frac{ax+by+cz+d}{\sqrt{a^2+b^2+c^2}} < r$$

Figure 14: By substituting the player's xyz coordinates and dividing by the norm of the plane, we can determine the distance to the plane.

For the second phase, each wall is aligned on an axis: x, y, or z. For the axis that it is aligned on, largest and smallest values of the coordinates are compared to the player's coordinates. palyer's corresponding coordinate is in between the two values, the player has hit the wall. Otherwise, they hit the plane but not the wall, and they do not collide.

3.1.12 2D

As the player's HUD, the main menu, the developer console, and terminals all need to display in a 2D environment, I extracted the ability to draw in 2D into is own class that is inherited by them in order to reduce reused code.

To convert OpenGL into 2D frame, lighting and depth masking must be disabled. Next an *orthogonal* matrix is pushed onto OpenGL's matrix stack using the length and width of the screen so that all matrix transformations corresponded to a pixel on the screen. Re-enabeling 3D is as simple as popping the orthogonal matrix from the stack and re-enabling depth testing and masking.

3.1.13 Game Saving and Loading

Game saving and loading is a simple file transaction. To save, the current level (as a string) and the song that is playing are appended to each other. The string is then encrypted and written to the save file.

Loading is a two step process. First the contents of the save file are read, decrypted, and parsed into the saved level and the saved song. Next the contents are verified so that they are valid levels to load and songs to play. If either one is invalid, the save file is considered corrupted and the game will refuse to complete the load.

3.1.14 Heads up Display

The *Heads Up Display* (HUD) is a 2D interface that overlays the screen. I provides both a bit of decoration for the player by drawing the boundaries of the player's helmet, but it also has a functional purpose. It can display prompts to the user, such as when an interactible object is within range of the player, as well as providing in introductory fade in from black with the player initially loads the level.

3.1.15 Console and Logging

To aid in debugging a created a Developer Console and a game log. The developer console accepts user commands to perform actions such as writing to the save file, reading the save file, disabling collision, and changing what song is playing.

The logger writes to a log file as the game runs to report on the status of operations, primarily the loading of each level. If an error occurs and the game aborts (without crashing), the appropriate error and

error code is written at the end of the log file. There is only ever one log file, which is erased when the game is launched and new data is appended to it as the game runs.

3.2 The Game

The game itself was also developed over a period of two years, starting fall of 2015 and ending in spring of 2017. The game itself consists of the SQLite database containing the game objects, as well as all text, terminal, image, and sound files that the game engine uses. The game is relatively short, an average play through would take 15-20 minutes, although it can easily be speed-ran in approximately five minutes.

3.2.1 Game Data

By generalizing the game engine itself away from the game data, the game engine can support and run any game that exists within the database and resource files, the game that I developed exists as a proof of concept that the engine does actually function. The particular game that I developed consists of:

- 162 Walls
- 24 Doors
- 33 Switches
- 14 Triggers
- 18 Terminals
- 17 Cylinders

3.2.2 Setting

The game takes place in the year 300x. Humanity has united under British rule, and the New British Empire has turned its eyes to colonizing the stars. The player is Special Constable Rikker, an elite agent of the Empire who has been called to scout out one of the Crown's top secret research facilities, The Daedalus, that has stopped communicating in preparation for a full investigative team that will follow behind them.

3.2.3 Level Zero

Level zero is an introductory tutorial level where the player can get a grasp with the controls. It takes place on the Constable's personal shuttle, and there is a terminal that gives access to the prior information.

3.2.4 Level One

In level one, the player explores one hanger of the ship. There they can read logs detailing power outages and mechanical fluctuations, as well as security and intake reports detailing a few objects that the ship has taken on. The last report details them taking on the titular God Core.

3.2.5 Level Two

The next level takes place in offices, where the Constable learns more about the Daedalus. It exists to house strange, unexplainable, and possibly deadly objects that are too dangerous or unknown to be left alone. Ever since taking on the God Core, crew have been slowly disappearing and communications equipment have started to fail. It comes to light that the God Core warps reality itself, and no one can determine if the missing crew has been transported elsewhere, or if they have simple disappeared from reality.

3.2.6 Level Three

Level three takes place in a gallery housing access to eight different objects. Although the Constable can only access the exhibit containing the God Core, the Constable can read information about the abilities and containment procedures for various objects.

3.2.7 Level Four

The final level takes place in the God Core's exhibit. The player can only stare at the God Core as reality starts to deform around them, before they vanish into the unknown, ending the game.

4 Challenges and Future Work

4.1 Challenges that I Faced

Development was not always smooth, and I encountered a few interesting problems along the way.

4.1.1 The Death of a Computer

Over the course of my project, I changed computers twice. My laptop died, and I switched to a more powerful desktop in fall 2015, and in spring 2016 my operating system was corrupted and I had to perform a fresh reinstall. Both times I was able to get back up to speed in only a few hours thanks to GitHub, losing only a few hours of progress at most. Frequent commits and syncing is a solid defense against any disaster on the developers end.

4.1.2 Clipping Issues

There is a problem when getting to close to a wall or a door where the player can see through parts of the wall, no doubt to do OpenGL's depth buffering in relation to distance to the wall. Part of the development processes involved balancing collision distance to the walls, at distances where the user could not see through walls the user was a noticeable distance from the wall, so I chose to allow the user to get close enough to slightly peer through the wall, as the distance felt more natural.

4.1.3 APIs and Naming

C++ uses unique identifiers. This means that no class, variable, or function can share the same name. Initially the Plane class was named Rectangle, as it more clearly showed that it was a wrapper for the OpenGL rectangle primitive, but when I included the Windows API I discovered that it had its own function named Rectangle, rendering my program uncompilable until I renamed every instance of my class.

4.2 Future Work

Of course, time itself was a constraining factor; I only had two years to develop the project. As such every design choice that I made bore this limit in mind, and there portions of the engine that I was unable to optimize or implement due to lack of development time. Rarely is a project ever done, and there are always changes and improvements that could be made.

4.2.1 Triggers and Switches

Given time, I would have liked to implement the back end of a switch's interaction into triggers.The primary difference between triggers and switches is that a trigger is a one time activation, whereas a switch is a potentially many time toggle, but it would be a simple matter to add in different trigger types.

4.2.2 Engine and Data Separation

A true game engine is fully separate from the game it runs on, however I had a few roadblocks preventing me from completely separating the two of them.

The music files and maximum song number is hard coded into the engine, as are the maximum number of levels in the game. Music and levels could easily be given their own table in the database after reworking the code that directly deals with them, but the major hurdle that led me to hard coding levels is the lack of animation. I was unable to encapsulate animation in a database, which leads to parts of the fourth level's rendering to be hard coded into the game.

5 Acknowledgments

I would like to offer thanks to the following people:

- Kevin MacLeod, Devin Powers, and Arseniy Shkljaev for the music
- Cody Robertson for bouncing ideas off of
- Brian Affolter and Lauren Ball for helping test

6 References

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[2] Maplesoft, "Equation of a plane - 3 points."

[3] R. D. III, "Personal Interview."

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[8] D. R. Hipp, "An Introduction To The SQLite C/C++ Interface." https://www.sqlite.org/cintro.html.

7 Appendices

7.1 Source Code

7.1.1 main.cpp

```
1  /*************************************************************\
2   * main.cpp                                                  *
3   * This file was created by Jeremy Greenburg                 *
4   * As part of The God Core game for the University of        *
5   * Tennessee at Martin's University Scholars Organization    *
6   *                                                           *
7   * This file creates an OpenGL window to display the game    *
8   * and promptly passes control over to the GameManager object*
9  \*************************************************************/
10
11 // Because doth openGL demandeth
12 #include <cstdlib>
13 // OpenGL API
14 #include <GL\glut.h>
15 // time
16 #include <ctime>
17
18 // The Game manger
19 #include "GameManager.h"
20 GameManager Overlord;
21 // Save manager
22 #include "SaveManager.h"
23 // Return codes
24 #include "Return.h"
25 // System log
26 #include "Logger.h"
27 // Global variables
28 #include "Globals.h"
29
30 // Normal key presses
31 void normal(unsigned char key, int x, int y);
32
33 // For key releases
34 void key_up(unsigned char key, int x, int y);
35
36 // For Special keys
37 void special(int key, int x, int y);
38
39 // Mouse clicks
40 void mouse(int button, int state, int x, int y);
41
42 // Mouse movement
43 void motionPassive(int x, int y);
44
45 // Changing Window size (Not exactly working as hoped...
46 void changeSize(int w, int h);
47
48 // Initializes GLUT callbacks and returns true if core.sav exists (false otherwise
       )
49 bool initGame(int argc, char **argv);
```

```
50
51  // Manages the game's scenes
52  void manageScenes();
53
54  GLfloat light_diffuse[] = { 0.3f, 0.3f, 0.3f, 0.3f };
55  GLfloat light_position[] = { 0.0f, 0.0f, 0.0f, 0.0f }; // Currently nonexistant
        until I can figure out how lighting works
56  GLfloat mat_specular[] = { 1.0f, 1.0f, 1.0f, 1.0f };
57  GLfloat mat_shininess[] = { 75 };
58  GLfloat lmodel_ambient[] = { 0.6f, 0.6f, 0.6f, 1.0f };
59
60  using namespace std;
61
62  //****** FUNCTION DEFINITIONS ******\\
63
64  int main(int argc, char **argv)
65  {
66          Overlord.canContinue = initGame(argc, argv);
67
68          // Begin the game
69          glutMainLoop();
70
71          // If we ever get here, something bad happened
72
73          Logger log;
74          log.logLine("ERROR: GlutMainLoop exited early");
75
76          return EXIT_EARLY;
77  }
78
79  bool initGame(int argc, char **argv)
80  {
81          // Obliderate log file
82          Logger log;
83          log.nuke();
84
85          // Initialize GLUT
86          glutInit(&argc, argv);
87
88          // Create window
89          glutInitDisplayMode(GLUT_DOUBLE | GLUT_RGBA);
90          glutInitWindowPosition(50, 50);
91          glutInitWindowSize(500, 500);
92          glutCreateWindow("The God Core");
93
94          // register callbacks
95          glutDisplayFunc(manageScenes);
96          glutReshapeFunc(changeSize);
97          glutIdleFunc(manageScenes);
98          glutPassiveMotionFunc(motionPassive);
99          glutMouseFunc(mouse);
100         glutKeyboardFunc(normal);
101         glutKeyboardUpFunc(key_up);
102         glutSpecialFunc(special);
103
104         // Prebuilt function that works transparency
```

```
105         glBlendFunc(GL_SRC_ALPHA, GL_ONE_MINUS_SRC_ALPHA);
106
107         // Enable transparency
108         glEnable(GL_BLEND);
109         // Enable depth buffer
110         glEnable(GL_DEPTH_TEST);
111         // Let there be light!
112         glEnable(GL_LIGHTING);
113         // First light source
114         glEnable(GL_LIGHT0);
115
116         // Light properties
117         glMaterialfv(GL_FRONT, GL_SPECULAR, mat_specular);
118         glMaterialfv(GL_FRONT, GL_SHININESS, mat_shininess);
119         glColorMaterial(GL_FRONT_AND_BACK, GL_AMBIENT_AND_DIFFUSE);
120
121         // Light doesnt turn everything grey
122         glEnable(GL_COLOR_MATERIAL);
123
124         glLightfv(GL_LIGHT0, GL_DIFFUSE, light_diffuse);
125         glLightfv(GL_LIGHT0, GL_POSITION, light_position);
126         glLightModelfv(GL_LIGHT_MODEL_AMBIENT, lmodel_ambient);
127
128         glutWarpPointer(300, 300);
129
130         // Start in Fullscreen
131         glutFullScreen();
132
133         srand(time(NULL));
134
135         HUD.setStatus("INFO-WELL");
136
137         SaveManager SaveSystem;
138         return SaveSystem.checkSave();
139 }
140
141 // Everything below here is just passed along to the overlord
142
143 void mouse(int button, int state, int x, int y)
144 {
145         Overlord.mouse(button, state, x, y);
146 }
147
148 void motionPassive(int x, int y)
149 {
150         Overlord.motionPassive(x, y);
151 }
152
153 void changeSize(int w, int h)
154 {
155         Overlord.changeSize(w, h);
156 }
157
158 void manageScenes()
159 {
160         Overlord.manageScenes();
```

```
161 }
162
163 void normal(unsigned char key, int x, int y)
164 {
165         Overlord.normal(key, x, y);
166 }
167
168 void key_up(unsigned char key, int x, int y)
169 {
170         Overlord.key_up(key, x, y);
171 }
172
173 void special(int key, int x, int y)
174 {
175         Overlord.special(key, x, y);
176 }
```

7.1.2 CameraControl.h

```
 1 /************************************************************\
 2  * CameraControl.h                                          *
 3  * This file was created by Jeremy Greenburg                *
 4  * As part of The God Core game for the University of       *
 5  * Tennessee at Martin's University Scholars Organization   *
 6  *                                                          *
 7  * This file contains the declaration of the CameraControl  *
 8  * Class, which stores:                                     *
 9  *      The x, y, z ordered triple of the player's location *
10  *      The degree to which the player is turned, along     *
11  *           the x, y, and z axes                           *
12  * And contains methods to translate the player along       *
13  * 3D space                                                 *
14 \************************************************************/
15
16 #ifndef CAMERA_CONTROL_H
17 #define CAMERA_CONTROL_H
18
19 class CameraControl
20 {
21 private:
22         // Speeds for moving and rotating
23         double moveSpeed = 0.1f, turnSpeed = 0.5f;
24
25 public:
26         // Negatively adjusts angle and modifies lx
27         void lookLeft();
28         // Positively adjusts angle and modifies lx
29         void lookRight();
30         // Positively adjusts angle and modifies ly
31         void lookUp();
32         // Negatively adjusts angle and modifies ly
33         void lookDown();
34         // Translate the camera to the left
35         void strafeLeft();
36         // Translates the to the right
37         void strafeRight();
38         // Translates the camera forwards
```

```
39          void moveForward(int mod);
40          // Translate the camera backards
41          void moveBackward(int mod);
42          // Moves the camera positively along the Y axis
43          void moveUp();
44          // Moves the camera negatively along the Z axis
45          void moveDown();
46          // Flips the camera
47          void invertCam();
48          // If the player begins to run
49          void increaseSpeed();
50          // If the player begins to walk
51          void decreaseSpeed();
52          // Resets the camera to it's initial state
53          void resetCam();
54          // calls gluLookAt
55          void Display();
56
57          // Location of the camera
58          double x =0.0, y = 0.0, z = -1.0;
59          double prevx, prevz;
60          // Angles of rotation
61          double x_angle = 0.0, y_angle = 0.0, z_angle = -1.0;
62  };
63
64  #endif
```

7.1.3 CameraControl.cpp

```
1   /*************************************************************\
2    * CameraControl.cpp                                         *
3    * This file was created by Jeremy Greenburg                 *
4    * As part of The God Core game for the University of        *
5    * Tennessee at Martin's University Scholars Organization    *
6    *                                                           *
7    * This file contains the definition of the CameraControl    *
8    * Class. For more information, see CameraControl.h          *
9   \*************************************************************/
10
11  // Class definition
12  #include "CameraControl.h"
13
14  // For sin()
15  #include <cmath>
16
17  // glut is unhappy when cstdlib isn't here :/
18  #include <cstdlib>
19
20  // OpenGL API
21  #include <GL\glut.h>
22
23  // To display Suit Warnings
24  #include "TextEngine.h"
25
26  // To include Globals Variables
27  #include "Globals.h"
28
```

```
29 // For converting degrees to radians
30 const double PI = 3.14159;
31
32 // Takes in an angle, in degrees, and returns the angle in radians
33 double toRadian(double angle)
34 {
35         return angle * PI / 180;
36 }
37
38 void CameraControl::lookLeft()
39 {
40         x_angle -= 3 * turnSpeed;
41
42         // To avoid potential underflow errors
43         if (x_angle < 0)
44         {
45                 x_angle += 360;
46         }
47 }
48 void CameraControl::lookRight()
49 {
50         x_angle += 3 * turnSpeed;
51
52         // To avoid potential overflow errors
53         if (x_angle > 360)
54         {
55                 x_angle -= 360;
56         }
57 }
58
59 void CameraControl::lookUp()
60 {
61         y_angle -= 2 * turnSpeed;
62
63         // To avoid potential underflow errors
64         if (y_angle < 0)
65         {
66                 y_angle += 360;
67         }
68 }
69
70 void CameraControl::lookDown()
71 {
72         y_angle += 2 * turnSpeed;
73
74         // To avoid potential overflow errors
75         if (y_angle > 360)
76         {
77                 y_angle -= 360;
78         }
79 }
80
81 void CameraControl::strafeLeft()
82 {
83         prevz = z;
84         prevx = x;
```

```
85          // Angles + 90 degrees for an angle that is perpendicular to x_angle
86          z = z + moveSpeed * cos(toRadian(x_angle + 90));
87          x = x - moveSpeed * sin(toRadian(x_angle + 90));
88  }
89
90  void CameraControl::strafeRight()
91  {
92          prevz = z;
93          prevx = x;
94          // Angles - 90 degrees for an angle that is perpendicular to x_angle
95          z = z + moveSpeed * cos(toRadian(x_angle - 90));
96          x = x - moveSpeed * sin(toRadian(x_angle - 90));
97  }
98
99  void CameraControl::moveForward(int mod)
100 {
101         prevz = z;
102         prevx = x;
103         z = z + moveSpeed * mod * cos(toRadian(x_angle));
104         x = x - moveSpeed * mod * sin(toRadian(x_angle));
105 }
106
107 void CameraControl::moveBackward(int mod)
108 {
109         prevz = z;
110         prevx = x;
111         z = z - moveSpeed * mod * cos(toRadian(x_angle));
112         x = x + moveSpeed * mod * sin(toRadian(x_angle));
113 }
114
115 void CameraControl::moveUp()
116 {
117         y -= moveSpeed;
118 }
119
120 void CameraControl::moveDown()
121 {
122         y += moveSpeed;
123 }
124
125 void CameraControl::invertCam()
126 {
127         z_angle += 180;
128 }
129
130 void CameraControl::resetCam()
131 {
132         x = 0.0;
133         y = 0.0;
134         z = -1.0;
135         x_angle = 0.0;
136         y_angle = 0.0;
137         z_angle = 0.0;
138
139 }
140
```

```
141 void CameraControl::increaseSpeed()
142 {
143         moveSpeed *= 2;
144 }
145
146 void CameraControl::decreaseSpeed()
147 {
148         moveSpeed /= 2;
149 }
150
151 void CameraControl::Display()
152 {
153         // To stop eternal movement
154         glLoadIdentity();
155
156         // Rotate along proper axes
157         glRotatef(y_angle, 1, 0, 0);
158         glRotatef(x_angle, 0, 1, 0);
159         glRotatef(z_angle, 0, 0, 1);
160
161         // Translate along the Plane
162         glTranslatef(x, y, z);
163 }
```

7.1.4 CollisionEngine.h

```
1  /************************************************************\
2   * CollisionEngine.h                                        *
3   * This file was created by Jeremy Greenburg                *
4   * As part of The God Core game for the University of       *
5   * Tennessee at Martin's University Scholars Organization   *
6   *                                                          *
7   * This file creates the decleration of the CollisionEngine *
8   * class, which uses sweet sweet math to determine how the  *
9   * player interacts with his environment                    *
10 \************************************************************/
11
12 #ifndef COLLISION_ENGINE_H
13 #define COLLISION_ENGINE_H
14
15 class CollisionEngine
16 {
17 private:
18         // Determines if wall/door collision occured
19         bool collideWalls();
20         // Determines if other collision occured
21         bool collideObjects();
22         // Determines if an object can be interacted with
23         void checkInteract();
24 public:
25         // Master function that calls others
26         bool collide();
27
28 };
29
30 #endif
```

7.1.5 CollisionEngine.cpp

```
1  /*************************************************************\
2   * CollisionEngine.h                                         *
3   * This file was created by Jeremy Greenburg                 *
4   * As part of The God Core game for the University of        *
5   * Tennessee at Martin's University Scholars Organization    *
6   *                                                           *
7   * This file contains the definition of the CollisionEngine  *
8   * class. For more information, see SaveManager.h            *
9  \*************************************************************/
10
11 #include "CollisionEngine.h"
12
13 // For the Cam
14 #include "Globals.h"
15 // absolute value
16 #include <cmath>
17
18 // System Log
19 #include "Logger.h"
20
21 using namespace std;
22
23 const double PLAYER_RADIUS = 0.5;
24 const double INTERACT_RADIUS = 1; // Object interactivity radius
25 const double COLLIDE_RADIUS = 0.5;
26
27 void CollisionEngine::checkInteract()
28 {
29         activeSwitch = NULL;
30         activeTerminal = NULL;
31         // Auto don't work in these parts
32         for (unsigned int i = 0; i < switches.size(); i++)
33         {
34                 double distance = pow((switches[i].getX() + Cam.x), 2) + pow((
                        switches[i].getY() + Cam.y), 2) + pow((switches[i].getZ() + Cam
                        .z), 2);
35                 distance = sqrt(distance);
36                 double radii = (PLAYER_RADIUS + INTERACT_RADIUS);
37
38                 if (distance < radii && switches[i].checkIfOn())
39                 {
40                         interactivity = true;
41                         activeSwitch = &switches[i];
42                         return;
43                 }
44         }
45
46         for (unsigned int i = 0; i < terminals.size(); i++)
47         {
48                 double distance = pow((terminals[i].getX() + Cam.x), 2) + pow((
                        terminals[i].getY() + Cam.y), 2) + pow((terminals[i].getZ() +
                        Cam.z), 2);
49                 distance = sqrt(distance);
50                 double radii = (PLAYER_RADIUS + INTERACT_RADIUS);
```

```
51
52                  if (distance < radii && terminals[i].checkIfOn())
53                  {
54                          interactivity = true;
55                          activeTerminal = &terminals[i];
56                          return;
57                  }
58          }
59
60          interactivity = false;
61  }
62
63  bool CollisionEngine::collideObjects()
64  {
65          for (unsigned int i = 0; i < terminals.size(); i++)
66          {
67                  double distance = pow((terminals[i].getX() + Cam.x), 2) + pow((
                        terminals[i].getY() + Cam.y), 2) + pow((terminals[i].getZ() +
                        Cam.z), 2);
68                  distance = sqrt(distance);
69                  double radii = (PLAYER_RADIUS + COLLIDE_RADIUS);
70
71                  if (distance < radii && terminals[i].checkIfOn())
72                  {
73                          return true;
74                  }
75          }
76
77          return false;
78  }
79
80  bool CollisionEngine::collideWalls()
81  {
82          // Gotta check doors first
83          // And if you hit an open door
84          // You just ignore collision
85          // Because otherwise you can't fit
86          for (auto i : doors)
87          {
88                  double distance = fabs(Cam.x * i.a + Cam.y * i.b + Cam.z * i.c + i
                        .d); // Distance from door
89
90                  if ((distance / i.getNorm() < PLAYER_RADIUS) && i.isInBounds())
91                  {
92                          if (i.isOpen) return false;
93                          else return true;
94                  }
95          }
96
97          for (auto i : walls)
98          {
99                  double distance = fabs(Cam.x * i.a + Cam.y * i.b + Cam.z * i.c + i
                        .d); // Distance from wall
100
101                 if ((distance / i.getNorm() < PLAYER_RADIUS) && i.isInBounds())
                        return true;
```

```
102         }
103
104         return false;
105 }
106
107 bool CollisionEngine::collide()
108 {
109         if (!collision)
110         {
111                 return false;
112         }
113
114         checkInteract();
115         return (collideWalls() || collideObjects());
116 }
```

7.1.6 Console.h

```
 1 /************************************************************\
 2  * Connsole.h                                               *
 3  * This file was created by Jeremy Greenburg                *
 4  * As part of The God Core game for the University of       *
 5  * Tennessee at Martin's University Scholars Organization   *
 6  *                                                          *
 7  * This file contains the declaration of the Console Class, *
 8  * As well as the Trip struct for holding three integers    *
 9  * The Developer Console takes input from the user and      *
10  * Activates various effects based upon what the user has   *
11  * Typed in.                                                *
12 \************************************************************/
13
14 #ifndef CONSOLE_H
15 #define CONSOLE_H
16
17 // To act as a circular buffer for console history
18 #include <deque>
19 // Stores actual console input
20 #include <vector>
21 // std::string
22 #include <string>
23 // For processing text
24 #include "TextEngine.h"
25
26 // Windows API
27 #include <shlobj.h>
28
29
30 // To make rgb calues easier to store
31 #include "Triple.h"
32
33 class Console
34 {
35 private:
36         /***** Variables for the console itself ****/
37
38         // Triples for good color, bad color, and nuetral colors
39         Triple VALID_COLOR, INVALID_COLOR, NEUTRAL_COLOR;
```

```
40          // What the console "says" (aka what appears on screen)
41          std::deque<std::string> console_log;
42          // The colors of said strings
43          std::deque<Triple> console_color;
44          // Contains the actual player input
45          std::vector<std::string> console_input;
46          // The current (finished) input being processed
47          std::string currentInput;
48          // The current (unfinished) input being type
49          std::string currentText;
50          // Console History
51          TextEngine log;
52
53          // Path to core.sav
54          char CHAR_PATH[MAX_PATH];
55          std::string SAVE_PATH;
56
57          // Is the console active or not
58          bool isActive;
59
60          // The bottom of the console
61          const int SCREENBOTTOM = 500;
62
63          // Prints the current input and console_history
64          void printInput();
65          // Processes completed input
66          void processInput();
67
68          // Command functions
69
70          // Toggles collision on and off
71          void toggleCollision();
72
73          // Toggles godMode on and off
74          void toggleGod();
75
76          // Decrpyts the entry in core.sav
77          void decrpytSave();
78
79          // Shutdowns program
80          void halt();
81
82          // Clears the console log
83          void clear();
84
85          // Writes input to core.sav
86          void writeToSave(std::string input);
87
88          // Reads a bit from the file
89          void readFromFile(std::string input);
90
91          // Changes the currently played track
92          void playSong(std::string input);
93
94  public:
95          // Initializes VALID_COLOR, INVALID_COLOR, NEUTRAL_COLOR, and SAVE_PATH
```

```
96          Console();
97          // Manages console functions if input has been provided
98          void activate(std::string input, std::string text);
99          // Manages console function if input is still being provided
100         void activate(std::string text);
101         // Returns the console_input[count]
102         std::string getHist(int count);
103         // Returns console_input.size()
104         int getHistNum();
105
106 };
107
108 #endif
```

7.1.7 Console.cpp

```
1  /************************************************************\
2   * Console.cpp                                              *
3   * This file was created by Jeremy Greenburg                *
4   * As part of The God Core game for the University of       *
5   * Tennessee at Martin's University Scholars Organization   *
6   *                                                          *
7   * This file contains the definition of the Console class   *
8   * For more information, see Console.cpp                    *
9   \************************************************************/
10
11  // File I/O
12  #include <fstream>
13
14  // Class declaration
15  #include "Console.h"
16
17  // For saving and loading
18  #include "SaveManager.h"
19
20  // System log
21  #include "Logger.h"
22
23  // Contains global environment variables
24  #include "Globals.h"
25
26  // Return codes
27  #include "Return.h"
28
29  using namespace std;
30
31  Console::Console()
32  {
33          // Green!
34          VALID_COLOR = makeTrip(0, 1, 0);
35          // Red!
36          INVALID_COLOR = makeTrip(1, 0, 0);
37          // Gray!
38          NEUTRAL_COLOR = makeTrip(1, 1, 1);
39
40          // Get path to documents
```

```
41          HRESULT ret = SHGetFolderPath(NULL, CSIDL_PERSONAL, NULL,
                SHGFP_TYPE_CURRENT, CHAR_PATH);
42          // Assign to SAVE_PATH
43          SAVE_PATH = CHAR_PATH;
44          // Concatenate save file
45          SAVE_PATH += "\\The God Core\\core.sav";
46  }
47
48  void Console::activate(string input, string text)
49  {
50          currentInput = input;
51          // This should be empty. But just incase.
52          currentText = text;
53
54          processInput();
55          printInput();
56  }
57
58  void Console::activate(string text)
59  {
60          currentText = text;
61
62          printInput();
63  }
64
65  void Console::printInput()
66  {
67          deque<string>::iterator it = console_log.begin();
68          deque<Triple>::iterator jt = console_color.begin();
69          // Iterates through the console's current log and prints it to the screen
70          for (it; it != console_log.end(); it++, jt++)
71          {
72                  //                                          Index of it
73                  log.printString(0, 10 + 20 * (it - console_log.begin()),
74                          jt->a, jt->b, jt->c, *it);
75          }
76
77          // Prints whatever the user is typing
78          log.printString(0, SCREENBOTTOM / 2.4, 1, 1, 1, currentText);
79  }
80
81  void Console::processInput()
82  {
83          // TODO: Break this behemoth up into little, managable functions
84
85          if (currentInput == "TogClip")
86                  toggleCollision();
87
88          else if (currentInput == "TogGod")
89                  toggleGod();
90
91          else if (currentInput.substr(0, 5) == "Save ")
92                  writeToSave(currentInput.substr(5)); // Save everything after "
                        Save "
93
94          else if (currentInput == "Decrypt")
```

```
95                  decrpytSave();
96
97          else if (currentInput.substr(0, 5) == "Read ")
98                  readFromFile(currentInput.substr(5)); // Read everything after "
                        Read "
99
100         else if (currentInput == "Halt")
101                 halt();
102
103         else if (currentInput == "Clear")
104                 clear();
105
106         else if (currentInput.substr(0, 5) == "Play ")
107                 playSong(currentInput.substr(5)); // Process everything after "
                        Play "
108
109         else if (currentInput == "Goto Main")
110         {
111                 isInMain = true;
112                 isInConsole = false;
113                 HUD.toggleConsole();
114         }
115
116         // Invalid command
117         else
118         {
119                 console_log.push_back("ERROR: Do not recognize \"" + currentInput
                        + '\"');
120                 console_color.push_back(INVALID_COLOR);
121         }
122
123         // Clears the top of the console if too much history is added
124         if (console_log.size() > 9)
125         {
126                 console_log.pop_front();
127                 console_color.pop_front();
128         }
129
130         // Store the current input
131         console_input.push_back(currentInput);
132 }
133
134 void Console::writeToSave(string input)
135 {
136         // Writes whatever is in input to the save file.
137         // Probably not going to be good for loading purposes
138
139         SaveManager Jesus;
140
141         Jesus.saveLevel();
142
143         console_log.push_back("Saved: " + input);
144         console_color.push_back(VALID_COLOR);
145 }
146
147 void Console::readFromFile(string input)
```

```
148 {
149         // Syntax = Read core.sav
150         if (input == "core.sav")
151         {
152                 ifstream infile(SAVE_PATH);
153 
154                 string text;
155 
156                 // For now, core.sav only has one line. Hopefully I'll update this
                        when I change that
157                 infile >> text;
158 
159                 console_log.push_back(text);
160                 console_color.push_back(VALID_COLOR);
161         }
162 
163         // Syntax = Read TAG FILE
164         else
165         {
166                 // There should be a space seperating the file and the tag. We
                        find that space
167                 size_t pos = input.find(' ');
168 
169                 // If there ain't no space
170                 if (pos == string::npos)
171                 {
172                         console_log.push_back("ERROR: No tag detected");
173                         console_color.push_back(INVALID_COLOR);
174                 }
175 
176                 // Hooray! There's a space
177                 else
178                 {
179                         string tag = input.substr(0, pos);
180                         string file = input.substr(pos + 1); // +1 to avoid the
                                space
181 
182                         const char* TEXT_PATH = "Resources\\Text\\";
183                         string fullPath = TEXT_PATH + file;
184 
185                         // Simply to test for the file's existence
186                         ifstream infile(fullPath);
187 
188                         string text;
189                         getline(infile, text);
190 
191                         // If there ain't no file
192                         if (!infile)
193                         {
194                                 console_log.push_back("ERROR: File \"" + file +
                                        "\" not found");
195                                 console_color.push_back(INVALID_COLOR);
196                         }
197 
198                         // Hooray! There's a file
199                         else
```

```
200                         {
201                                 console_log.push_back("Reading \"" + file + "\"
                                        with tag \"" + tag + '\"');
202                                 console_color.push_back(VALID_COLOR);
203
204                                 vector<string> readText = log.getText(file, tag);
205
206                                 vector<string>::iterator it;
207
208                                 for (it = readText.begin(); it != readText.end();
                                        it++)
209                                 {
210                                         // Push everything we found into the log
211                                         console_log.push_back(*it);
212                                         console_color.push_back(NEUTRAL_COLOR);
213
214                                         // So we don't grow too much, keep bounds
                                            checking
215                                         if (console_log.size() > 9)
216                                         {
217                                                 console_log.pop_front();
218                                                 console_color.pop_front();
219                                         }
220                                 }
221                         }
222
223                         infile.close();
224                 }
225         }
226 }
227
228 void Console::toggleCollision()
229 {
230         console_log.push_back("Noclip toggled.");
231         console_color.push_back(VALID_COLOR);
232
233         collision = !collision;
234 }
235
236 void Console::toggleGod()
237 {
238         console_log.push_back("God Mode toggled.");
239         console_color.push_back(VALID_COLOR);
240
241         godMode = !godMode;
242 }
243
244 void Console::decrpytSave()
245 {
246         SaveManager Jesus;
247
248         console_log.push_back(Jesus.readSave());
249         console_color.push_back(VALID_COLOR);
250 }
251
252 void Console::halt()
```

```
253 {
254         Logger log;
255         log.logLine("Exiting via console");
256         exit(EXIT_OK);
257 }
258
259 void Console::clear()
260 {
261         console_log.clear();
262         console_color.clear();
263         console_input.clear();
264 }
265
266 void Console::playSong(string input)
267 {
268         int sNum = getSongNum(input);
269
270         if (sNum == -1) // Invalid input
271         {
272                 console_log.push_back("ERROR: " + input + " not a valid song file
                        ");
273                 console_color.push_back(INVALID_COLOR);
274         }
275
276         else // Valid input
277         {
278                 songNum = sNum;
279                 changeSong = true;
280                 string song = getSongName(sNum);
281                 console_log.push_back("Now playing " + song);
282                 console_color.push_back(VALID_COLOR);
283         }
284 }
285
286 string Console::getHist(int count)
287 {
288         int size = console_input.size();
289         if (console_input.empty())
290         {
291                 return "";
292         }
293
294         // If, somehow, a fool manages to get a variable that is out of bounds
295
296         else if (count >= size)
297         {
298                 return console_input.back();
299         }
300
301         else if (count < 0)
302         {
303                 return console_input.front();
304         }
305
306         else
307         {
```

```
308                 return console_input[size - count - 1];
309         }
310 }
311
312 int Console::getHistNum()
313 {
314         return console_input.size();
315 }
```

7.1.8 Cylinder.h

```
1  /************************************************************\
2   * Cylinder.h                                               *
3   * This file was created by Jeremy Greenburg                *
4   * As part of The God Core game for the University of       *
5   * Tennessee at Martin's University Scholars Organization   *
6   *                                                          *
7   * This file contains the declaration of the Cylinder Class, *
8   * Which contains the functionality to load and display a   *
9   * Cylindrical object in game                               *
10 \************************************************************/
11
12 #ifndef CYLINDER_H
13 #define CYLINDER_H
14
15 #include <cstdlib>
16
17 #include <GL\glut.h>
18
19 class Cylinder
20 {
21 private:
22         // A few variables to control the shape of the cylinder
23         double baseRadius, topRadius, height;
24         int stacks, slices;
25
26         // Arrays for the location, orientation, and color of the cylinder
27         double translate[3], rotate[3], color[4];
28         // A thingamajig for glut
29         GLUquadric *quad;
30 public:
31         Cylinder(double _baseRadius, double _topRadius, double _height, int
              _stacks, int _slices,
32                 const double(&_translate)[3], const double(&_rotate)[3], const
                    double (&_color)[4]);
33
34         void Display();
35         ~Cylinder();
36 };
37
38 #endif
```

7.1.9 Cylinder.cpp

```
1  /************************************************************\
2   * Cylinder.cpp                                             *
3   * This file was created by Jeremy Greenburg                *
```

```
 * As part of The God Core game for the University of        *
 * Tennessee at Martin's University Scholars Organization    *
 *                                                           *
 * This file contains the defintion of the Cylinder class.   *
 * for more information, see Cylinder.h                      *
\***********************************************************/

#include "Cylinder.h"

// For copying
#include <iterator>
#include <utility>

using namespace std;

Cylinder::Cylinder(double _baseRadius, double _topRadius, double _height, int
    _stacks, int _slices,
        const double(&_translate)[3], const double(&_rotate)[3], const double(&
            _color)[4])
{
        baseRadius = _baseRadius;
        topRadius = _topRadius;
        height = _height;
        stacks = _stacks;
        slices = _slices;

        copy(begin(_color), end(_color), color);
        copy(begin(_translate), end(_translate), translate);
        copy(begin(_rotate), end(_rotate), rotate);

        quad = gluNewQuadric();
}

Cylinder::~Cylinder()
{
        //gluDeleteQuadric(quad);
}

void Cylinder::Display()
{
        glColor4d(color[0], color[1], color[2], color[3]);

        glPushMatrix();

        glTranslated(translate[0], translate[1], translate[2]);
        glRotated(rotate[0], 1, 0, 0);
        glRotated(rotate[1], 0, 1, 0);
        glRotated(rotate[2], 0, 0, 1);

        gluCylinder(quad, baseRadius, topRadius, height, slices, stacks);

        glPopMatrix();
}
```

7.1.10 Door.h

```
/***********************************************************\
```

```
 * Door.h                                                    *
 * This file was created by Jeremy Greenburg                 *
 * As part of The God Core game for the University of        *
 * Tennessee at Martin's University Scholars Organization    *
 *                                                           *
 * This file contains the declaration of the Door class      *
 * It's mostly a fancy wrapper for a Plane with a bit        *
 * Of added functionality                                    *
\***********************************************************/

#ifndef DOOR_H
#define DOOR_H

// Class decleration
#include "Plane.h"
// std::string
#include <string>

// Figure out a way to bind a controller to the door to activate it.
class Door
{
private:
        // Name, so a switch can find it
        std::string id;
        // The physical door
        Plane rect;
public:
        // Is the door open?
        bool isOpen;
        // Plane's a, b, c, and d.
        // For easier access
        double a, b, c, d;

        // Takes in the initial Plane and name
        Door(Plane _rect, std::string _id);
        // Calls rect.Display()
        void Display();
        // Returns rect.getNorm()
        double getNorm();
        // Returns id
        std::string getID();
        // Returns rect.isInBounds()
        bool isInBounds();
};

#endif
```

7.1.11 Door.cpp

```
/***********************************************************\
 * Door.cpp                                                  *
 * This file was created by Jeremy Greenburg                 *
 * As part of The God Core game for the University of        *
 * Tennessee at Martin's University Scholars Organization    *
 *                                                           *
 * This file contains the defintion of the Door class.       *
 * for more information, see Door.h                          *
```

```
\************************************************************/

// Class declaration
#include "Door.h"

using namespace std;

Door::Door(Plane _rect, std::string _id) : rect(_rect), id(_id)
{
        isOpen = false;
        a = rect.a;
        b = rect.b;
        c = rect.c;
        d = rect.d;
};

void Door::Display()
{
        if (!isOpen) rect.Display();
}

double Door::getNorm()
{
        return rect.getNorm();
}

string Door::getID()
{
        return id;
}

bool Door::isInBounds()
{
        return rect.isInBounds();
}
```

7.1.12 GameManager.h

```
/************************************************************\
 * GameManager.h                                            *
 * This file was created by Jeremy Greenburg                *
 * As part of The God Core game for the University of       *
 * Tennessee at Martin's University Scholars Organization   *
 *                                                          *
 * This file contains the declaration of the GameManger class*
 * Which oversees and manages the flow of the game          *
\************************************************************/

#ifndef GAMEMANAGER_H
#define GAMEMANAGER_H

//****** LIBRARIES AND CLASSES ******\\

// For the keyboard functionality
#include "Keyboard.h"

// glut really wants cstdlib here
```

```
20 #include <cstdlib>
21
22 // For arrays of strings
23 #include <string>
24 #include <vector>
25
26 // OpenGL API
27 #include <GL\glut.h>
28
29 // Standard I/O for debugging
30 #include <iostream>
31
32 // To manage background music
33 #include "MusicManager.h"
34
35 // To manage saving and loading
36 #include "SaveManager.h"
37
38 class GameManager
39 {
40 private:
41         // Variables
42
43         // Objects
44         MusicManager SoundSystem;
45         Keyboard board;
46
47         // Because the main menu is dumb, we have to know when to get a click
48         bool processClick = false;
49
50         // When in the main menu, mouse coords of a click
51         int mouse_x, mouse_y;
52
53         // Functions
54
55 public:
56
57         // Captures mouse clicks
58         void mouse(int button, int state, int x, int y);
59         // Captures mouse motion
60         void motionPassive(int x, int y);
61         // CHanges window size
62         void changeSize(int w, int h);
63         // Manages scene display
64         void manageScenes();
65         // Displaying function
66         void draw();
67         // Function to bring about game end on Level 4
68         void endGame();
69         // Normal key presses
70         void normal(unsigned char key, int x, int y);
71         // Key releases
72         void key_up(unsigned char key, int x, int y);
73         // Special keys
74         void special(int key, int x, int y);
75         // To manage playing and releasing music
```

```
76          void manageMusic();
77
78          // Wether or not core.sav exists
79          bool canContinue;
80
81  };
82
83  #endif
```

7.1.13 GameManager.cpp

```
1   /************************************************************\
2    * GameManager.cpp                                          *
3    * This file was created by Jeremy Greenburg                *
4    * As part of The God Core game for the University of       *
5    * Tennessee at Martin's University Scholars Organization   *
6    *                                                          *
7    * This file contains the defintion of the GameManager class.*
8    * for more information, see GameManager.h                  *
9   \************************************************************/
10
11  // Class declaration
12  #include "GameManager.h"
13  // Globals
14  #include "Globals.h"
15  // Level
16  #include "Level.h"
17  // Main Menu
18  #include "MainMenu.h"
19
20  #include "Logger.h"
21
22  #include "Return.h"
23
24  using namespace std;
25
26  void GameManager::mouse(int button, int state, int x, int y)
27  {
28          if (button == GLUT_RIGHT_BUTTON)
29          {
30                  // Jokes on my I never ended up using the right button
31                  if (state == GLUT_DOWN)
32                  {
33
34                  }
35
36                  else
37                  {
38
39                  }
40          }
41
42          else if (button == GLUT_LEFT_BUTTON)
43          {
44                  if (state == GLUT_DOWN)
45                  {
46                          if (isInMain)
```

```
47                          {
48                                  mouse_x = x;
49                                  mouse_y = y;
50                                  processClick = true;
51                          }
52
53                          Logger log;
54                          vector<string> output = { "X: ", to_string(x), " ", "Y:",
                                to_string(y) };
55                          log.logLine(output);
56                  }
57
58                  else
59                  {
60
61                  }
62          }
63  }
64
65  void GameManager::motionPassive(int x, int y)
66  {
67          static int _x = 0, _y = 0;
68
69          // If nothing else is happening basically
70          if (!isInConsole && !isInTerminal && !isInMain)
71          {
72                  if (x > _x)
73                  {
74                          Cam.lookRight();
75                          _x = x;
76                  }
77
78                  else if (x < _x)
79                  {
80                          Cam.lookLeft();
81                          _x = x;
82                  }
83
84                  if (y < _y)
85                  {
86                          Cam.lookUp();
87                          _y = y;
88                  }
89
90                  else if (y > _y)
91                  {
92                          Cam.lookDown();
93                          _y = y;
94                  }
95
96                  // Loop around to the other side of the screen
97
98                  bool updateMouse = false;
99                  int newY = y, newX = x;
100                 if (y == 0 || y > 700)
101                 {
```

```
102                         updateMouse = true;
103                         newY = 300;
104                         _y = 300;
105                 }
106
107                 if (x == 0 || x > 700)
108                 {
109                         updateMouse = true;
110                         newX = 300;
111                         _x = 300;
112                 }
113
114                 if (updateMouse)
115                 {
116                         glutWarpPointer(newX, newY);
117                 }
118         }
119 }
120
121 void GameManager::changeSize(int w, int h)
122 {
123         // Don't want to divide by zero
124         if (h == 0)
125                 h = 1;
126
127         double ratio = w * 1.0 / h;
128
129         // Use the Projection Matrix
130         glMatrixMode(GL_PROJECTION);
131
132         // Reset Matrix
133         glLoadIdentity();
134
135         // Set the viewport to be the entire window
136         glViewport(0, 0, w, h);
137
138         // Set the correct perspective.
139         gluPerspective(45, ratio, 1, 100);
140
141         // Get Back to the Modelview
142         glMatrixMode(GL_MODELVIEW);
143 }
144
145 void GameManager::draw()
146 {
147         if (loading)
148         {
149                 lvl.loadLevel(curr_level);
150
151                 loading = false;
152
153                 // Save current progress after loading level
154                 SaveManager Jesus; // saves
155                 Jesus.saveLevel();
156         }
157
```

```
158         else
159         {
160                 lvl.displayLevel();
161         }
162 }
163
164 void GameManager::endGame()
165 {
166         if (loading)
167         {
168                 lvl.loadLevel(curr_level);
169
170                 loading = false;
171
172                 // Save current progress after loading level
173                 SaveManager Jesus; // saves
174                 Jesus.saveLevel();
175         }
176
177         else
178         {
179                 // The time left for each segment
180                 static int timeLeft = 1000;
181                 // The last level is divided into 3 segments
182                 static int segment = 1;
183                 // Wether the current segment has been initialized yet
184                 static bool initSegment = true;
185
186                 // The last portion of the game is divided into 3 segments
187                 if (segment == 1)
188                 {
189                         HUD.displayWarning("");
190                         glClearColor(1, 1, 1, 1);
191                 }
192
193                 else if (segment == 2)
194                 {
195                         if (initSegment)
196                         {
197                                 HUD.displayWarning("QUANT");
198                                 initSegment = false;
199                         }
200
201                         for (unsigned i = 0; i < walls.size(); i++)
202                         {
203                                 walls[i].mutate();
204                         }
205                 }
206
207                 else if (segment == 3)
208                 {
209                         if (initSegment)
210                         {
211                                 HUD.goFade(15);
212                                 HUD.setStatus("INFO-UN");
213                                 initSegment = false;
```

```
214                         }
215
216                         for (unsigned i = 0; i < walls.size(); i++)
217                         {
218                                 walls[i].mutate();
219                         }
220                 }
221
222                 else
223                 {
224                         // Return to main menu at game end
225                         isInMain = true;
226
227                         // Return everything to as it was before level 4
228                         HUD.setStatus("INFO-WELL");
229                         HUD.displayWarning("");
230                         segment = 1;
231                         HUD.goDark(0);
232                 }
233
234                 // Switch segments
235                 if (timeLeft == 0)
236                 {
237                         timeLeft = 1000;
238                         segment++;
239                         initSegment = true;
240                 }
241                 timeLeft--;
242
243
244                 // Draw the titular object
245                 glPushMatrix();
246                 glTranslated(0, 0, -7);
247                 glColor4d(.9, .9, .9, 1);
248                 glutSolidSphere(3, 50, 50);
249                 glPopMatrix();
250
251                 lvl.displayLevel();
252         }
253 }
254
255 void GameManager::manageScenes()
256 {
257         // If we need to change the song, we can do it here
258         if (changeSong)
259         {
260                 manageMusic();
261         }
262
263         // Clears the previous drawing
264         glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);
265
266         if (isInTerminal)
267         {
268                 activeTerminal->DisplayScreen();
269         }
```

```
270
271         else if (isInMain)
272         {
273                 // Enable using textures (pictures)
274                 glutSetCursor(GLUT_CURSOR_LEFT_ARROW);
275                 static MainMenu MM;
276
277                 // For some reason, MM breaks horribly when it's a global or class
                        member
278                 // So we'll just handle mouse clicks in the display function
279                 // Rather than the mouse click function
280                 // Because I'm a competent programmer
281                 if (processClick)
282                 {
283                         MM.getClick(mouse_x, mouse_y);
284                         processClick = false;
285                 }
286
287                 MM.display();
288         }
289
290         // glutSetCursor(GLUT_CURSOR_LEFT_ARROW); Keypads maybe?
291
292         else
293         {
294                 // Enable using textures (pictures)
295                 glutSetCursor(GLUT_CURSOR_NONE);
296
297                 if (curr_level != "LEVELFOUR") draw();
298
299                 else endGame();
300
301                 // Moves the camera to the correct position
302                 Cam.Display();
303
304                 // Prompt the user to interact if we should
305                 if (interactivity) HUD.displayWarning("INTERACT");
306                 else if (curr_level != "LEVELFOUR") HUD.displayWarning("");
307
308                 // Prints the HUD
309                 HUD.DisplayHUD();
310         }
311
312         // Displays the current drawing
313         glutSwapBuffers();
314 }
315
316 void GameManager::manageMusic()
317 {
318         // All variables need to persist between frames
319         static SoundClass background;
320
321         SoundSystem.releaseSound(background);
322         changeSong = false;
323
324         // Because you can never have too much bounds checking
```

```
325         if (songNum >= 0 && songNum <= 9)
326         {
327                 std::string song = getSongName(songNum);
328                 SoundSystem.makeSound(&background, song.c_str());
329                 SoundSystem.playSound(background);
330         }
331 }
332
333 // Normal key presses
334 void GameManager::normal(unsigned char key, int x, int y)
335 {
336         board.normal(key, x, y);
337 }
338
339 // Key releases
340 void GameManager::key_up(unsigned char key, int x, int y)
341 {
342         board.key_up(key, x, y);
343 }
344
345 // Special keys
346 void GameManager::special(int key, int x, int y)
347 {
348         board.special(key, x, y);
349 }
```

7.1.14 GCTypes.h

```
1  /************************************************************\
2   * GCTypes.h                                                *
3   * This file was created by Jeremy Greenburg                *
4   * As part of The God Core game for the University of       *
5   * Tennessee at Martin's University Scholars Organization   *
6   *                                                          *
7   * This file contains integer types corresponding to various *
8   * In game object types                                     *
9  \************************************************************/
10
11 #ifndef GC_TYPES_H
12 #define GC_TYPES_H
13
14 // Object Types
15
16 #define T_NULL 0                // Nothing
17 #define T_DOOR 1                // Door
18 #define T_TERMINAL 2    // Terminal
19 #define T_SWITCH 3              // Switch
20 #define T_LEVEL_END 4   // Switch that ends level
21
22 typedef int GCtype;
23
24 #endif
```

7.1.15 Globals.h

```
1  /************************************************************\
2   * Globals.h                                                *
```

```
 * This file was created by Jeremy Greenburg                 *
 * As part of The God Core game for the University of        *
 * Tennessee at Martin's University Scholars Organization    *
 *                                                           *
 * This file contains the declaration of the Globals         *
 * All of them.                                              *
 * Thers a lot of them                                       *
\***********************************************************/

#ifndef GLOBALS_H
#define GLOBALS_H

// ALLLLLLL the classes
#include "HeadsUpDisplay.h"
#include "CameraControl.h"
#include "Level.h"
#include "Terminal.h"
#include "Door.h"
#include "Switch.h"
#include "Plane.h"
#include "Trigger.h"
#include "Cylinder.h"

// Remember that if you're doing anything else, globals are bad.
// But we're in the hellscape that is graphics
// There are no rules here
// Only madness dwells here

// Typedefs make life easy
typedef std::vector<Plane> vr;
typedef std::vector<Door> vd;
typedef std::vector<Switch> vs;
typedef std::vector<Terminal> vt;
typedef std::vector<Trigger> vtr;
typedef std::vector<Cylinder> vc;

// Pointers to various interactive objects
extern Switch *activeSwitch;
extern Terminal *activeTerminal;

// Vectors containing all of the level's assets
extern vr walls;
extern vd doors;
extern vs switches;
extern vt terminals;
extern vtr triggers;
extern vc cylinders;

extern bool
        // Are we colliding / Can we die?
        collision, godMode,
        // Go dim or go dark?
        goDim, goDark,
        // Dunno if I actually need this one
        loading,
        // Is in varius different stages of non-normal play
```

```
59          isInConsole, isInTerminal, isInMain,
60          // Should we change the song?
61          changeSong,
62          // Is something in interaction range?
63          interactivity;
64
65  // Number of song to change to
66  extern int songNum;
67
68  // Current level (int and string)
69  extern int levelNum;
70  extern std::string curr_level;
71
72  // Constant strings of the song names
73  extern const char *SONG0, *SONG1, *SONG2, *SONG3, *SONG4, *SONG5,
74                                          *SONG6, *SONG7, *SONG8, *SONG9;
75
76  // A few global objects
77  extern HeadsUpDisplay HUD;
78  extern CameraControl Cam;
79  extern Level lvl;
80
81  // Converts a songname to an integer
82  int getSongNum(std::string input);
83  // Converts an integer to a songname
84  std::string getSongName(int input);
85  // Converts a level name to an integer
86  int getLevelNum(std::string input);
87  // Converts level_num to a string in curr_level
88  std::string getLevelString(int input);
89  // Safely advance the song
90  void advanceMusic();
91
92  #endif
```

7.1.16 Globals.cpp

```
1   /*************************************************************\
2    * Globals.cpp                                               *
3    * This file was created by Jeremy Greenburg                 *
4    * As part of The God Core game for the University of        *
5    * Tennessee at Martin's University Scholars Organization    *
6    *                                                           *
7    * This file instantiates the global variables               *
8   \*************************************************************/
9
10  #include "Globals.h"
11
12  vr walls;
13  vd doors;
14  vs switches;
15  vt terminals;
16  vtr triggers;
17  vc cylinders;
18
19  Switch *activeSwitch = NULL;
20  Terminal *activeTerminal = NULL;
```

```
21
22  bool collision = true;
23  bool godMode = false;
24  bool goDim = false;
25  bool goDark = false;
26  bool loading = true;
27  bool isInConsole = false;
28  bool isInTerminal = false;
29  bool isInMain = true;
30  bool changeSong = true;
31  bool interactivity = false;
32
33  int songNum = 0;
34
35  int levelNum = 0;
36  std::string curr_level = "LEVELZERO";
37
38  const char* SONG0 = "Dark Fog.mp3";
39  const char* SONG1 = "Mismer.mp3";
40  const char* SONG2 = "One Sly Move.mp3";
41  const char* SONG3 = "Hypnothis.mp3";
42  const char* SONG4 = "Cold Hope.mp3";
43  const char* SONG5 = "Spacial Harvest.mp3";
44
45  HeadsUpDisplay HUD;
46  CameraControl Cam;
47  Level lvl;
48
49  int getSongNum(std::string input)
50  {
51          if (input == SONG0 || input == "0")
52                  return 0;
53          if (input == SONG1 || input == "1")
54                  return 1;
55          if (input == SONG2 || input == "2")
56                  return 2;
57          if (input == SONG3 || input == "3")
58                  return 3;
59          if (input == SONG4 || input == "4")
60                  return 4;
61          if (input == SONG5 || input == "5")
62                  return 5;
63          return -1; // Invalid song
64  }
65
66  std::string getSongName(int input)
67  {
68          std::string ret;
69          switch (input)
70          {
71          case 0: ret = SONG0;
72                  break;
73          case 1: ret = SONG1;
74                  break;
75          case 2: ret = SONG2;
76                  break;
```

```
77          case 3: ret = SONG3;
78                  break;
79          case 4: ret = SONG4;
80                  break;
81          case 5: ret = SONG5;
82                  break;
83          default: ret = "\0";;
84                  break;
85          }
86
87          return ret;
88  }
89
90  int getLevelNum(std::string input)
91  {
92          if (input == "LEVELZERO" || input == "LEVELZERO\n")
93                  return 0;
94          if (input == "LEVELONE" || input == "LEVELONE\n")
95                  return 1;
96          if (input == "LEVELTWO")
97                  return 2;
98          if (input == "LEVELTHREE")
99                  return 3;
100         if (input == "LEVELFOUR")
101                 return 4;
102         return -1; // Invalid song
103 }
104
105 std::string getLevelString(int input)
106 {
107         std::string ret;
108         switch (input)
109         {
110         case 0: ret = "LEVELZERO";
111                 break;
112         case 1: ret = "LEVELONE";
113                 break;
114         case 2: ret = "LEVELTWO";
115                 break;
116         case 3: ret = "LEVELTHREE";
117                 break;
118         case 4: ret = "LEVELFOUR";
119                 break;
120         default: ret = "ERROR";;
121                 break;
122         }
123
124         return ret;
125 }
126
127 void advanceMusic()
128 {
129         songNum++;
130         if (songNum > 5) songNum = 0;
131 }
```

7.1.17 HeadsUpDisplay.h

```
1  /*************************************************************\
2   * HeadsUpDisplay.h                                          *
3   * This file was created by Jeremy Greenburg                 *
4   * As part of The God Core game for the University of        *
5   * Tennessee at Martin's University Scholars Organization    *
6   *                                                           *
7   * This file contains the declaration of the HeadsUpDisplay  *
8   * Class, which created an Orthoganl Matrix infront of the   *
9   * Screen which allows for a 2D Heads Up Display to be       *
10  * Printed before the user at any time                       *
11  * It also passes input to the developer console             *
12 \*************************************************************/
13
14 #ifndef HEADSUPDISPLAY
15 #define HEADSUPDISPLAY
16
17 // Base class for 2D operations
18 #include "TwoD.h"
19
20 // For displaying text in the HUD
21 #include "TextEngine.h"
22 // The Developer Console
23 #include "Console.h"
24
25 class HeadsUpDisplay : public TwoD
26 {
27 private:
28         // Duration of time to dim screen (Goes from black to clear as time
              progresses)
29         int dimTime = 0;
30         // Duration of time to go dark (completely black)
31         int darkTime = 0;
32         // Duration of the time to fade the screen (goes from clear to black as
              time progresses)
33         int fadeTime = 0;
34         // Wether or not to dim
35         bool dimNow = false;
36         // Wether or not to darken
37         bool darkNow = false;
38         // Wether or not to fade
39         bool fadeNow = false;
40         // Wether or not we are in developer console
41         bool devConsole = false;
42
43         // Tag to current alert
44         std::string currentAlert;
45         // Tag to current status
46         std::string currentStatus;
47         // Text to print to the screen
48         std::string currentText;
49         // What the user is typing
50         std::string currentInput;
51
52         // To Display text
```

```
53          TextEngine helmet;
54          // Dev Console
55          Console dev;
56
57          // Draws an info bar at the top of the screen
58          void drawHelmetBounds();
59          // Displays suit alerts
60          void DisplayAlerts();
61          // Draws the Heads Up Display
62          void drawHUD();
63          // Manages the dimming of the screen
64          void dim();
65          // Manages the darkening of the screen
66          void dark();
67          // Manages the fading of the screen
68          void fade();
69          // Draws the box which stores the info text
70          void drawInfoBox();
71          // Draws the developer console window
72          void drawConsole();
73          // Displays standard info in the top left corner
74          void displayInfo(std::string tag);
75
76
77  public:
78          // Manages the HUD
79          void DisplayHUD();
80
81          /****           ALTERATION FUNCTIONS            *****\
82          \**** Should always be called before DisplayHud *****/
83
84          // Tells the HUD how long to dim
85          void goDim(int time);
86
87          //Tells the HUD how long to go dark
88          void goDark(int time);
89          // Tels the HUD how long to fade for
90          void goFade(int time);
91          // Flips dev_console
92          void toggleConsole();
93
94          // Takes in a tag to print to screen
95          void displayWarning(std::string warning);
96
97          // Takes in a string to display in the status box
98          void setStatus(std::string status);
99
100         // Takes in a string to print to screen
101         void printToConsole(std::string text);
102
103         // Signifies a completed input to the console
104         void inputString(std::string text);
105
106         // Returns an item of the console's log
107         std::string getHist(int count);
108
```

```
109         // Returns the number of items in the console's log
110         int getHistNum();
111 };
112
113 #endif
```

7.1.18 HeadsUpDiplay.cpp

```
 1 /*************************************************************\
 2  * HeadsUpDisplay.cpp                                        *
 3  * This file was created by Jeremy Greenburg                 *
 4  * As part of The God Core game for the University of        *
 5  * Tennessee at Martin's University Scholars Organization    *
 6  *                                                           *
 7  * This file contains the definition of the HeadsUpDisplay   *
 8  * Class. For more information, see HeadsUpDisplay.h         *
 9 \*************************************************************/
10
11 // Class Declaration
12 #include "HeadsUpDisplay.h"
13
14 // OpenGL API
15 #include <gl\glut.h>
16
17 // For counting seconds
18 #include <ctime>
19
20 // For displaying Planes
21 #include "Plane.h"
22
23 // For displaying triangles
24 #include "Triangle.h"
25
26 using namespace std;
27
28 void HeadsUpDisplay::drawHelmetBounds()
29 {
30         // Helmet bounds are black
31         double colors[4] = { 0, 0, 0, 1 };
32
33         // The top of the helmet
34         double top_vertices[9] =
35         {
36                 SCREENRIGHT, SCREENTOP, -1,
37                 SCREENLEFT, SCREENTOP, -1,
38                 SCREENRIGHT / 2.0, SCREENBOTTOM / 20.0, -1
39         };
40
41         // The left of the hemlet
42         double left_vertices[9] =
43         {
44                 SCREENLEFT, SCREENBOTTOM, -1,
45                 SCREENLEFT, SCREENTOP, -1,
46                 SCREENRIGHT / 20.0, 3 * SCREENBOTTOM / 5.0, -1
47         };
48
49         // The back of the helmet
```

```
50          double right_vertices[9] =
51          {
52                  SCREENRIGHT, SCREENBOTTOM, -1,
53                  SCREENRIGHT, SCREENTOP, -1,
54                  19 * SCREENRIGHT / 20.0, 3 * SCREENBOTTOM / 5.0, -1
55          };
56
57          Triangle top_helm{ top_vertices, colors };
58          Triangle left_helm{ left_vertices, colors };
59          Triangle right_helm{ right_vertices, colors };
60
61          top_helm.Display2D();
62          left_helm.Display2D();
63          right_helm.Display2D();
64  }
65
66  void HeadsUpDisplay::DisplayAlerts()
67  {
68          helmet.openFile(.5 * SCREENRIGHT, .5 * SCREENBOTTOM,
69                  1, 1, 1,
70                  "suitAlerts.log", currentAlert);
71  }
72
73  void HeadsUpDisplay::dim()
74  {
75          static int startTime;
76          static bool timeSet = false;
77          if (dimNow)
78          {
79                  if (!timeSet)
80                  {
81                          startTime = time(NULL);
82                          timeSet = true;
83                  }
84
85                  int currentTime = time(NULL);
86                  int timeElapsed = currentTime - startTime;
87                  if (timeElapsed < dimTime)
88                  {
89                          // A black square that grows more transparent as time
                               passes
90                          double colors[4] = { 0, 0, 0, (double)(dimTime -
                               timeElapsed) / dimTime };
91                          double dimVert[12] =
92                          {
93                                  SCREENLEFT, SCREENTOP, -1,
94                                  SCREENLEFT, SCREENBOTTOM, -1,
95                                  SCREENRIGHT, SCREENBOTTOM, -1,
96                                  SCREENRIGHT, SCREENTOP, -1
97                          };
98
99                          Plane black{ dimVert, colors };
100                         black.Display2D();
101                 }
102
103                 else
```

```
104                 {
105                         dimNow = false;
106                         timeSet = false;
107                 }
108         }
109 }
110
111 void HeadsUpDisplay::fade()
112 {
113         static int startTime;
114         static bool timeSet = false;
115         if (fadeNow)
116         {
117                 if (!timeSet)
118                 {
119                         startTime = time(NULL);
120                         timeSet = true;
121                 }
122
123                 int currentTime = time(NULL);
124                 int timeElapsed = currentTime - startTime;
125                 if (timeElapsed < fadeTime)
126                 {
127                         // A black square that grows more transparent as time
                            passes
128                         double colors[4] = { 0, 0, 0, 1 - ((double)(fadeTime -
                            timeElapsed) / fadeTime) };
129                         double dimVert[12] =
130                         {
131                                 SCREENLEFT, SCREENTOP, -1,
132                                 SCREENLEFT, SCREENBOTTOM, -1,
133                                 SCREENRIGHT, SCREENBOTTOM, -1,
134                                 SCREENRIGHT, SCREENTOP, -1
135                         };
136
137                         Plane black{ dimVert, colors };
138                         black.Display2D();
139                 }
140
141                 else
142                 {
143                         fadeNow = false;
144                         timeSet = false;
145
146
147                         // Go dark till game ends
148                         darkNow = true;
149                         darkTime = 1000;
150                 }
151         }
152 }
153
154 void HeadsUpDisplay::dark()
155 {
156         static int startTime;
157         static bool timeSet = false;
```

```
158         if (darkNow)
159         {
160                 if (!timeSet)
161                 {
162                         startTime = time(NULL);
163                         timeSet = true;
164                 }
165
166                 int currentTime = time(NULL);
167                 int timeElapsed = currentTime - startTime;
168                 if (timeElapsed < darkTime)
169                 {
170                         // A black square that obscures vision
171                         double colors[4] = { 0, 0, 0, 1 };
172                         double dimVert[12] =
173                         {
174                                 SCREENLEFT, SCREENTOP, -1,
175                                 SCREENLEFT, SCREENBOTTOM, -1,
176                                 SCREENRIGHT, SCREENBOTTOM, -1,
177                                 SCREENRIGHT, SCREENTOP, -1
178                         };
179
180                         Plane black{ dimVert, colors };
181                         black.Display2D();
182                 }
183
184                 else
185                 {
186                         darkNow = false;
187                         timeSet = false;
188                 }
189         }
190 }
191
192 void HeadsUpDisplay::drawConsole()
193 {
194         double colors[4] = { .1, .1, .1, .9 };
195         double vertices[12] =
196         {
197                 SCREENLEFT, SCREENTOP, -1,
198                 SCREENLEFT, SCREENBOTTOM / 5, -1,
199                 SCREENRIGHT, SCREENBOTTOM / 5, -1,
200                 SCREENRIGHT, SCREENTOP, -1
201         };
202
203         Plane console_tab{ vertices, colors };
204         console_tab.Display2D();
205
206         if (currentInput != "")
207         {
208                 dev.activate(currentInput, currentText);
209                 currentInput.clear();
210         }
211
212         else
213         {
```

```
214                 dev.activate(currentText);
215         }
216 }
217
218 void HeadsUpDisplay::drawInfoBox()
219 {
220         double colors[4] = { 0, 1, 1, .5 };
221         double vertices[12] =
222         {
223                 SCREENLEFT, SCREENTOP, -1,
224                 SCREENLEFT, SCREENBOTTOM / 10, -1,
225                 SCREENRIGHT / 10, SCREENBOTTOM / 10, -1,
226                 SCREENRIGHT / 10, SCREENTOP, -1
227         };
228
229         Plane info{ vertices, colors };
230         info.Display2D();
231 }
232
233 void HeadsUpDisplay::displayInfo(string tag)
234 {
235         helmet.openFile(SCREENLEFT, SCREENTOP +  20, 1, 1, 1,
236                 "suitAlerts.log", currentStatus);
237 }
238
239 void HeadsUpDisplay::goDim(int time)
240 {
241         dimTime = time;
242         dimNow = true;
243 }
244
245 void HeadsUpDisplay::goDark(int time)
246 {
247         darkTime = time;
248         darkNow = true;
249 }
250
251 void HeadsUpDisplay::goFade(int time)
252 {
253         fadeTime = time;
254         fadeNow = true;
255 }
256
257 void HeadsUpDisplay::displayWarning(std::string warning)
258 {
259         currentAlert = warning;
260 }
261
262 void HeadsUpDisplay::setStatus(std::string status)
263 {
264         currentStatus = status;
265 }
266
267 void HeadsUpDisplay::printToConsole(std::string text)
268 {
269         currentText = text;
```

```
}

void HeadsUpDisplay::inputString(std::string text)
{
        currentInput = text;
}

void HeadsUpDisplay::toggleConsole()
{
        devConsole = !devConsole;
}

void HeadsUpDisplay::drawHUD()
{
        drawHelmetBounds();

        if (dimNow)
        {
                dim();
        }

        else if (fadeNow)
        {
                fade();
        }

        // Not else if due to fade -> dark transition
        if (darkNow)
        {
                dark();
        }

        drawInfoBox();
        displayInfo(currentStatus);

        if (devConsole)
        {
                drawConsole();
        }

        if (currentAlert != "")
        {
                DisplayAlerts();
        }
}

string HeadsUpDisplay::getHist(int count)
{
        return dev.getHist(count);
}

int HeadsUpDisplay::getHistNum()
{
        return dev.getHistNum();
}

```

```
326 void HeadsUpDisplay::DisplayHUD()
327 {
328         prepare2D();
329
330         drawHUD();
331
332         prepare3D();
333 }
```

7.1.19 Keyboard.h

```
 1 /************************************************************\
 2  * Keyboard.h                                               *
 3  * This file was created by Jeremy Greenburg                *
 4  * As part of The God Core game for the University of       *
 5  * Tennessee at Martin's University Scholars Organization   *
 6  *                                                          *
 7  * This file contains the declaration of the Keyboard class, *
 8  * which logs keypresses from the user and determines,      *
 9  * depending on the context, what action to take such.      *
10 \************************************************************/
11
12 #ifndef KEYBOARD_H
13 #define KEYBOARD_H
14
15 // std::string
16 #include <string>
17
18 class Keyboard
19 {
20 private:
21         // Signals to recieve a part of the console's history
22         bool getPrev, getNext;
23
24 public:
25         // Normal keys
26         void normal(unsigned char key, int x, int y);
27         // To read console input
28         void inputConsole(unsigned char key, int x, int y);
29         // To read terminal input
30         void inputTerminal(unsigned char key, int x, int y);
31         // To interact with the world
32         void interact(unsigned char key, int x, int y);
33         // If a key is released
34         void key_up(unsigned char key, int x, int y);
35         // Special keys (functions, arrows, ect.)
36         void special(int key, int x, int y);
37         // Manages interactivity
38         void interact();
39 };
40
41 #endif
```

7.1.20 Keyboard.cpp

```
1 /************************************************************\
2  * Keyboard.cpp                                             *
```

```
 3   * This file was created by Jeremy Greenburg                 *
 4   * As part of The God Core game for the University of        *
 5   * Tennessee at Martin's University Scholars Organization    *
 6   *                                                           *
 7   * This file contains the defintion of the Keyboard class.   *
 8   * for more information, see Keyboard.h                      *
 9  \***********************************************************/
10
11  // Class decleration
12  #include "Keyboard.h"
13
14  // std::string
15  #include <string>
16
17  // glut really wants cstdlib here
18  #include <cstdlib>
19
20  // OpenGL API
21  #include <GL\glut.h>
22
23  // To recieve and manage global variables
24  #include "Globals.h"
25  // Collision detection
26  #include "CollisionEngine.h"
27
28  // Return codes
29  #include "Return.h"
30  // System log
31  #include "Logger.h"
32
33  using namespace std;
34
35  void Keyboard::normal(unsigned char key, int x, int y)
36  {
37          // If we are currently capturing input
38          if (isInConsole)
39          {
40                  inputConsole(key, x, y);
41          }
42
43          // If we're in a computer
44          else if (isInTerminal)
45          {
46                  inputTerminal(key, x, y);
47          }
48
49          // Otherwise (as long we aren't in a menu)
50          else if (!isInMain)
51          {
52                  interact(key, x, y);
53          }
54  }
55
56  void Keyboard::inputConsole(unsigned char key, int x, int y)
57  {
58          // User string input
```

```
59          static string input;
60          // Number in console history
61          static int count = 0;
62
63          // Up arrow, recieves the next older entry in the console's history
64          if (getPrev)
65          {
66                  input = HUD.getHist(count);
67
68                  if (count < HUD.getHistNum() - 1)
69                  {
70                          count++;
71                  }
72
73                  getPrev = false;
74          }
75
76          // Down arrow, recieves the next newer entry in the console's history
77          else if (getNext)
78          {
79                  input = HUD.getHist(count);
80
81                  if (count > 0)
82                  {
83                          count--;
84                  }
85
86                  getNext = false;
87          }
88
89          // Enter key, process and clear input
90          else if (key == 13)
91          {
92                  HUD.inputString(input);
93                  input.clear();
94                  count = 0;
95          }
96
97          // Tilda, close the console
98          else if (key == '~' || isInConsole == false)
99          {
100                 input.clear();
101                 isInConsole = false;
102                 HUD.toggleConsole();
103                 count = 0;
104         }
105
106         // Backspace. Self explanatory
107         else if (key == 8 && !input.empty())
108         {
109                 input.pop_back();
110         }
111
112         // Otherwise, type normally
113         else
114         {
```

```
115                     input += key;
116             }
117
118             // Print what's been typed so far
119             HUD.printToConsole(input);
120     }
121
122     // Pretty much a copy pasta of inputConsole because I'm a terrible programmer
123     // I'll try to combine em in the future, I swear
124     // Just adjust all of these to do terminally stuff I guess
125     void Keyboard::inputTerminal(unsigned char key, int x, int y)
126     {
127             // TODO: Fix terminal input with active Terminal hijibis
128
129             // User string input
130             static string input;
131             // Number in console history
132             static int count = 0;
133
134             // Up arrow, recieves the next older entry in the console's history
135             if (getPrev)
136             {
137                     input = activeTerminal->getHist(count);
138
139                     if (count < activeTerminal->getHistNum() - 1)
140                     {
141                             count++;
142                     }
143
144                     getPrev = false;
145             }
146
147             // Down arrow, recieves the next newer entry in the console's history
148             else if (getNext)
149             {
150                     input = activeTerminal->getHist(count);
151
152                     if (count > 0)
153                     {
154                             count--;
155                     }
156
157                     getNext = false;
158             }
159
160             // Enter key, process and clear input
161             else if (key == 13)
162             {
163                     activeTerminal->getInput(input);
164                     input.clear();
165                     count = 0;
166             }
167
168             // Backspace. Self explanatory
169             else if (key == 8 && !input.empty())
170             {
```

```
171                     input.pop_back();
172             }
173
174             // Otherwise, type normally
175             else
176             {
177                     input += key;
178             }
179
180             // Print what's been typed so far
181             activeTerminal->getText(input); // Drawing handled elsewhere?
182     }
183
184     void Keyboard::interact(unsigned char key, int x, int y)
185     {
186             CollisionEngine col;
187             // Speed at which the player moves
188             int speedMod = 1;
189
190             int modKey = glutGetModifiers();
191
192             if (modKey == GLUT_ACTIVE_SHIFT)
193             {
194                     speedMod = 2;
195             }
196
197             else
198             {
199                     speedMod = 1;
200             }
201
202             switch (key)
203             {
204             case 'w':
205             case 'W':
206                     Cam.moveForward(speedMod);
207                     if (col.collide())
208                     {
209                             Cam.moveBackward(speedMod);
210                     }
211                     break;
212             case 'a':
213             case 'A':
214                     Cam.strafeRight();
215                     if (col.collide())
216                     {
217                             Cam.strafeLeft();
218                     }
219                     break;
220             case 's':
221             case 'S':
222                     Cam.moveBackward(speedMod);
223                     if (col.collide())
224                     {
225                             Cam.moveForward(speedMod);
226                     }
```

```
227                 break;
228         case 'd':
229         case 'D':
230                 Cam.strafeLeft();
231                 if (col.collide())
232                 {
233                         Cam.strafeRight();
234                 }
235                 break;
236         case 'e':
237         case 'E':
238                 interact();
239                 break;
240         case '~':
241                 isInConsole = true;
242                 HUD.toggleConsole();
243                 break;
244
245                 // Enter
246         case 13:
247                 //goDim = true;
248                 break;
249
250                 // Escape
251         case 27:
252                 isInMain = true;
253                 songNum = 0;
254                 changeSong = true;
255                 break;
256         }
257 }
258
259 void Keyboard::key_up(unsigned char key, int x, int y)
260 {
261         // I'm sure I'll do something smart here
262 }
263
264 void Keyboard::special(int key, int x, int y)
265 {
266         Logger log;
267         // We start in fullscreen
268         static bool fullScreen = true;
269         switch (key)
270         {
271         case GLUT_KEY_F1:
272                 fullScreen = !fullScreen;
273                 break;
274
275         case GLUT_KEY_F2:
276                 // Only way to exit main loop.
277                 log.logLine("Exiting via F2");
278                 exit(EXIT_OK);
279                 break;
280
281         case GLUT_KEY_F3:
282                 Cam.resetCam();
```

```
283                 break;
284
285         case GLUT_KEY_F4:
286                 isInMain = !isInMain;
287                 break;
288
289         case GLUT_KEY_F5:
290                 log.logCamCoords();
291                 break;
292
293         case GLUT_KEY_UP:
294                 if (isInConsole || isInTerminal)
295                 {
296                         getPrev = true;
297                         getNext = false;
298
299                         // To ensure that the input is updated BEFORE next key
                            press
300                         normal(0, 0, 0);
301                 }
302                 break;
303
304         case GLUT_KEY_DOWN:
305                 if (isInConsole || isInTerminal)
306                 {
307                         getNext = true;
308                         getPrev = false;
309
310                         // To ensure that the input is updated BEFORE next key
                            press
311                         normal(0, 0, 0);
312                 }
313                 break;
314         }
315
316         if (fullScreen)
317         {
318                 glutFullScreen();
319         }
320
321         else
322         {
323                 glutReshapeWindow(1367, 767);
324                 glutPositionWindow(50, 50);
325         }
326 }
327
328 void Keyboard::interact()
329 {
330         // Only do things if we actually can
331         if (interactivity)
332         {
333                 if (activeSwitch != NULL)
334                 {
335                         activeSwitch->toggleTarget();
336
```

```
337                         for (unsigned int i = 0; i < triggers.size(); i++)
338                         {
339                                 triggers[i].tryToTrigger(activeSwitch, T_SWITCH);
340                         }
341                 }
342
343                 else if (activeTerminal != NULL)
344                 {
345                         isInTerminal = true;
346
347                         for (unsigned int i = 0; i < triggers.size(); i++)
348                         {
349                                 triggers[i].tryToTrigger(activeTerminal,
                                    T_TERMINAL);
350                         }
351                 }
352         }
353 }
```

7.1.21 Level.h

```
1  /************************************************************\
2   * Level.h                                                  *
3   * This file was created by Jeremy Greenburg                *
4   * As part of The God Core game for the University of       *
5   * Tennessee at Martin's University Scholars Organization   *
6   *                                                          *
7   * This file contains the declaration of the Level class    *
8   * Which loads all level assets from a sqlite database      *
9   * (data.db)                                                *
10  \************************************************************/
11
12  #ifndef LEVEL_H
13  #define LEVEL_H
14
15  // std;:string
16  #include <string>
17  // std::vector
18  #include <vector>
19  // Planes for walls/doors/such else
20  #include "Plane.h"
21
22  // SQLite API
23  #include "sqlite3.h"
24
25  // Glut API
26  #include <GL\glut.h>
27
28  class Level
29  {
30  private:
31          // Used to load cylinders
32          GLUquadricObj *quadratic;
33          // The current level being loaded
34          std::string currLevel;
35
36          // Look, the names are self-explanatory
```

```
37          void loadWalls(sqlite3 *db);
38          void loadDoors(sqlite3 *db);
39          void loadCylinders(sqlite3 *db);
40          void loadSwitches(sqlite3 *db);
41          void loadTerminals(sqlite3 *db);
42          void loadTriggers(sqlite3 *db);
43
44          // Binds the triggering object and target object to a single trigger
45          bool bindTrigger(std::string id, std::string trigger, std::string
                triggerType);
46          bool bindTarget(std::string id, std::string target, std::string targetType
                );
47
48  public:
49          // Manages the loading of the level
50          void loadLevel(std::string levelName);
51          // Draws the level
52          void displayLevel();
53  };
54
55  #endif
```

7.1.22 Level.cpp

```
1   /*************************************************************\
2    * Level.cpp                                                 *
3    * This file was created by Jeremy Greenburg                 *
4    * As part of The God Core game for the University of        *
5    * Tennessee at Martin's University Scholars Organization    *
6    *                                                           *
7    * This file contains the defintion of the Level class.      *
8    * for more information, see Level.h                         *
9   \*************************************************************/
10
11  // Class declaration
12  #include "Level.h"
13  // To use Planes
14  #include "Plane.h"
15  // Vectors to plop stuff in
16  #include "Globals.h"
17  // Return codes
18  #include "Return.h"
19  // System log
20  #include "Logger.h"
21  // Oject Types
22  #include "GCTypes.h"
23
24  #include <iostream>
25
26  using namespace std;
27
28  void Level::loadWalls(sqlite3 *db)
29  {
30          walls.clear();
31          // Prepared Statement
32          sqlite3_stmt *stm;
33          // SQL command
```

```
34          string cmd;
35          // Connection Error Test
36          int err;
37          cmd = "SELECT * FROM walls WHERE LEVEL = \"" + currLevel + "\"";
38
39          err = sqlite3_prepare(db, cmd.c_str(), -1, &stm, 0);
40
41          if (err != SQLITE_OK)
42          {
43                  Logger log;
44                  vector<string> output = { "FATAL ERROR: failed to load walls from
                        ", currLevel };
45                  log.logLine(output);
46                  exit(STATEMENT_ERROR);
47          }
48
49          // While we still get rows of output
50          while (sqlite3_step(stm) == SQLITE_ROW)
51          {
52                  double x1, x2, x3, x4,
53                          y1, y2, y3, y4,
54                          z1, z2, z3, z4,
55                          r, g, b, a;
56                  string axis;
57
58                  x1 = sqlite3_column_double(stm, 2);
59                  x2 = sqlite3_column_double(stm, 3);
60                  x3 = sqlite3_column_double(stm, 4);
61                  x4 = sqlite3_column_double(stm, 5);
62
63                  y1 = sqlite3_column_double(stm, 6);
64                  y2 = sqlite3_column_double(stm, 7);
65                  y3 = sqlite3_column_double(stm, 8);
66                  y4 = sqlite3_column_double(stm, 9);
67
68                  z1 = sqlite3_column_double(stm, 10);
69                  z2 = sqlite3_column_double(stm, 11);
70                  z3 = sqlite3_column_double(stm, 12);
71                  z4 = sqlite3_column_double(stm, 13);
72
73                  r = sqlite3_column_double(stm, 14);
74                  g = sqlite3_column_double(stm, 15);
75                  b = sqlite3_column_double(stm, 16);
76                  a = sqlite3_column_double(stm, 17);
77
78                  axis = reinterpret_cast<const char*>(sqlite3_column_text(stm, 18))
                        ;
79
80                  char ax;
81                  if (axis == "x") ax = 'x';
82                  else if (axis == "y") ax = 'y';
83                  else if (axis == "z") ax = 'z';
84                  else ax = 0;
85
86                  double verts[12] =
87                  {
```

```
88                          x1, y1, z1,
89                          x2, y2, z2,
90                          x3, y3, z3,
91                          x4, y4, z4
92                  };
93                  double colors[4] = { r, g, b, a };
94
95                  Plane rect(verts, colors, ax);
96
97                  walls.push_back(rect);
98          }
99
100         /*
101         Logger log;
102         vector<string> output = { "Loaded walls on", currLevel };
103         log.logLine(output);
104         */
105
106         // Deconstructs the statement
107         sqlite3_finalize(stm);
108 }
109
110 void Level::loadDoors(sqlite3 *db)
111 {
112         doors.clear();
113         // Prepared Statement
114         sqlite3_stmt *stm;
115         // SQL command
116         string cmd;
117         // Connection Error Test
118         int err;
119         cmd = "SELECT * FROM doors WHERE LEVEL = \"" + currLevel + "\"";
120
121         err = sqlite3_prepare(db, cmd.c_str(), -1, &stm, 0);
122
123         if (err != SQLITE_OK)
124         {
125                 Logger log;
126                 vector<string> output = { "FATAL ERROR: Can't load doors while
                        loading", currLevel };
127                 log.logLine(output);
128
129                 exit(STATEMENT_ERROR);
130         }
131
132         // While we still get rows of output
133         while (sqlite3_step(stm) == SQLITE_ROW)
134         {
135                 double x1, x2, x3, x4,
136                         y1, y2, y3, y4,
137                         z1, z2, z3, z4,
138                         r, g, b, a;
139                 string id;
140                 string axis;
141
142                 id = reinterpret_cast<const char*>(sqlite3_column_text(stm, 0));
```

```
143                 x1 = sqlite3_column_double(stm, 2);
144                 x2 = sqlite3_column_double(stm, 3);
145                 x3 = sqlite3_column_double(stm, 4);
146                 x4 = sqlite3_column_double(stm, 5);
147
148                 y1 = sqlite3_column_double(stm, 6);
149                 y2 = sqlite3_column_double(stm, 7);
150                 y3 = sqlite3_column_double(stm, 8);
151                 y4 = sqlite3_column_double(stm, 9);
152
153                 z1 = sqlite3_column_double(stm, 10);
154                 z2 = sqlite3_column_double(stm, 11);
155                 z3 = sqlite3_column_double(stm, 12);
156                 z4 = sqlite3_column_double(stm, 13);
157
158                 r = sqlite3_column_double(stm, 14);
159                 g = sqlite3_column_double(stm, 15);
160                 b = sqlite3_column_double(stm, 16);
161                 a = sqlite3_column_double(stm, 17);
162
163                 a = sqlite3_column_double(stm, 17);
164
165                 axis = reinterpret_cast<const char*>(sqlite3_column_text(stm, 18))
                        ;
166
167                 char ax;
168                 if (axis == "x") ax = 'x';
169                 else if (axis == "y") ax = 'y';
170                 else if (axis == "z") ax = 'z';
171                 else ax = 0;
172
173                 double verts[12] =
174                 {
175                         x1, y1, z1,
176                         x2, y2, z2,
177                         x3, y3, z3,
178                         x4, y4, z4
179                 };
180                 double colors[4] = { r, g, b, a };
181
182                 Plane rect(verts, colors, ax);
183
184                 doors.push_back(Door(rect, id));
185         }
186
187         Logger log;
188         vector<string> output = { "Loaded doors on", currLevel };
189         log.logLine(output);
190
191         // Deconstructs the statement
192         sqlite3_finalize(stm);
193 }
194
195 void Level::loadCylinders(sqlite3 *db)
196 {
197         cylinders.clear();
```

```
198         // Prepared Statement
199         sqlite3_stmt *stm;
200         // SQL command
201         string cmd;
202         // Connection Error Test
203         int err;
204         cmd = "SELECT * FROM cylinders WHERE LEVEL = \"" + currLevel + "\"";
205
206         err = sqlite3_prepare(db, cmd.c_str(), -1, &stm, 0);
207
208         if (err != SQLITE_OK)
209         {
210                 Logger log;
211                 vector<string> output = { "FATAL ERROR: Can't load cylinders while
                        loading", currLevel };
212                 log.logLine(output);
213
214                 exit(STATEMENT_ERROR);
215         }
216
217         // While we still get rows of output
218         while (sqlite3_step(stm) == SQLITE_ROW)
219         {
220                 double xt, yt, zt,
221                         xr, yr, zr,
222                         r, g, b, a,
223                         baseRadius, topRadius, height;
224                 int stacks, slices;
225
226
227                 xt = sqlite3_column_double(stm, 1);
228                 yt = sqlite3_column_double(stm, 2);
229                 zt = sqlite3_column_double(stm, 3);
230
231                 xr = sqlite3_column_double(stm, 4);
232                 yr = sqlite3_column_double(stm, 5);
233                 zr = sqlite3_column_double(stm, 6);
234
235                 baseRadius = sqlite3_column_double(stm, 7);
236                 topRadius = sqlite3_column_double(stm, 8);
237                 height = sqlite3_column_double(stm, 9);
238
239                 stacks = sqlite3_column_int(stm, 10);
240                 slices = sqlite3_column_int(stm, 11);
241
242                 r = sqlite3_column_double(stm, 12);
243                 g = sqlite3_column_double(stm, 13);
244                 b = sqlite3_column_double(stm, 14);
245                 a = sqlite3_column_double(stm, 15);
246
247
248                 double translate[3] = { xt, yt, zt };
249                 double rotate[3] = { xr, yr, zr };
250                 double colors[4] = { r, g, b, a };
251
252                 cylinders.push_back(Cylinder(baseRadius, topRadius, height, stacks
```

```
                        , slices, translate, rotate, colors));
253         }
254
255         Logger log;
256         vector<string> output = { "Loaded cylinders on", currLevel };
257         log.logLine(output);
258
259         // Deconstructs the statement
260         sqlite3_finalize(stm);
261 }
262
263
264 void Level::loadSwitches(sqlite3 *db)
265 {
266         switches.clear();
267         // Prepared Statement
268         sqlite3_stmt *stm;
269         // SQL command
270         string cmd;
271         // Connection Error Test
272         int err;
273         cmd = "SELECT * FROM switches WHERE LEVEL = \"" + currLevel + "\"";
274
275         err = sqlite3_prepare(db, cmd.c_str(), -1, &stm, 0);
276
277         if (err != SQLITE_OK)
278         {
279                 Logger log;
280                 vector<string> output = { "FATAL ERROR: Can't load switches while
                        loading", currLevel };
281                 log.logLine(output);
282
283                 exit(STATEMENT_ERROR);
284         }
285
286         // While we still get rows of output
287         while (sqlite3_step(stm) == SQLITE_ROW)
288         {
289                 double xt, yt, zt,
290                         xr, yr, zr;
291                 string target, s_type, id;
292                 int i_type;
293                 bool isOn;
294
295                 id = reinterpret_cast<const char*>(sqlite3_column_text(stm, 0));
296                 target = reinterpret_cast<const char*>(sqlite3_column_text(stm, 2)
                        );
297                 xt = sqlite3_column_double(stm, 3);
298                 yt = sqlite3_column_double(stm, 4);
299                 zt = sqlite3_column_double(stm, 5);
300
301                 xr = sqlite3_column_double(stm, 6);
302                 yr = sqlite3_column_double(stm, 7);
303                 zr = sqlite3_column_double(stm, 8);
304
305                 s_type = reinterpret_cast<const char*>(sqlite3_column_text(stm, 9)
```

```
                    );
306
307                 isOn = (bool)sqlite3_column_int(stm, 10);
308
309                 double translate[3] = { xt, yt, zt };
310                 double rotate[3] = { xr, yr, zr };
311
312                 if (s_type == "DOOR")
313                         i_type = T_DOOR;
314                 else if (s_type == "TERMINAL")
315                         i_type = T_TERMINAL;
316                 else if (s_type == "LEVEL_END")
317                         i_type = T_LEVEL_END;
318                 else
319                 {
320                         Logger log;
321                         vector<string> output = { "Failed to evaluate string type
                                entry: ", s_type, "for switch ", id };
322                         log.logLine(output);
323
324                         exit(DATA_ENTRY_ERROR);
325                 }
326
327                 switches.push_back(Switch(translate, rotate, i_type, id, isOn));
328
329                 bool assigned = false;
330
331                 if (s_type == "LEVEL_END")
332                 {
333                         assigned = true;
334
335                         Logger log;
336                         vector<string> output = { "Switch ", id, " bound to end
                                level" };
337                         log.logLine(output);
338                 }
339
340                 else if (s_type == "DOOR")
341                 {
342                         for (unsigned int i = 0; i < doors.size(); i++)
343                         {
344                                 if (doors[i].getID() == target)
345                                 {
346                                         Logger log;
347                                         vector<string> output = { "Binding switch
                                            ", id, " to door", target };
348                                         log.logLine(output);
349
350                                         switches[switches.size() - 1].assign(&(
                                            doors[i]));
351
352                                         assigned = true;
353                                 }
354                         }
355                 }
356
```

```
357                 else if (s_type == "TERMINAL")
358                 {
359                         for (unsigned int i = 0; i < terminals.size(); i++)
360                         {
361                                 if (terminals[i].getID() == target)
362                                 {
363                                         Logger log;
364                                         vector<string> output = { "Binding switch
                                            ", id, " to terminal", target };
365                                         log.logLine(output);
366 
367                                         switches[switches.size() - 1].assign(&(
                                            terminals[i]));
368 
369                                         assigned = true;
370                                 }
371                         }
372                 }
373 
374                 if (!assigned)
375                 {
376                         Logger log;
377                         vector<string> output = { "Failed to bind switch ", id, "
                            to a ", s_type };
378                         log.logLine(output);
379 
380                         exit(BINDING_ERROR);
381                 }
382         }
383 
384         Logger log;
385         vector<string> output = { "Loaded switches on", currLevel };
386         log.logLine(output);
387 
388         // Deconstructs the statement
389         sqlite3_finalize(stm);
390 }
391 
392 void Level::loadTerminals(sqlite3 *db)
393 {
394         terminals.clear();
395         // Prepared Statement
396         sqlite3_stmt *stm;
397         // SQL command
398         string cmd;
399         // Connection Error Test
400         int err;
401         cmd = "SELECT * FROM terminals WHERE LEVEL = \"" + currLevel + "\"";
402 
403         err = sqlite3_prepare(db, cmd.c_str(), -1, &stm, 0);
404 
405         if (err != SQLITE_OK)
406         {
407                 Logger log;
408                 vector<string> output = { "FATAL ERROR: Can't load terminals while
                        loading", currLevel };
```

```
409                 log.logLine(output);
410
411                 exit(STATEMENT_ERROR);
412         }
413
414         // While we still get rows of output
415         while (sqlite3_step(stm) == SQLITE_ROW)
416         {
417                 double xt, yt, zt,
418                         xr, yr, zr;
419                 string file, id;
420                 id = reinterpret_cast<const char*>(sqlite3_column_text(stm, 0));
421                 file = reinterpret_cast<const char*>(sqlite3_column_text(stm, 2));
422                 xt = sqlite3_column_double(stm, 3);
423                 yt = sqlite3_column_double(stm, 4);
424                 zt = sqlite3_column_double(stm, 5);
425
426                 xr = sqlite3_column_double(stm, 6);
427                 yr = sqlite3_column_double(stm, 7);
428                 zr = sqlite3_column_double(stm, 8);
429
430                 double translate[3] = { xt, yt, zt };
431                 double rotate[3] = { xr, yr, zr };
432
433                 Logger log;
434                 log.logLine(id);
435
436                 terminals.push_back(Terminal(translate, rotate, file, id));
437         }
438
439
440         Logger log;
441         vector<string> output = { "Loaded terminals on", currLevel };
442         log.logLine(output);
443
444         // Deconstructs the statement
445         sqlite3_finalize(stm);
446 }
447
448 void Level::loadTriggers(sqlite3 *db)
449 {
450         triggers.clear();
451         // Prepared Statement
452         sqlite3_stmt *stm;
453         // SQL command
454         string cmd;
455         // Connection Error Test
456         int err;
457         cmd = "SELECT * FROM triggers WHERE LEVEL = \"" + currLevel + "\"";
458
459         err = sqlite3_prepare(db, cmd.c_str(), -1, &stm, 0);
460
461         if (err != SQLITE_OK)
462         {
463                 Logger log;
464                 vector<string> output = { "FATAL ERROR: Can't load triggers while
```

```
                    loading", currLevel };
465                 log.logLine(output);
466
467                 exit(STATEMENT_ERROR);
468         }
469
470         // While we still get rows of output
471         while (sqlite3_step(stm) == SQLITE_ROW)
472         {
473                 string target, trigger, targetType, triggerType, id;
474                 int i_targetType, i_triggerType;
475
476                 id = reinterpret_cast<const char*>(sqlite3_column_text(stm, 0));
477                 trigger = reinterpret_cast<const char*>(sqlite3_column_text(stm,
                        2));
478                 target = reinterpret_cast<const char*>(sqlite3_column_text(stm, 3)
                        );
479                 triggerType = reinterpret_cast<const char*>(sqlite3_column_text(
                        stm, 4));
480                 targetType = reinterpret_cast<const char*>(sqlite3_column_text(stm
                        , 5));
481
482                 if (triggerType == "SWITCH")
483                         i_triggerType = T_SWITCH;
484                 else if (triggerType == "TERMINAL")
485                         i_triggerType = T_TERMINAL;
486                 else
487                 {
488                         Logger log;
489                         vector<string> output = { "Failed to evaluate string
                                trigger type entry: ", triggerType, "for trigger ", id
                                };
490                         log.logLine(output);
491
492                         exit(DATA_ENTRY_ERROR);
493                 }
494
495                 if (targetType == "SWITCH")
496                         i_targetType = T_SWITCH;
497                 else if (targetType == "TERMINAL")
498                         i_targetType = T_TERMINAL;
499                 else
500                 {
501                         Logger log;
502                         vector<string> output = { "Failed to evaluate string
                                trigger type entry: ", targetType, "for trigger ", id
                                };
503                         log.logLine(output);
504
505                         exit(DATA_ENTRY_ERROR);
506                 }
507
508                 triggers.push_back(Trigger(i_triggerType, i_targetType));
509
510                 bool assigned = bindTrigger(id, trigger, triggerType) &&
                        bindTarget(id, target, targetType);
```

```
511
512                 if (!assigned)
513                 {
514                         Logger log;
515                         vector<string> output = { "Failed to bind trigger ", id };
516                         log.logLine(output);
517
518                         exit(BINDING_ERROR);
519                 }
520         }
521
522         Logger log;
523         vector<string> output = { "Loaded trigger on", currLevel };
524         log.logLine(output);
525
526         // Deconstructs the statement
527         sqlite3_finalize(stm);
528 }
529
530 bool Level::bindTrigger(string id, string trigger, string triggerType)
531 {
532         if (triggerType == "SWITCH")
533         {
534                 for (unsigned int i = 0; i < switches.size(); i++)
535                 {
536                         if (switches[i].getID() == trigger)
537                         {
538                                 Logger log;
539                                 vector<string> output = { "Binding trigger ", id,
                                        " to trigger-switch", trigger };
540                                 log.logLine(output);
541
542                                 triggers[triggers.size() - 1].bindTrigger(&(
                                        switches[i]));
543
544                                 return true;
545                         }
546                 }
547         }
548
549         else if (triggerType == "TERMINAL")
550         {
551                 for (unsigned int i = 0; i < terminals.size(); i++)
552                 {
553                         if (terminals[i].getID() == trigger)
554                         {
555                                 Logger log;
556                                 vector<string> output = { "Binding trigger ", id,
                                        " to trigger-terminal", trigger };
557                                 log.logLine(output);
558
559                                 triggers[triggers.size() - 1].bindTrigger(&(
                                        terminals[i]));
560
561                                 return true;
562                         }
```

```
563                 }
564         }
565
566         return false;
567 }
568
569 bool Level::bindTarget(string id, string target, string targetType)
570 {
571
572         if (targetType == "SWITCH")
573         {
574                 for (unsigned int i = 0; i < switches.size(); i++)
575                 {
576                         if (switches[i].getID() == target)
577                         {
578                                 Logger log;
579                                 vector<string> output = { "Binding trigger ", id,
                                        " to target-switch", target };
580                                 log.logLine(output);
581
582                                 triggers[triggers.size() - 1].bindTarget(&(
                                        switches[i]));
583
584                                 return true;
585                         }
586                 }
587         }
588
589         else if (targetType == "TERMINAL")
590         {
591                 for (unsigned int i = 0; i < terminals.size(); i++)
592                 {
593                         if (terminals[i].getID() == target)
594                         {
595                                 Logger log;
596                                 vector<string> output = { "Binding trigger ", id,
                                        " to target-terminal", target };
597                                 log.logLine(output);
598
599                                 triggers[triggers.size() - 1].bindTarget(&(
                                        terminals[i]));
600
601                                 return true;
602                         }
603                 }
604         }
605
606         return false;
607 }
608
609 void Level::loadLevel(std::string levelName)
610 {
611         Logger log;
612         vector<string> output = { "Starting to load", levelName };
613         log.logLine(output);
614
```

```
615         if (quadratic == NULL)
616         {
617                 quadratic = gluNewQuadric();
618         }
619
620         currLevel = levelName;
621
622         // Connection to SQL database
623         sqlite3 *db;
624         // 1 if error with DB
625         int connectErr = sqlite3_open("Data.db", &db);
626
627         if (connectErr != SQLITE_OK)
628         {
629                 Logger log;
630                 log.logLine("FATAL ERROR: Can't access database");
631
632                 exit(DATABASE_ERROR);
633         }
634
635         loadWalls(db);
636         loadDoors(db);
637         loadCylinders(db);
638         loadTerminals(db);
639
640         // Loading switches must be after doors/terminals to properly bind
641         loadSwitches(db);
642
643         // Loading triggers must be done last to properly bind
644         loadTriggers(db);
645
646         // Closes the database
647         sqlite3_close(db);
648
649         output[0] = "Finished loading";
650         log.logLine(output);
651
652         Cam.resetCam();
653
654         interactivity = false;
655
656         // Get out of wall
657         for (unsigned int i = 0; i < 10; i++)
658         {
659                 Cam.moveForward(1);
660         }
661
662         // Go dim for 5 seconds
663         HUD.goDim(5);
664 }
665
666 void Level::displayLevel()
667 {
668         for (auto i : doors)
669         {
670                 i.Display();
```

```
671         }
672
673         for (auto i : cylinders)
674         {
675                 i.Display();
676         }
677
678         for (auto i : switches)
679         {
680                 i.Display();
681         }
682
683         for (auto i : terminals)
684         {
685                 i.Display();
686         }
687
688         for (auto i : walls)
689         {
690                 i.Display();
691         }
692 }
```

7.1.23 Logger.h

```
1  /************************************************************\
2   * Logger.h                                                 *
3   * This file was created by Jeremy Greenburg                *
4   * As part of The God Core game for the University of       *
5   * Tennessee at Martin's University Scholars Organization   *
6   *                                                          *
7   * This file contains the declaration of the Logger class   *
8   * Which writes messages to output.log because it's more    *
9   * Reliable than stdout                                     *
10  \************************************************************/
11
12  #ifndef LOGGER_H
13  #define LOGGER_H
14
15  // To help find the user's document folder
16  #include <shlobj.h>
17
18  // std::vector
19  #include <vector>
20  // std::string
21  #include <string>
22
23  class Logger
24  {
25  private:
26          // Path to the log file
27          char CHAR_PATH[MAX_PATH];
28          std::string LOG_PATH;
29
30  public:
31          Logger();
32          // Erases the log file, called at the beggining of the program
```

```
33          void nuke();
34          // Writes to the log, either multiple lines or one line
35          void logLine(std::vector<std::string> input);
36          void logLine(std::string input);
37          // Writes the Camera Coordinates to the log file
38          void logCamCoords();
39
40  };
41
42  #endif
```

7.1.24 Logger.cpp

```
1   /*************************************************************\
2    * Logger.cpp                                                *
3    * This file was created by Jeremy Greenburg                 *
4    * As part of The God Core game for the University of        *
5    * Tennessee at Martin's University Scholars Organization    *
6    *                                                           *
7    * This file contains the defintion of the Logger class.     *
8    * for more information, see Logger.h                        *
9   \*************************************************************/
10
11  // Class declaration
12  #include "Logger.h"
13  // For Cam coords
14  #include "Globals.h"
15  // File I/O
16  #include <fstream>
17
18  #include <iostream>
19
20  using namespace std;
21
22  Logger::Logger()
23  {
24          HRESULT ret = SHGetFolderPath(NULL, CSIDL_PERSONAL, NULL,
                SHGFP_TYPE_CURRENT, CHAR_PATH);
25          LOG_PATH = CHAR_PATH;
26          LOG_PATH += "\\The God Core\\output.log";
27  }
28
29  void Logger::nuke()
30  {
31          ofstream outfile(LOG_PATH); // Nukes everything within
32  }
33
34  void Logger::logLine(vector<string> input)
35  {
36          ofstream outfile(LOG_PATH, ios::app);
37
38          string output;
39
40          for (auto i : input)
41          {
42                  output += i;
43                  output += " ";
```

```
44          }
45          outfile << output << std::endl;
46  }
47
48  void Logger::logLine(string input)
49  {
50          ofstream outfile(LOG_PATH, ios::app);
51
52          outfile << input << std::endl;
53  }
54
55  void Logger::logCamCoords()
56  {
57          ofstream outfile(LOG_PATH, ios::app);
58
59          outfile << "Player Coordinates:\n";
60          outfile << "X: " << -Cam.x << endl;
61          outfile << "Y: " << -Cam.y << endl;
62          outfile << "Z: " << -Cam.z << endl;
63  }
```

7.1.25 MainMenu.h

```
1   /*************************************************************\
2   * MainMenu.h                                                  *
3   * This file was created by Jeremy Greenburg                   *
4   * As part of The God Core game for the University of          *
5   * Tennessee at Martin's University Scholars Organization      *
6   *                                                             *
7   * This file contains the decleration of the MainMenu class    *
8   * Which uses the Simple OpenGL Interface Library to load a    *
9   * png picture of the main menu, as well as provide button     *
10  * Interactivity                                               *
11  \*************************************************************/
12
13  #ifndef MAIN_MENU_H
14  #define MAIN_MENU_H
15
16  // For loading pictures
17  #include <SOIL.h>
18  // Inherit 2D functionality
19  #include "TwoD.h"
20
21  // Make OpenGL happy
22  #include <cstdlib>
23  // openGL API
24  #include <GL\glut.h>
25
26  class MainMenu : public TwoD
27  {
28  public:
29          // Loads the picture up in memory
30          MainMenu();
31          // Handles drawing to the screen
32          void display();
33          // Handles and processes mouse clicks
34          void getClick(double x, double y);
```

```
35
36 private:
37         // Draws the main picture
38         void drawMainPic();
39         // DEBUG: draws boxes around all buttons
40         void drawClickBoxes();
41         // What the picture is bound to
42         GLint texture;
43 };
44
45 #endif
```

7.1.26 MainMenu.cpp

```
1  /*************************************************************\
2   * MainMenu.cpp                                              *
3   * This file was created by Jeremy Greenburg                 *
4   * As part of The God Core game for the University of        *
5   * Tennessee at Martin's University Scholars Organization    *
6   *                                                           *
7   * This file contains the defintion of the MainMenu class.   *
8   * for more information, see MainMenu.h                      *
9  \*************************************************************/
10
11 // Class declaration
12 #include "MainMenu.h"
13 // isInMain
14 #include "Globals.h"
15 // Return codes
16 #include "Return.h"
17 // System log
18 #include "Logger.h"
19
20 #include "SaveManager.h"
21
22 using namespace std;
23
24 MainMenu::MainMenu()
25 {
26         texture = SOIL_load_OGL_texture
27                         (
28                                 "Resources\\Images\\Main.png",   // Image to load
29                                 SOIL_LOAD_AUTO,                                  //
                                        ???
30                                 SOIL_CREATE_NEW_ID,
31                                 SOIL_FLAG_MIPMAPS | SOIL_FLAG_NTSC_SAFE_RGB |
                                        SOIL_FLAG_COMPRESS_TO_DXT // !?!?!?!
32                         );
33
34         if (texture == 0)
35         {
36                 Logger log;
37                 vector<string> output = {"FATAL ERROR: SOIL cannot load image",
                        SOIL_last_result()};
38                 log.logLine(output);
39                 exit(SOIL_ERROR);
40         }
```

```
41 }
42
43 void MainMenu::drawMainPic()
44 {
45         glEnable(GL_TEXTURE_2D);
46
47         glBindTexture(GL_TEXTURE_2D, texture); // Prepares the texture for usage
48
49         glColor3d(1, 1, 1);
50         glBegin(GL_QUADS);
51         glTexCoord2d(0, 0);     glVertex2d(SCREENLEFT, SCREENTOP);
52         glTexCoord2d(0, 1); glVertex2d(SCREENLEFT, SCREENBOTTOM);
53         glTexCoord2d(1, 1); glVertex2d(SCREENRIGHT, SCREENBOTTOM);
54         glTexCoord2d(1, 0);     glVertex2d(SCREENRIGHT, SCREENTOP);
55
56         glEnd();
57
58         glDisable(GL_TEXTURE_2D);
59
60 }
61
62 void MainMenu::drawClickBoxes()
63 {
64         glColor3d(1, 0, 0);
65
66         // Start a new game
67         glBegin(GL_LINE_LOOP);
68         glVertex2d(SCREENRIGHT / 20.0, SCREENBOTTOM / 2.2);
69         glVertex2d(SCREENRIGHT / 20.0, SCREENBOTTOM / 1.9);
70         glVertex2d(SCREENRIGHT / 3.0, SCREENBOTTOM / 1.9);
71         glVertex2d(SCREENRIGHT / 3.0, SCREENBOTTOM / 2.2);
72         glEnd();
73
74         // Load game
75         glBegin(GL_LINE_LOOP);
76         glVertex2d(SCREENRIGHT / 10.0, SCREENBOTTOM / 1.57);
77         glVertex2d(SCREENRIGHT / 10.0, SCREENBOTTOM / 1.75);
78         glVertex2d(SCREENRIGHT / 3.5, SCREENBOTTOM / 1.75);
79         glVertex2d(SCREENRIGHT / 3.5, SCREENBOTTOM / 1.57);
80         glEnd();
81
82         // Options
83         glBegin(GL_LINE_LOOP);
84         glVertex2d(SCREENRIGHT / 8.5, SCREENBOTTOM / 1.35);
85         glVertex2d(SCREENRIGHT / 8.5, SCREENBOTTOM / 1.45);
86         glVertex2d(SCREENRIGHT / 3.9, SCREENBOTTOM / 1.45);
87         glVertex2d(SCREENRIGHT / 3.9, SCREENBOTTOM / 1.35);
88         glEnd();
89
90         // Exit
91
92         glBegin(GL_LINE_LOOP);
93         glVertex2d(SCREENRIGHT / 6.5, SCREENBOTTOM / 1.16);
94         glVertex2d(SCREENRIGHT / 6.5, SCREENBOTTOM / 1.25);
95         glVertex2d(SCREENRIGHT / 4.5, SCREENBOTTOM / 1.25);
96         glVertex2d(SCREENRIGHT / 4.5, SCREENBOTTOM / 1.16);
```

```
97          glEnd();
98  }
99
100 void MainMenu::getClick(double x, double y)
101 {
102         // Start new game
103         if (x >= SCREENRIGHT / 20.0 && x <= SCREENRIGHT / 3.0)
104         {
105                 if (y >= SCREENBOTTOM / 2.2 && y <= SCREENBOTTOM / 1.9)
106                 {
107                         isInMain = false;
108                         songNum = 1;
109                         changeSong = true;
110                         curr_level = "LEVELZERO";
111                         loading = true;
112                 }
113         }
114
115         // Load Game
116         if (x >= SCREENRIGHT / 10.0 && x <= SCREENRIGHT / 3.5)
117         {
118                 if (y >= SCREENBOTTOM / 1.75 && y <= SCREENBOTTOM / 1.57)
119                 {
120                         SaveManager Jesus; // Jesus Saves
121                         if (!Jesus.loadGame()); // null
122                         else isInMain = false;
123
124                 }
125         }
126
127         // Options
128         if (x >= SCREENRIGHT / 8.5 && x <= SCREENRIGHT / 3.9)
129         {
130                 if (y >= SCREENBOTTOM / 1.45 && y <= SCREENBOTTOM / 1.35)
131                 {
132                         // Jokes on me I never did get any options up
133                 }
134         }
135
136         // Exit
137         if (x >= SCREENRIGHT / 6.5 && x <= SCREENRIGHT / 4.5)
138         {
139                 if (y >= SCREENBOTTOM / 1.25 && y <= SCREENBOTTOM / 1.16)
140                 {
141                         exit(EXIT_OK);
142                 }
143         }
144 }
145
146 void MainMenu::display()
147 {
148         prepare2D();
149
150         drawMainPic();
151
152         // Disable once finished
```

```
153         //drawClickBoxes();
154
155         glEnd();
156
157         prepare3D();
158 }
```

7.1.27 MusicManager.h

```
 1 /************************************************************\
 2  * MusicManager.h                                           *
 3  * This file was created by Jeremy Greenburg                *
 4  * As part of The God Core game for the University of       *
 5  * Tennessee at Martin's University Scholars Organization   *
 6  *                                                          *
 7  * This file contains the declaration of the MusicManager   *
 8  * Class, which uses the FMOD API to load .mp3 files into   *
 9  * Memory, play them when called, and release the memory    *
10  * When the song is no longer needed.                       *
11 \************************************************************/
12
13 #ifndef MUSICMANAGER_H
14 #define MUSICMANAGER_H
15
16 // FMOD API
17 #include <fmod.hpp>
18
19 // Creates new type for ease of use
20 typedef FMOD::Sound* SoundClass;
21
22 class MusicManager
23 {
24 private:
25         // Pointer to dynamic system memory to load music
26         FMOD::System *m_pSystem;
27
28         // The path to the music folder
29         static const char* MUSIC_PATH;
30
31 public:
32         // Loads the song in memory
33         void makeSound(SoundClass *psound, const char *song);
34         // Plays the song (Always loops)
35         void playSound(SoundClass pSound, bool bLoop = true);
36         // Releases the song
37         void releaseSound(SoundClass psound);
38         // Initializes FMOD
39         MusicManager();
40 };
41
42 #endif
```

7.1.28 MusicManager.cpp

```
1 /************************************************************\
2  * MusicManager.cpp                                         *
3  * This file was created by Jeremy Greenburg                *
```

```
 * As part of The God Core game for the University of        *
 * Tennessee at Martin's University Scholars Organization    *
 *                                                           *
 * This file contains the definition of the MusicManager     *
 * Class. For more information, see MusicManager.h           *
\***********************************************************/

// Class definition
#include "MusicManager.h"

// Because concatenating char*'s are really hard
#include <string>

// Return codes
#include "Return.h"

// System log
#include "Logger.h"

using namespace std;

// Initialize the constant member of the class
const char* MusicManager::MUSIC_PATH = "Resources\\Music\\";

MusicManager::MusicManager()
{
        Logger log;
        if (FMOD::System_Create(&m_pSystem) != FMOD_OK)
        {
                log.logLine("FATAL ERROR: FMOD unable to create system");
                exit(FMOD_ERROR);
        }

        int driverCount = 0;
        m_pSystem->getNumDrivers(&driverCount);

        // If you have no driver, you have bigger problems to worry about
        if (driverCount == 0)
        {
                // Report Error
                log.logLine("ERROR: FMOD unable to detect drivers");
                exit(FMOD_ERROR);
        }

        log.logLine("FMOD succesfully initialized");
        // Initialize our Instance with 36 Channels
        m_pSystem->init(36, FMOD_INIT_NORMAL, NULL);
}

void MusicManager::makeSound(SoundClass *psound, const char *song)
{
        // MUSIC_PATH is placed in a nice string. Good string. Strings are friends
        string fullPath = MUSIC_PATH;
        // Now there is a full path to the song
        fullPath += song;

```

```
60          m_pSystem->createSound(fullPath.c_str(), FMOD_DEFAULT, 0, psound);
61  }
62
63  void MusicManager::playSound(SoundClass pSound, bool bLoop)
64  {
65          if (!bLoop)
66                  pSound->setMode(FMOD_LOOP_OFF);
67          else
68          {
69                  pSound->setMode(FMOD_LOOP_NORMAL);
70                  pSound->setLoopCount(-1);
71          }
72
73          m_pSystem->playSound(pSound, NULL , false, 0);
74  }
75
76  void MusicManager::releaseSound(SoundClass pSound)
77  {
78          pSound->release();
79  }
```

7.1.29 Plane.h

```
1   /************************************************************\
2    * Plane.h                                                  *
3    * This file was created by Jeremy Greenburg                *
4    * As part of The God Core game for the University of       *
5    * Tennessee at Martin's University Scholars Organization   *
6    *                                                          *
7    * This file contains the declaration of the Plane class    *
8    * Which is used to hold the details of a 2D Plane and      *
9    * draw  it to the screen                                   *
10  \************************************************************/
11
12  #ifndef Plane_H
13  #define Plane_H
14
15  class Plane
16  {
17  private:
18          // Arrays containing the color and vertices of the Plane
19          double color[4];
20          // What axis is it aligned on (x y z)
21          char axis;
22          // The vertices of the corners
23          double vertices[12];
24  public:
25
26          // Paramaterized constructor, as there cannot be a Plane without vertices
27          // Can take an axis or can ignore exis
28          Plane(const double(&new_vertices)[12], const double(&new_color)[4], char
                _axis);
29          Plane(const double(&new_vertices)[12], const double(&new_color)[4]);
30
31          // Part of the plane equation, calculated in constructor
32          double a, b, c, d;
33
```

```
34          // Determines if the player is in the bounds of the Plane (based on axis)
35          bool isInBounds();
36
37          // Returns the plane norm (Perpindicular line)
38          double getNorm();
39
40          // Mutate's the rectangles coordinates for the end of the game
41          void mutate();
42
43          // Print a Plane in 3D
44          void Display();
45          // Print a Plane in 2D
46          void Display2D();
47  };
48
49  #endif
```

7.1.30 Plane.cpp

```
1   /*************************************************************\
2    * Plane.cpp                                                 *
3    * This file was created by Jeremy Greenburg                 *
4    * As part of The God Core game for the University of        *
5    * Tennessee at Martin's University Scholars Organization    *
6    *                                                           *
7    * This file contains the definition of the Plane class      *
8    * For more information, see Plane.h                         *
9   \*************************************************************/
10
11  #include "Plane.h"
12
13  // For std::copy
14  #include <iterator>
15  #include <utility>
16
17  // max and min
18  #include <algorithm>
19
20  // OpenGL API
21  #include <GL\glut.h>
22
23  // For Cam coords
24  #include "Globals.h"
25
26  using namespace std;
27
28  Plane::Plane(const double (&new_vertices)[12], const double (&new_color)[4], char
        _axis)
29  {
30          // Copies the color
31          copy(begin(new_color), end(new_color), color);
32
33          // Copies the vertices
34          copy(begin(new_vertices), end(new_vertices), vertices);
35
36
37          // Somedays I wonder what I'm even doing \\
```

```
38          // When I forget what all this means: http://keisan.casio.com/exec/system
                /1223596129 \\
39
40          // Calculate vector equation ax + by + cz + d = 0
41          // Get two vectors from three of the corners
42          double AB[] = { vertices[3] - vertices[0], vertices[4] - vertices[1],
                vertices[5] - vertices[2] };
43          double AC[] = { vertices[6] - vertices[0], vertices[7] - vertices[1],
                vertices[8] - vertices[2] };
44          // Cross Product of AB and AC
45          a = (AB[1] * AC[2]) - (AB[2] * AC[1]);
46          b = (AB[2] * AC[0]) - (AB[0] * AC[2]);
47          c = (AB[0] * AC[1]) - (AB[1] * AC[0]);
48          d = (a * vertices[0] + b * vertices[1] + c * vertices[2]);
49
50          axis = _axis;
51  }
52
53  Plane::Plane(const double(&new_vertices)[12], const double(&new_color)[4])
54  {
55          // Copies the color
56          copy(begin(new_color), end(new_color), color);
57
58          // Copies the vertices
59          copy(begin(new_vertices), end(new_vertices), vertices);
60
61
62          // Somedays I wonder what I'm even doing \\
63                  // When I forget what all this means: http://keisan.casio.com/exec
                        /system/1223596129 \\
64
65  // Calculate vector equation ax + by + cz + d = 0
66  // Get two vectors from three of the corners
67          double AB[] = { vertices[3] - vertices[0], vertices[4] - vertices[1],
                vertices[5] - vertices[2] };
68          double AC[] = { vertices[6] - vertices[0], vertices[7] - vertices[1],
                vertices[8] - vertices[2] };
69          // Cross Product of AB and AC
70          a = (AB[1] * AC[2]) - (AB[2] * AC[1]);
71          b = (AB[2] * AC[0]) - (AB[0] * AC[2]);
72          c = (AB[0] * AC[1]) - (AB[1] * AC[0]);
73          d = (a * vertices[0] + b * vertices[1] + c * vertices[2]);
74
75          axis = 0;
76  }
77
78  void Plane::Display()
79  {
80          // Set's OpenGL's color to the color of the Plane
81          glColor4f(color[0], color[1], color[2], color[3]);
82
83          glBegin(GL_QUADS);
84          glVertex3d(vertices[0], vertices[1], vertices[2]);
85          glVertex3d(vertices[3], vertices[4], vertices[5]);
86          glVertex3d(vertices[6], vertices[7], vertices[8]);
87          glVertex3d(vertices[9], vertices[10], vertices[11]);
```

```
88          glEnd();
89  }
90
91  void Plane::Display2D()
92  {
93          glColor4f(color[0], color[1], color[2], color[3]);
94
95          glBegin(GL_QUADS);
96          glVertex2d(vertices[0], vertices[1]);
97          glVertex2d(vertices[3], vertices[4]);
98          glVertex2d(vertices[6], vertices[7]);
99          glVertex2d(vertices[9], vertices[10]);
100         glEnd();
101 }
102
103 bool Plane::isInBounds()
104 {
105         if (axis == 'x')
106         {
107                 vector<double> X = { vertices[0], vertices[3], vertices[6],
                        vertices[9] };
108                 double maxX = *max_element(X.begin(), X.end());
109                 double minX = *min_element(X.begin(), X.end());
110
111                 return (-Cam.x <= maxX && -Cam.x >= minX);
112
113         }
114
115         else if (axis == 'y')
116         {
117                 vector<double> Y = { vertices[1], vertices[4], vertices[7],
                        vertices[10] };
118                 double maxY = *max_element(Y.begin(), Y.end());
119                 double minY = *min_element(Y.begin(), Y.end());
120
121                 return (-Cam.y <= maxY && -Cam.x >= minY);
122         }
123
124         else if (axis == 'z')
125         {
126                 vector<double> Z = { vertices[2], vertices[5], vertices[8],
                        vertices[11] };
127                 double maxZ = *max_element(Z.begin(), Z.end());
128                 double minZ = *min_element(Z.begin(), Z.end());
129
130                 return (-Cam.z <= maxZ && -Cam.z >= minZ);
131         }
132         else return false;
133 }
134
135 double Plane::getNorm()
136 {
137         return sqrt(a * a + b * b + c * c);
138 }
139
140 void Plane::mutate()
```

```
{
        // We're gonna mess stuff up, disable the axis so nothing funky happens
            with collision
        axis = ' ';

        for (unsigned int i = 0; i < 12; i++)
        {
                // 0 <= mutator <= 200
                double mutator = rand() % 201;
                // -100 <= mutator <= 100
                mutator -= 100;
                // -.01 <= mutator <= .01
                mutator /= 10000;

                vertices[i] += mutator;
        }
}
```

7.1.31 Return.h

```
/************************************************************\
 * Return.h                                                 *
 * This file was created by Jeremy Greenburg                *
 * As part of The God Core game for the University of       *
 * Tennessee at Martin's University Scholars Organization   *
 *                                                          *
 * This file contains varius return codes for when things   *
 * Go horribly wrong (and they do)                          *
 * (just hopefully not during my senior defense)            *
\************************************************************/

#ifndef RETURN_H
#define RETURN_H

#define EXIT_OK 0 // Indicates an intended exit
#define EXIT_EARLY 1 // If we exit OpenGL main loop early
#define FMOD_ERROR 2 // Fmod can't load sound
#define DATABASE_ERROR 3 // sqlite can't load database
#define STATEMENT_ERROR 4 // sqlite statement fails to execute
#define SOIL_ERROR 5 // SOIl fails to load image
#define DATA_ENTRY_ERROR 6 // Indicates an internal error in a database entry
#define BINDING_ERROR 7 // Error binding a trigger
#define FILE_NOT_FOUND 8 // A file is not found

#endif
```

7.1.32 Resource.h

```
/************************************************************\
 * Return.h                                                 *
 * This file was created by Jeremy Greenburg                *
 * As part of The God Core game for the University of       *
 * Tennessee at Martin's University Scholars Organization   *
 *                                                          *
 * This file contains varius return codes for when things   *
 * Go horribly wrong (and they do)                          *
 * (just hopefully not during my senior defense)            *
```

```
\************************************************************/

#ifndef RETURN_H
#define RETURN_H

#define EXIT_OK 0 // Indicates an intended exit
#define EXIT_EARLY 1 // If we exit OpenGL main loop early
#define FMOD_ERROR 2 // Fmod can't load sound
#define DATABASE_ERROR 3 // sqlite can't load database
#define STATEMENT_ERROR 4 // sqlite statement fails to execute
#define SOIL_ERROR 5 // SOIl fails to load image
#define DATA_ENTRY_ERROR 6 // Indicates an internal error in a database entry
#define BINDING_ERROR 7 // Error binding a trigger
#define FILE_NOT_FOUND 8 // A file is not found

#endif
```

7.1.33 SaveManager.h

```
/************************************************************\
 * SaveManager.h                                            *
 * This file was created by Jeremy Greenburg                *
 * As part of The God Core game for the University of       *
 * Tennessee at Martin's University Scholars Organization   *
 *                                                          *
 * This file contains the declaration of the SaveManager    *
 * Class, which saves data by encrypting an array of strings *
 * And writing them to core.sav, or by reading in an array of*
 * Strings from core.sav and decrypting them                *
\************************************************************/

#ifndef SAVEMANAGER_H
#define SAVEMANAGER_H

// Windows API
#include <shlobj.h>

// Because concatenating char*'s is really hard
#include <string>

class SaveManager
{
private:
        // The path to core.sav
        char CHAR_PATH[MAX_PATH];
        std::string SAVE_PATH;

        // Takes an unencrypted string and returns an encrypted string
        std::string encrytData(std::string data);
        // Takes an encrypted string and returns a decrypted string
        std::string decryptData(std::string data);
public:
        SaveManager();
        // Writes the array of encrypted strings to core.sav
        void saveLevel();
        // Sets global variables to load game
        bool loadGame();
```

```
39          // Returns the decrypted string in core.sav
40          std::string readSave();
41          // Returns true if core.save exists
42          bool checkSave();
43  };
44
45  #endif
```

7.1.34 SaveManager.cpp

```
1   /*************************************************************\
2    * SaveManager.cpp                                           *
3    * This file was created by Jeremy Greenburg                 *
4    * As part of The God Core game for the University of        *
5    * Tennessee at Martin's University Scholars Organization    *
6    *                                                           *
7    * This file contains the definition of the SaveManager class*
8    * For more information, see SaveManager.h                   *
9   \*************************************************************/
10
11  // Class definition
12  #include "SaveManager.h"
13
14  // File I/O
15  #include <fstream>
16
17  #include "Globals.h"
18
19  #include "Logger.h"
20
21  using namespace std;
22
23  SaveManager::SaveManager()
24  {
25          HRESULT ret = SHGetFolderPath(NULL, CSIDL_PERSONAL, NULL,
                SHGFP_TYPE_CURRENT, CHAR_PATH);
26          SAVE_PATH = CHAR_PATH;
27          SAVE_PATH += "\\The God Core\\core.sav";
28  }
29
30  string SaveManager::encrytData(string data)
31  {
32          string ret_str;
33          for (unsigned int i = 0; i < data.length()*3; i+=3)
34          {
35                  ret_str += data[i/3] + 48;
36                  ret_str += data[i/3] - 48;
37                  ret_str += data[i/3] + 53;
38          }
39          return ret_str;
40  }
41
42  string SaveManager::decryptData(string data)
43  {
44          string ret_str;
45          for (unsigned int i = 0; i < data.length(); i+=3)
46          {
```

```
47                  ret_str += data[i] - 48;
48          }
49
50          return ret_str;
51  }
52
53  string SaveManager::readSave()
54  {
55          Logger log;
56
57          ifstream save(SAVE_PATH);
58          log.logLine("Checking Save integrity.");
59
60          string enc_data; // Encrypted Data
61          string dcr_data; // Decrypted Data
62          save >> enc_data;// Read encrypted data from file
63          dcr_data = decryptData(enc_data); // Decrypt data
64
65          vector<string> output{ "Decrypted Data: ", dcr_data };
66          log.logLine(output);
67
68          save.close();
69
70          return dcr_data;
71  }
72
73  void SaveManager::saveLevel()
74  {
75          ofstream save(SAVE_PATH);
76
77          string input = curr_level + " " + to_string(songNum);
78
79          string encr_str = encrytData(input);
80
81          save << encr_str;
82
83          save.close();
84  }
85
86  bool SaveManager::loadGame()
87  {
88          // might change to vector<string> later
89          string data = readSave();
90          size_t pos = data.find(' ');
91
92          if (pos == string::npos) return false;
93          string savedLevel = data.substr(0, pos);
94          int savedSong = stoi(data.substr(pos + 1));
95
96          int temp_levelNum = getLevelNum(savedLevel);
97
98          if (temp_levelNum == -1) return false;
99
100         levelNum = temp_levelNum;
101         curr_level = getLevelString(levelNum);
102         songNum = savedSong;
```

```
103
104         loading = true;
105         changeSong = true;
106
107         return true;
108 }
109
110 bool SaveManager::checkSave()
111 {
112         ifstream save(SAVE_PATH);
113
114         if (save)
115         {
116                 return true;
117         }
118
119         else
120         {
121                 return false;
122         }
123 }
```

7.1.35 Switch.h

```
1  /************************************************************\
2   * Switch.h                                                 *
3   * This file was created by Jeremy Greenburg                *
4   * As part of The God Core game for the University of       *
5   * Tennessee at Martin's University Scholars Organization   *
6   *                                                          *
7   * This file contains the declaration of the Switch class   *
8   * Which is bound to a Door via pointer and can open and    *
9   * Close the door at will                                   *
10  \************************************************************/
11
12  #ifndef SWITCH_H
13  #define SWITCH_H
14
15  // Door class
16  #include "Door.h"
17  #include "PoweredObject.h"
18  // Terminal Class
19  #include "Terminal.h"
20
21  // Types
22  #include "GCTypes.h"
23
24  class Switch  : public PoweredObject
25  {
26  private:
27          void* target; // The door that this switch activates
28          // Translation and rotation coordinates
29          double translate[3], rotate[3];
30
31          // One of the predefined types
32          GCtype targetType;
33
```

```
34          // Unique ID
35          std::string id;
36
37  public:
38          // Initializes the translation and rotation matrices
39          Switch(const double(&_translate)[3], const double(&_rotate)[3], GCtype
                _type, std::string _id, bool _isOn);
40          // Binds the target pointer to an object
41          void assign(void* _target);
42          // Opens/Closes the door
43          void toggleTarget();
44          // Actually draws the switch
45          void Display();
46
47          // Get's the switch's ID
48          std::string getID();
49
50          // Gets the translation coordinates
51          double getX();
52          double getY();
53          double getZ();
54  };
55
56  #endif
```

7.1.36 Switch.cpp

```
1   /************************************************************\
2    * Switch.cpp                                                *
3    * This file was created by Jeremy Greenburg                 *
4    * As part of The God Core game for the University of        *
5    * Tennessee at Martin's University Scholars Organization    *
6    *                                                           *
7    * This file contains the definition of the Switch class     *
8    * For more information, see Switch.h                        *
9   \************************************************************/
10
11  // Class decleration
12  #include "Switch.h"
13
14  // Allows copying arrays
15  #include <iterator>
16  #include <utility>
17  #include <algorithm>
18
19  #include "Globals.h"
20
21  // OpenGL API
22  #include <GL\glut.h>
23
24  using namespace std;
25
26  Switch::Switch(const double(&_translate)[3], const double(&_rotate)[3], GCtype
        _type, string _id, bool _isOn)
27  {
28          // Copies the color
29          copy(begin(_translate), end(_translate), translate);
```

```
30
31          // Copies the vertices
32          copy(begin(_rotate), end(_rotate), rotate);
33
34          targetType = _type;
35
36          target = NULL;
37
38          id = _id;
39
40          if (_isOn) activate();
41          else deactivate();
42
43  }
44
45  void Switch::assign(void* _target)
46  {
47          target = _target;
48  }
49
50  void Switch::toggleTarget()
51  {
52          switch (targetType)
53          {
54                  case T_DOOR:
55                  {
56                          Door* t = (Door*)target;
57                          t->isOpen = !t->isOpen;
58                          break;
59                  }
60                  case T_TERMINAL:
61                  {
62                          Terminal* t = (Terminal*)target;
63                          t->toggle();
64                          break;
65                  }
66                  case T_LEVEL_END:
67                  {
68                          levelNum++;
69                          curr_level = getLevelString(levelNum);
70                          loading = true;
71
72                          // TEMP
73                          advanceMusic();
74                          changeSong = true;
75                  }
76          }
77  }
78
79  void Switch::Display()
80  {
81          glPushMatrix();
82          glTranslated(translate[0], translate[1], translate[2]);
83          glRotated(rotate[0], 1, 0, 0);
84          glRotated(rotate[1], 0, 1, 0);
85          glRotated(rotate[2], 0, 0, 1);
```

```
86
87          glColor3d(0.9, 0.9, 0.9);
88          glutSolidCube(.1);
89
90          switch (targetType)
91          {
92          case T_DOOR:
93                  glColor3d(0, 1, 0);
94                  break;
95          case T_TERMINAL:
96                  glColor3d(1, 0, 0);
97                  break;
98          default:
99                  glColor3d(0, 0, 1);
100         }
101
102         // If powered off, recolor to black
103         if (!checkIfOn()) glColor3d(0, 0, 0);
104
105         glScaled(.5, .5, 1.5);
106         glutSolidCube(.1);
107
108         glPopMatrix();
109 }
110
111 string Switch::getID()
112 {
113         return id;
114 }
115
116 double Switch::getX()
117 {
118         return translate[0];
119 }
120
121 double Switch::getY()
122 {
123         return translate[1];
124 }
125
126 double Switch::getZ()
127 {
128         return translate[2];
129 }
```

7.1.37 Terminal.h

```
1  /*************************************************************\
2   * Terminal.h                                                *
3   * This file was created by Jeremy Greenburg                 *
4   * As part of The God Core game for the University of        *
5   * Tennessee at Martin's University Scholars Organization    *
6   *                                                           *
7   * This file contains the declaration of the Terminal class  *
8   * Which draws and manages ingame computer terminals         *
9   * And has nothing to do with terminal illness I swear       *
10  \*************************************************************/
```

```
11
12 #ifndef TERMINAL_H
13 #define TERMINAL_H
14
15 #include "TwoD.h" // To inherit 2D class
16 #include "PoweredObject.h"
17
18 #include <cstdlib>
19
20 // For loading pictures
21 #include <SOIL.h>
22
23 #include "TextEngine.h" // To display text to screen
24
25 #include <string>
26
27 #include <GL\glut.h>
28
29 class Terminal : public TwoD, public PoweredObject // Inherit 2D functionality and
       power functionality
30 {
31 private:
32         // text = what the user is typing, input = completed input
33         std::string currentInput, currentText, error, file;
34         std::vector<std::string> history, prompts, content;
35         std::string id;
36
37         // Where to print each item
38         const double INPUT_LINE = SCREENBOTTOM / 7.0;
39         const double ERROR_LINE = INPUT_LINE - 30;
40         const double PROMPT_START = INPUT_LINE + 30;
41         const double CONTENT_START = PROMPT_START + 150;
42
43         // The banner texture
44         GLint bTexture;
45
46         // The user inputed number
47         int num;
48
49         // Print our text
50         TextEngine text;
51
52         // Translation and rotation matrices
53         double translate[3], rotate[3];
54
55         // Draws the actual terminal
56         void draw();
57
58         // Draws a standing terminal
59         void drawStanding();
60
61         // Draws a wall mounter terminal
62         void drawWallMounted();
63
64         // Processes the user input
65         void processInput();
```

```
66
67          // Parse the terminal file
68          void parseFile();
69
70          // The path to the Terminal Files
71          static const char* TERM_PATH;
72
73  public:
74          // Draws the 3D object in the world
75          void Display();
76          // Draws the 2D Terminal screen
77          void DisplayScreen();
78          // Shows the currently typed string
79          void getText(std::string text);
80          // Signifies a completed string to process
81          void getInput(std::string text);
82          // Returns an item in the terminal's log
83          std::string getHist(int count);
84          // Returns the number of items in the terminal's log
85          int getHistNum();
86
87          // Gets the translation coordinates
88          double getX();
89          double getY();
90          double getZ();
91
92          // Get the terminal's ID
93          std::string getID();
94
95          // To construct and initialize the terminal
96          Terminal(const double(&_translate)[3], const double(&_rotate)[3], std::
                string _file, std::string _id);
97
98  };
99
100 #endif
```

7.1.38 Terminal.cpp

```
1   /*************************************************************\
2    * Terminal.cpp                                              *
3    * This file was created by Jeremy Greenburg                 *
4    * As part of The God Core game for the University of        *
5    * Tennessee at Martin's University Scholars Organization    *
6    *                                                           *
7    * This file contains the definition of the Terminal class   *
8    * For more information, see Terminal.h                      *
9   \*************************************************************/
10
11  //
12  // Class declaration
13  #include "Terminal.h"
14
15  // Planes
16  #include "Plane.h"
17
18  // For system logging
```

```
19 #include "Logger.h"
20
21 // Return codes
22 #include "Return.h"
23
24 // Global variables
25 #include "Globals.h"
26
27 // Logger
28 #include "Logger.h"
29
30 // File I/O
31 #include <fstream>
32
33 using namespace std;
34
35 const char* Terminal::TERM_PATH = "Resources\\Text\\";
36
37 void Terminal::getText(std::string text)
38 {
39         currentText = text;
40 }
41
42 void Terminal::getInput(std::string text)
43 {
44         currentInput = text;
45 }
46
47 string Terminal::getHist(int count)
48 {
49         int size = history.size();
50         if (history.empty())
51         {
52                 return "";
53         }
54
55         // If, somehow, a fool manages to get a variable that is out of bounds
56
57         else if (count >= size)
58         {
59                 return history.back();
60         }
61
62         else if (count < 0)
63         {
64                 return history.front();
65         }
66
67         else
68         {
69                 return history[size - count - 1];
70         }
71 }
72
73 int Terminal::getHistNum()
74 {
```

```
75          return history.size();
76  }
77
78  void Terminal::draw()
79  {
80          // Completely black background
81          double colors[4] = { 0, 0, 0, 1 };
82          double vertices[12] =
83          {
84                  SCREENLEFT, SCREENTOP, -1,
85                  SCREENLEFT, SCREENBOTTOM, -1,
86                  SCREENRIGHT, SCREENBOTTOM, -1,
87                  SCREENRIGHT, SCREENTOP, -1
88          };
89
90          Plane background{ vertices, colors};
91          background.Display2D();
92
93
94          // Gotta do the banner manually
95          glEnable(GL_TEXTURE_2D);
96
97          glBindTexture(GL_TEXTURE_2D, bTexture); // Prepares the texture for usage
98
99          glColor3d(1, 1, 1);
100         glBegin(GL_QUADS);
101         glTexCoord2d(0, 0);     glVertex2d(SCREENLEFT, SCREENTOP);
102         glTexCoord2d(0, 1); glVertex2d(SCREENLEFT, SCREENBOTTOM / 9.0);
103         glTexCoord2d(1, 1); glVertex2d(SCREENRIGHT, SCREENBOTTOM / 9.0);
104         glTexCoord2d(1, 0);     glVertex2d(SCREENRIGHT, SCREENTOP);
105
106         glEnd();
107
108         glDisable(GL_TEXTURE_2D);
109 }
110
111 void Terminal::DisplayScreen()
112 {
113         prepare2D();
114
115         draw();
116
117         // If we need to proces a command
118         if (currentInput != "")
119         {
120                 processInput();
121
122                 history.push_back(currentInput);
123
124                 currentInput.clear();
125         }
126
127         else
128         {
129                 // Print all prompts
130                 for (unsigned int i = 0; i < prompts.size(); i++)
```

```
131                 {
132                         text.printString(SCREENLEFT, PROMPT_START + 20 * i, 0, 1,
                                0, prompts[i]);
133                 }
134
135                 // Print an error
136                 text.printString(SCREENLEFT, ERROR_LINE, 1, 0, 0, error);
137                 // Echo user text
138                 text.printString(SCREENLEFT, INPUT_LINE, 0, 1, 0, ":> " +
                        currentText);
139
140                 // If needed, print content
141                 if (num != -1 && num < (signed int)content.size())
142                 {
143                         text.openFile(SCREENLEFT, CONTENT_START, 0, 1, 0, file,
                                content[num]);
144                 }
145         }
146
147         prepare3D();
148 }
149
150 void Terminal::processInput()
151 {
152         error = "";
153         if (currentInput == "exit" || currentInput == "Exit")
154         {
155                 isInTerminal = false;
156                 history.clear();
157         }
158
159         else if (currentInput == "clear" || currentInput == "Clear")
160         {
161                 num = -1;
162         }
163
164         else if (currentInput == "help" || currentInput == "Help")
165         {
166                 num = 0;
167         }
168
169         else
170         {
171                 string first, last;
172                 size_t pos = currentInput.find(" ");
173
174                 first = currentInput.substr(0, pos); // First half of string
175                 last = currentInput.substr(pos + 1); // Second half of string
176
177                 if (first == "read" || first == "Read")
178                 {
179                         num = atoi(last.c_str());
180                         if (num <= 0 || num >= (signed int)prompts.size())
181                         {
182                                 error = "ERROR: Invalid file number";
183                                 num = -1;
```

```
184                         }
185                 }
186
187                 else
188                 {
189                         error = "ERROR: Invalid Command: " + currentInput;
190                         num = -1;
191                 }
192         }
193 }
194
195 void Terminal::Display()
196 {
197         // Add two styles - Standing and wall mounted
198         glPushMatrix();
199
200         // Initial Positioning and rotation
201         glTranslated(translate[0], translate[1], translate[2]);
202         glRotated(rotate[0], 1, 0, 0);
203         glRotated(rotate[1], 0, 1, 0);
204         glRotated(rotate[2], 0, 0, 1);
205
206         //drawWallMounted();
207         drawStanding();
208
209         glPopMatrix();
210 }
211
212 void Terminal::drawStanding()
213 {
214         // Steel grey
215         glColor3d(.1, .1, .1);
216
217         // Draw Floor mount
218         glPushMatrix();
219         glTranslated(0, -1, 0);
220         glScaled(.5, .1, 1);
221         glutSolidCube(.5);
222         glPopMatrix();
223
224         // Draw leg
225         glPushMatrix();
226         glTranslated(0, -.6, 0);
227         glScaled(.1, .75, .1);
228         glutSolidCube(1);
229         glPopMatrix();
230
231         // Draw Monitor
232         glPushMatrix();
233         glScaled(.1, .5, .7);
234         glutSolidCube(1);
235
236         // Draw Screen
237         glPushMatrix();
238         // Change Screen based on power
239         if (checkIfOn())
```

```
240                     glColor3d(0, 1, 1);
241             else
242                     glColor3d(0, 0, 0);
243
244             glTranslated(-.3, 0, 0);
245             glutSolidCube(.7);
246
247             glPopMatrix();
248
249             glPopMatrix();
250     }
251
252     void Terminal::drawWallMounted()
253     {
254             glColor3d(0, 1, 1);
255             glutSolidSphere(1, 50, 50);
256     }
257
258     double Terminal::getX()
259     {
260             return translate[0];
261     }
262
263     double Terminal::getY()
264     {
265             return translate[1];
266     }
267
268     double Terminal::getZ()
269     {
270             return translate[2];
271     }
272
273     void Terminal::parseFile()
274     {
275             ifstream infile{ TERM_PATH + file};
276             string buff;
277
278             if (!infile)
279             {
280                     Logger log;
281                     vector<string> output = { "FATAL ERROR: File ", file, " NOT FOUND"
                            };
282                     log.logLine(output);
283                     exit(FILE_NOT_FOUND);
284             }
285
286             content.push_back("HELP"); // Help text is always the 0th tag in the
                terminals
287
288             getline(infile, buff);
289             prompts.push_back(buff); // Push back the file tag
290             getline(infile, buff);
291
292             while (buff != "<TAGS>")
293             {
```

```
294                 size_t pos = buff.find("--");
295                 if (pos != string::npos)
296                 {
297                         prompts.push_back(buff.substr(0, pos));
298                         content.push_back(buff.substr(pos + 3));
299                 }
300                 getline(infile, buff);
301         }
302
303 }
304
305 string Terminal::getID()
306 {
307         return id;
308 }
309
310 Terminal::Terminal(const double(&_translate)[3], const double(&_rotate)[3], string
        _file, string _id)
311 {
312         // Copies the color
313         copy(begin(_translate), end(_translate), translate);
314
315         // Copies the vertices
316         copy(begin(_rotate), end(_rotate), rotate);
317
318         bTexture = SOIL_load_OGL_texture
319                 (
320                         "Resources\\Images\\banner.png",   // Image to load
321                         SOIL_LOAD_AUTO,                                    // ???
322                         SOIL_CREATE_NEW_ID,
323                         SOIL_FLAG_MIPMAPS | SOIL_FLAG_COMPRESS_TO_DXT // !?!?!?!
324                         );
325
326         if (bTexture == 0)
327         {
328                 Logger log;
329                 vector<string> output = { "FATAL ERROR: SOIL cannot load terminal
                    banner", SOIL_last_result() };
330                 log.logLine(output);
331                 exit(SOIL_ERROR);
332         }
333
334         file = _file;
335
336         id = _id;
337
338         num = 0;
339
340         parseFile();
341 }
```

7.1.39 TextEngine.h

```
1  /*********************************************************\
2   * TextEngine.h                                          *
3   * This file was created by Jeremy Greenburg             *
4   * As part of The God Core game for the University of    *
```

```
 * Tennessee at Martin's University Scholars Organization    *
 *                                                           *
 * This file contains the declaration of the TextEngine class*
 * Which uses glutBitmapCharacter to print strings into the  *
 * OpenGL window.                                            *
\***********************************************************/

#ifndef TEXTENGINE_H
#define TEXTENGINE_H

// For string lengths in displaying text
#include <string>

// For multiple lines of text
#include <vector>

class TextEngine
{
private:
        // The path to the game's text files (.log's)
        static const char* TEXT_PATH;
        // The offset between lines of characters
        static const double LINE_OFFSET;

        void displayText(
                // 2d start location of the text
                double x, double y,
                // rgb color of text
                double r, double g, double b,
                // glut font and text to be displayed
                void* font,
                std::vector<std::string> text);

        // Searches a text file for text related to the tag, and returns all text
            within the tag
        std::vector<std::string> findText(std::string fileName, std::string tag);

public:
        // Takes the location to display the text, color of the text,
        // The file to read from, and a tag to search for
        void openFile(double x, double y, double r, double g, double b,
                std::string fileName, std::string tag);

        // Takes in a string to display
        void printString(double x, double y, double r, double g, double b,
                std::string text);

        // Returns text from fileName specified by tag
        std::vector<std::string> getText(std::string fileName, std::string tag);
};

#endif
```

7.1.40 TextEngine.cpp

```
/***********************************************************\
 * TextEngine.cpp                                          *
```

```
3   * This file was created by Jeremy Greenburg                 *
4   * As part of The God Core game for the University of        *
5   * Tennessee at Martin's University Scholars Organization    *
6   *                                                           *
7   * This file contains the definition of the TextEngine class *
8   * For more information, see TextEngine.h                    *
9   \***********************************************************/
10
11  // TextEngine declaration and std::string
12  #include "TextEngine.h"
13
14  // std::ifstream
15  #include <fstream>
16
17  // Standard I/O for debugging
18  #include <iostream>
19
20  // OpenGL API
21  #include <gl\glut.h>
22
23  using namespace std;
24
25  // Initializing the constants
26  const char* TextEngine::TEXT_PATH = "Resources\\Text\\";
27  const double TextEngine::LINE_OFFSET = 20;
28
29  void TextEngine::displayText(double x, double y,
30          double r, double g, double b,
31          void* font, vector<string> text)
32  {
33          vector<string>::iterator it;
34
35          // Iterates throguh the text vector and prints it to the screen
36          for (it = text.begin(); it != text.end(); it++)
37          {
38                  glColor3d(r, g, b);
39                  glRasterPos2d(x, y);
40
41                  for (unsigned int i = 0; i < it->length(); i++)
42                  {
43                          glutBitmapCharacter(font, (*it)[i]);
44                  }
45
46                  // Because glut does not print newlines
47                  y += LINE_OFFSET;
48          }
49  }
50
51  vector<string> TextEngine::findText(string fileName, string tag)
52  {
53          // The tags are listed between dollar signs
54          string fullTag = '$' + tag + '$';
55
56          string fullPath = TEXT_PATH + fileName;
57
58          ifstream infile(fullPath);
```

```
59
60          // Buffer to read in data
61          string buff;
62          // Array to store strings
63          vector<string> data;
64
65          // Find the string(s) to read in
66          getline(infile, buff);
67          while (infile && buff != fullTag)
68          {
69                  getline(infile, buff);
70          }
71
72          // Store the string(s)
73          getline(infile, buff);
74          while (infile && buff != "$END$")
75          {
76                  data.push_back(buff);
77                  getline(infile, buff);
78          }
79
80          infile.close();
81
82          return data;
83  }
84
85  void TextEngine::openFile(double x, double y,
86          double r, double g, double b,
87          string fileName, string tag)
88  {
89          vector<string> input = findText(fileName, tag);
90
91          displayText(x, y, r, g, b,
92                  GLUT_BITMAP_HELVETICA_18,
93                  input);
94  }
95
96  vector<string> TextEngine::getText(string fileName, string tag)
97  {
98          vector<string> input = findText(fileName, tag);
99
100         return input;
101 }
102
103 void TextEngine::printString(double x, double y, double r, double g, double b,
104         string text)
105 {
106         glColor3d(r, g, b);
107         glRasterPos2d(x, y);
108
109         for (unsigned int i = 0; i < text.length(); i++)
110         {
111                 glutBitmapCharacter(GLUT_BITMAP_HELVETICA_18, text[i]);
112         }
113
114         // Vertical spacing
```

```
115         y += LINE_OFFSET;
116 }
```

7.1.41 Triangle.h

```
 1 /*************************************************************\
 2  * Triangle.h                                                *
 3  * This file was created by Jeremy Greenburg                 *
 4  * As part of The God Core game for the University of        *
 5  * Tennessee at Martin's University Scholars Organization    *
 6  *                                                           *
 7  * This file contains the declaration of the Triangle class  *
 8  * Which is used to hold the details of a 2D Triangle and    *
 9  * draw  it to the screen                                    *
10 \*************************************************************/
11
12 #ifndef TRIANGLE_H
13 #define TRIANGLE_H
14
15 class Triangle
16 {
17 private:
18         // Arrays containing the colors and the xyz vertices of the triangles
19         double color[4], vertices[9];
20 public:
21         // Takes in the vertices and color of the triangle
22         Triangle(const double(&new_vertices)[9], const double(&new_color)[4]);
23         // Print the triangle in 3D
24         void Display();
25         // Print the triangle in 2D
26         void Display2D();
27 };
28
29 #endif
```

7.1.42 Triangle.cpp

```
 1 /*************************************************************\
 2  * Triangle.h                                                *
 3  * This file was created by Jeremy Greenburg                 *
 4  * As part of The God Core game for the University of        *
 5  * Tennessee at Martin's University Scholars Organization    *
 6  *                                                           *
 7  * This file contains the definition of the triangle class   *
 8  * For more information, see Triangle.h                      *
 9 \*************************************************************/
10
11 // Class declaration
12 #include "Triangle.h"
13
14 // For std::copy
15 #include <iterator>
16 #include <utility>
17
18 // OpenGL API
19 #include <GL\glut.h>
20
```

```
21 using namespace std;
22
23
24 Triangle::Triangle(const double(&new_vertices)[9], const double(&new_color)[4])
25 {
26         // Copies the color entry
27         copy(begin(new_color), end(new_color), color);
28
29         // Copies the vertices
30         copy(begin(new_vertices), end(new_vertices), vertices);
31 }
32
33 void Triangle::Display()
34 {
35         // Sets OpenGL's color to the triangle's color
36         glColor4f(color[0], color[1], color[2], color[3]);
37
38         // Draws the triangle
39         glBegin(GL_TRIANGLES);
40         glVertex3d(vertices[0], vertices[1], vertices[2]);
41         glVertex3d(vertices[3], vertices[4], vertices[5]);
42         glVertex3d(vertices[6], vertices[7], vertices[8]);
43         glEnd();
44 }
45
46 void Triangle::Display2D()
47 {
48         // Set's OpenGL's color to the triangle's color
49         glColor4f(color[0], color[1], color[2], color[3]);
50
51         // Draw's the triangle without the Z vertices
52         glBegin(GL_TRIANGLES);
53         glVertex2d(vertices[0], vertices[1]);
54         glVertex2d(vertices[3], vertices[4]);
55         glVertex2d(vertices[6], vertices[7]);
56         glEnd();
57 }
```

7.1.43 Trigger.h

```
1  /************************************************************\
2   * Trigger.h                                                *
3   * This file was created by Jeremy Greenburg                *
4   * As part of The God Core game for the University of       *
5   * Tennessee at Martin's University Scholars Organization   *
6   *                                                          *
7   * This file contains the declaration of the Trigger class  *
8   * Which can be bound to a trigger-object that, upon use,   *
9   * Will activate a designated target-object.                *
10  \************************************************************/
11
12 #ifndef TRIGGER_H
13 #define TRIGGER_H
14
15 #include "Terminal.h"
16 #include "Switch.h"
17
```

```
18 #include "GCTypes.h"
19
20 class Trigger
21 {
22 private:
23         void* trigger; // The object that activates the target
24         void* target;  // The object that is activated by the target
25
26         GCtype triggerType; // The type (defined from GCtypes.h) of the trigger
27         GCtype targetType;  // The type(defined from GCtypes.h) of the target
28
29         void activateTarget();
30
31 public:
32         // Get the object type of the trigger
33         int getTriggerType();
34         // Attempts to trigger the target
35         bool tryToTrigger(void* input, GCtype type);
36         // Binds the triggering object
37         void bindTrigger(void* _trigger);
38         // Binds the target object
39         void bindTarget(void* _target);
40         // Constructor takes in trigger type and target type
41         Trigger(GCtype _triggerType, GCtype _targetType);
42
43 };
44
45 #endif
```

7.1.44 Trigger.cpp

```
1  /*************************************************************\
2   * Trigger.cpp                                               *
3   * This file was created by Jeremy Greenburg                 *
4   * As part of The God Core game for the University of        *
5   * Tennessee at Martin's University Scholars Organization    *
6   *                                                           *
7   * This file contains the definition of the Trigger class    *
8   * For more information, see Trigger.h                       *
9  \*************************************************************/
10
11 #include <cstdlib>
12 #include "Trigger.h"
13
14 int Trigger::getTriggerType()
15 {
16         return triggerType;
17 }
18
19 void Trigger::activateTarget()
20 {
21         switch (targetType)
22         {
23                 case T_TERMINAL:
24                 {
25                         Terminal* t = (Terminal*)target;
26                         t->activate();
```

```
27                          break;
28                  }
29                  case T_SWITCH:
30                  {
31                          Switch* s = (Switch*)target;
32                          s->activate();
33                          break;
34                  }
35                  default:
36                  {
37                          break;
38                  }
39          }
40  }
41
42  bool Trigger::tryToTrigger(void* input, GCtype type)
43  {
44          // If this trigger is the correct type
45          if (triggerType != type) return false;
46
47          // If this trigger is the correct object
48          if (trigger != input) return false;
49
50          activateTarget();
51
52          return true;
53  }
54
55  void Trigger::bindTrigger(void* _trigger)
56  {
57          trigger = _trigger;
58  }
59
60  void Trigger::bindTarget(void* _target)
61  {
62          target = _target;
63  }
64
65  Trigger::Trigger(GCtype _triggerType, GCtype _targetType)
66  {
67          trigger = NULL;
68          target = NULL;
69          triggerType = _triggerType;
70          targetType = _targetType;
71  }
```

7.1.45 Triple.h

```
1  /*************************************************************\
2   * Triple.h                                                  *
3   * This file was created by Jeremy Greenburg                 *
4   * As part of The God Core game for the University of        *
5   * Tennessee at Martin's University Scholars Organization    *
6   *                                                           *
7   * This file contains the declaration of the Triple class    *
8   * Which is just a simple 3-tuple really                     *
9   \*************************************************************/
```

```
10
11 #ifndef TRIPLE_H
12 #define TRIPLE_H
13
14 class Triple
15 {
16 public:
17         double a, b, c;
18 };
19
20 // For converting to a triple
21 Triple makeTrip(double _a, double _b, double _c);
22
23 #endif
```

7.1.46 Triple.cpp

```
1  /*************************************************************\
2   * Triple.cpp                                                *
3   * This file was created by Jeremy Greenburg                 *
4   * As part of The God Core game for the University of        *
5   * Tennessee at Martin's University Scholars Organization    *
6   *                                                           *
7   * This file contains the definition of the TwoD class       *
8   * For more information, see Triple.h                        *
9   \*************************************************************/
10
11 #include "Triple.h"
12
13 Triple makeTrip(double _a, double _b, double _c)
14 {
15         Triple ret;
16         ret.a = _a;
17         ret.b = _b;
18         ret.c = _c;
19
20         return ret;
21 }
```

7.1.47 TwoD.h

```
1  /*************************************************************\
2   * TwoD.h                                                    *
3   * This file was created by Jeremy Greenburg                 *
4   * As part of The God Core game for the University of        *
5   * Tennessee at Martin's University Scholars Organization    *
6   *                                                           *
7   * This file contains the declaration of the TwoD class      *
8   * Which is used to hold the data and functionality for      *
9   * Drawing in 2D with OpenGL                                 *
10  \*************************************************************/
11
12 #ifndef TWOD
13 #define TWOD
14
15 class TwoD
16 {
```

```
protected:
        // The pixel boundaries of the screen
        const double SCREENTOP = 0, SCREENBOTTOM = 1080,
                SCREENLEFT = 0, SCREENRIGHT = 1920;

        // Prepares OpenGL draw in 2D
        void prepare2D();

        // "Resets" OpenGL to draw in 3D
        void prepare3D();

};

#endif
```

7.1.48 TwoD.cpp

```
/************************************************************\
 * TwoD.cpp                                                 *
 * This file was created by Jeremy Greenburg                *
 * As part of The God Core game for the University of       *
 * Tennessee at Martin's University Scholars Organization   *
 *                                                          *
 * This file contains the definition of the TwoD class      *
 * For more information, see TwoD.h                         *
\************************************************************/

#include "TwoD.h"

// OpenGL API
#include <gl\glut.h>

void TwoD::prepare2D()
{
        // Disable depth testing
        glDisable(GL_DEPTH_TEST);
        // Disable writing to the z buffer
        glDepthMask(GL_FALSE);
        // Disables lighting
        glDisable(GL_LIGHTING);

        // Create an orthogonal matrix to write on
        glMatrixMode(GL_PROJECTION);
        glPushMatrix();
        glLoadIdentity();
        glOrtho(SCREENLEFT, SCREENRIGHT, SCREENBOTTOM, SCREENTOP, -1, 1);
        glMatrixMode(GL_MODELVIEW);
        glPushMatrix();
        glLoadIdentity();
}

void TwoD::prepare3D()
{
        // Discards the orthogonal matrices
        glMatrixMode(GL_PROJECTION);
        glPopMatrix();
        glMatrixMode(GL_MODELVIEW);
```

```
41          glPopMatrix();
42
43          // Enable depth testing
44          glEnable(GL_DEPTH_TEST);
45          // Enables writing to the z buffer
46          glDepthMask(GL_TRUE);
47          // Renable lighting
48          glEnable(GL_LIGHTING);
49  }
```

7.2 Database

7.2.1 Walls

ID	LEVEL	X1	X2	X3	X4	Y1	Y2	Y3	Y4	Z1	Z2	Z3	Z4	R	G	B	A	Axis
lvlceiling	LEVELZERO	-5	-5	8	8	1	1	1	1	-4	1	1	-4	0.70	0.70	0.70	1	0
lvlfloor	LEVELZERO	-5	-5	8	8	-1	-1	-1	-1	-4	1	1	-4	0.70	0.70	0.70	1	0
room0frntlftwall	LEVELZERO	5	5	5	5	-1	1	1	-1	-4	-4	-2.5	-2.5	0.29	0.29	0.29	1	z
room0frntrghtwall	LEVELZERO	5	5	5	5	-1	1	1	-1	-0.5	-0.5	1	1	0.29	0.29	0.29	1	z
room0backwall	LEVELZERO	-5	-5	-5	-5	-1	1	1	-1	-4	-4	1	1	0.29	0.29	0.29	1	z
room0rghtwall	LEVELZERO	-5	-5	5	5	-1	1	1	-1	1	1	1	1	0.29	0.29	0.29	1	x
room0frnttopwall	LEVELZERO	5	5	5	5	0.5	1	1	0.5	-2.5	-2.5	-0.5	-0.5	0.29	0.29	0.29	1	z
room1lftwall	LEVELZERO	5	5	8	8	-1	1	1	-1	-4	-4	-4	-4	0.29	0.29	0.29	1	x
room1rghtwall	LEVELZERO	5	5	8	8	-1	1	1	-1	1	1	1	1	0.29	0.29	0.29	1	x
room1frntbotwall	LEVELZERO	8	8	8	8	-1	-0.5	-0.5	-1	-4	-4	1	1	0.29	0.29	0.29	1	z
room1frnttopwall	LEVELZERO	8	8	8	8	0.5	1	1	0.5	-4	-4	1	1	0.29	0.29	0.29	1	z
room0lftlftwall	LEVELZERO	-5	-5	-1.5	-1.5	-1	1	1	-1	-4	-4	-4	-4	0.29	0.29	0.29	1	x
room0lftrghtwall	LEVELZERO	1.5	1.5	5	5	-1	1	1	-1	-4	-4	-4	-4	0.29	0.29	0.29	1	x
room0lfttopwall	LEVELZERO	-1.5	-1.5	1.5	1.5	0.70	1	1	0.70	-4	-4	-4	-4	0.29	0.29	0.29	1	x
room0frntmidwall	LEVELZERO	8	8	8	8	0.5	-0.5	-0.5	0.5	-4	-4	1	1	0.12	0.56	1	0.60	z
lvl1Floor	LEVELONE	30	30	-30	-30	-1	-1	-1	-1	40	-5	-5	40	0.70	0.70	0.70	1	0
lv1HangarCeiling	LEVELONE	15	15	-15	-15	5	5	5	5	5	-5	-5	5	0.70	0.70	0.70	1	0
lv1HangerFrntLeftWall	LEVELONE	15	15	1	1	-1	5	5	-1	5	5	5	5	0.80	0	0	1	x
lv1HangerFrntRghtWall	LEVELONE	-1	-1	-15	-15	-1	5	5	-1	5	5	5	5	0.80	0	0	1	x
lvl1HangerFrntTopWall	LEVELONE	1	1	-1	-1	1	5	5	1	5	5	5	5	0.80	0	0	1	x
lvl1HangerRghtWall	LEVELONE	-15	-15	-15	-15	-1	5	5	-1	5	5	-5	-5	0.80	0	0	1	z
lvl1HangerLeftWall	LEVELONE	15	15	15	15	-1	5	5	-1	5	5	-5	-5	0.80	0	0	1	z
lvl1HangerBckWall	LEVELONE	15	15	-15	-15	-1	5	5	-1	-5	-5	-5	-5	0.12	0.56	1	0.402	x
lvl1HallLftWall1	LEVELONE	3	3	3	3	-1	1	1	-1	5	5	11	11	0.80	0	0	1	z
lvl1HallRghtWall1	LEVELONE	-3	-3	-3	-3	-1	1	1	-1	5	5	8	8	0.80	0	0	1	z
lvl1HallLftWall2	LEVELONE	3	3	3	3	-1	1	1	-1	13	13	19	19	0.80	0	0	1	z
lvl1HallRghtWall2	LEVELONE	-3	-3	-3	-3	-1	1	1	-1	10	10	15	15	0.80	0	0	1	z
lvl1HallRghtWall3	LEVELONE	-3	-3	-3	-3	-1	1	1	-1	17	17	19	19	0.80	0	0	1	z
lvl1HallCeiling	LEVELONE	15	15	-15	-15	1	1	1	1	5	29	29	5	0.70	0.70	0.70	1	0
lvl1HallLftEnd	LEVELONE	7.5	7.5	1	1	-1	1	1	-1	19	19	19	19	0.80	0	0	1	x
lvl1HallRghtEnd	LEVELONE	-3	-3	-1	-1	-1	1	1	-1	19	19	19	19	0.80	0	0	1	x
lvl1LftRoom1LeftWall	LEVELONE	-3	-3	-15	-15	-1	1	1	-1	19	19	19	19	0.80	0	0	1	x
lvl1LftRoom1RghtWall	LEVELONE	-3	-3	-15	-15	-1	1	1	-1	12.5	12.5	12.5	12.5	0.80	0	0	1	x
lvl1LftRoomsBckWall	LEVELONE	-15	-15	-15	-15	-1	1	1	-1	19	19	5	5	0.80	0	0	1	z
lvl1Room4LeftWall	LEVELONE	7.5	7.5	7.5	7.5	-1	1	1	-1	19	19	29	29	0.80	0	0	1	z
lvl1Room4RghtWall	LEVELONE	-7.5	-7.5	-7.5	-7.5	-1	1	1	-1	19	19	29	29	0.80	0	0	1	z
lvl1Room3LeftWall	LEVELONE	20	20	20	20	-1	1	1	-1	10	10	-3	-3	0.80	0	0	1	z
lvl1Room3BckWall	LEVELONE	20	20	15	15	-1	1	1	-1	-3	-3	-3	-3	0.80	0	0	1	x
lvl1Room3FrntWall1	LEVELONE	20	20	6	6	-1	1	1	-1	10	10	10	10	0.80	0	0	1	x
lvl1Room3FrntWall2	LEVELONE	4	4	3	3	-1	1	1	-1	10	10	10	10	0.80	0	0	1	x
lvl1Room2LftWall	LEVELONE	7.5	7.5	7.5	7.5	-1	1	1	-1	19	19	10	10	0.80	0	0	1	z
lvl1Room3Ceiling	LEVELONE	20	20	15	15	1	1	1	1	-3	10	10	-3	0.70	0.70	0.70	1	0
lvl1Room4BckWallLft	LEVELONE	7.5	7.5	1	1	-1	1	1	-1	29	29	29	29	0.80	0	0	1	x
lvl1Room4BckWallRght	LEVELONE	-1	-1	-7.5	-7.5	-1	1	1	-1	29	29	29	29	0.80	0	0	1	x
lvl2Room0BckWallLft	LEVELTWO	5	5	1	1	-1	1	1	-1	2	2	2	2	0	0.80	0	1	x
lvl2Room0BckWallRght	LEVELTWO	-5	-5	-1	-1	-1	1	1	-1	2	2	2	2	0	0.80	0	1	x
lvl2Room0LftWallLft	LEVELTWO	-5	-5	-5	-5	-1	1	1	-1	2	2	1	1	0	0.80	0	1	z
lvl2Room0LftWallRght	LEVELTWO	-5	-5	-5	-5	-1	1	1	-1	-1	-1	-2	-2	0	0.80	0	1	z
Lvl2Room0FrtnWall	LEVELTWO	-5	-5	5	5	-1	1	1	-1	-2	-2	-2	-2	0	0.80	0	1	x
Lvl2Room0RghtwallLft	LEVELTWO	5	5	5	5	-1	1	1	-1	-2	-2	-1	-1	0	0.80	0	1	z
Lvl2Room0RghtWallRght	LEVELTWO	5	5	5	5	-1	1	1	-1	1	1	2	2	0	0.80	0	1	z
Lvl2Room0FakeDoor	LEVELTWO	-1	-1	1	1	-1	1	1	-1	2	2	2	2	0.29	0.29	0.29	1	x
Lvl2LftHallBckWall	LEVELTWO	-5	-5	-18	-18	-1	1	1	-1	1	1	1	1	0	0.80	0	1	x
lvl2RghtHallBckWall	LEVELTWO	5	5	18	18	1	-1	-1	1	1	1	1	1	0	0.80	0	1	x
Lvl2LftHallLftWall	LEVELTWO	-18	-18	-18	-18	1	-1	-1	1	1	1	-15	-15	0	0.80	0	1	z
lvl2RghtHallRghtWall	LEVELTWO	18	18	18	18	1	-1	-1	1	1	1	-15	-15	0	0.80	0	1	z
lvl2LftHallFrntWallRght	LEVELTWO	-5	-5	-9	-9	-0.5	0.5	0.5	-0.5	-1	-1	-1	-1	0	0.80	0	1	x
lvl2LftHallLftWall	LEVELTWO	-11	-11	-15	-15	-0.5	0.5	0.5	-0.5	-1	-1	-1	-1	0	0.80	0	1	x
lvl2LftHallTopStrip1	LEVELTWO	-5	-5	-15	-15	1	0.5	0.5	1	-1	-1	-1	-1	0	0.80	0	1	x
lvl2LftHallBotStrip1	LEVELTWO	-5	-5	-15	-15	-0.5	-1	-1	-0.5	-1	-1	-1	-1	0	0.80	0	1	x
lvl2RghtHallFrntWallLft	LEVELTWO	5	5	9	9	-0.5	0.5	0.5	-0.5	-1	-1	-1	-1	0	0.80	0	1	x
lvl2RghtHallFrntWallRght	LEVELTWO	11	11	15	15	-0.5	0.5	0.5	-0.5	-1	-1	-1	-1	0	0.80	0	1	x
lvl2RghtHallTopStrip1	LEVELTWO	5	5	15	15	0.5	1	1	0.5	-1	-1	-1	-1	0	0.80	0	1	x
lvl2RghtHallBotStrip1	LEVELTWO	5	5	15	15	-0.5	-1	-1	-0.5	-1	-1	-1	-1	0	0.80	0	1	x
lvl2LftRoomsRghtWall	LEVELTWO	-5	-5	-5	-5	1	-1	-1	1	-2	-2	-12	-12	0	0.80	0	1	z
lvl2RghtRoomsLftWall	LEVELTWO	5	5	5	5	1	-1	-1	1	-2	-2	-12	-12	0	0.80	0	1	z
lvl2LftHallBckWall2	LEVELTWO	-18	-18	-1	-1	1	-1	-1	1	-15	-15	-15	-15	0	0.80	0	1	x
lvl2RghtHallBckWall2	LEVELTWO	18	18	1	1	1	-1	-1	1	-15	-15	-15	-15	0	0.80	0	1	x
lvl2BckWall	LEVELTWO	-9	-9	9	9	1	-1	-1	1	-12	-12	-12	-12	0	0.80	0	1	x
lvl2LftDividerLft	LEVELTWO	-15	-15	-11	-11	1	-1	-1	1	-5.5	-5.5	-5.5	-5.5	0	0.80	0	1	x
lvl2LftDividerRght	LEVELTWO	-9	-9	-5	-5	1	-1	-1	1	-5.5	-5.5	-5.5	-5.5	0	0.80	0	1	x
lvl2LftDividerTop	LEVELTWO	-11	-11	-9	-9	0.5	1	1	0.5	-5.5	-5.5	-5.5	-5.5	0	0.80	0	1	x
lvl2LftDividerTBot	LEVELTWO	-11	-11	-9	-9	-0.5	-1	-1	-0.5	-5.5	-5.5	-5.5	-5.5	0	0.80	0	1	x
lvl2RghtDividerLft	LEVELTWO	15	15	11	11	1	-1	-1	1	-5.5	-5.5	-5.5	-5.5	0	0.80	0	1	x
lvl2RghtDividerRght	LEVELTWO	9	9	5	5	1	-1	-1	1	-5.5	-5.5	-5.5	-5.5	0	0.80	0	1	x
lvl2RghtDividerTop	LEVELTWO	11	11	9	9	0.5	1	1	0.5	-5.5	-5.5	-5.5	-5.5	0	0.80	0	1	x
lvl2RghtDividerTBot	LEVELTWO	11	11	9	9	-0.5	-1	-1	-0.5	-5.5	-5.5	-5.5	-5.5	0	0.80	0	1	x

ID	LEVEL	X1	X2	X3	X4	Y1	Y2	Y3	Y4	Z1	Z2	Z3	Z4	R	G	B	A	Axis
lvl2Ceiling	LEVELTWO	-18	-18	18	18	1	1	1	1	2	-20	-20	2	0.70	0.70	0.70	1	0
lvl2Floor	LEVELTWO	-18	-18	18	18	-1	-1	-1	-1	2	-20	-20	2	0.70	0.70	0.70	1	0
lvl2LftInnerWallLft	LEVELTWO	-15	-15	-15	-15	-1	1	1	-1	-1	-1	-2	-2	0	0.80	0	1	z
lvl2LftInnerWallCtr	LEVELTWO	-15	-15	-15	-15	-1	1	1	-1	-4	-4	-8	-8	0	0.80	0	1	z
lvl2LftInnerWalLRght	LEVELTWO	-15	-15	-15	-15	-1	1	1	-1	-10	-10	-12	-12	0	0.80	0	1	z
lvl2RghtInnerWallLft	LEVELTWO	15	15	15	15	-1	1	1	-1	-1	-1	-2	-2	0	0.80	0	1	z
lvl2RghtInnerWallCtr	LEVELTWO	15	15	15	15	-1	1	1	-1	-4	-4	-8	-8	0	0.80	0	1	z
lvl2RghtInnerWalLRght	LEVELTWO	15	15	15	15	-1	1	1	-1	-10	-10	-12	-12	0	0.80	0	1	z
lvl2EndHallLft	LEVELTWO	-1	-1	-1	-1	-1	1	1	-1	-15	-15	-20	-20	0	0.80	0	1	z
lvl2EndHallRght	LEVELTWO	1	1	1	1	-1	1	1	-1	-15	-15	-20	-20	0	0.80	0	1	z
lvl3StrtWallLft	LEVELTHREE	-1	-1	-13	-13	-1	1	1	-1	1	1	1	1	0	0	0.80	1	x
lvl3StrtWallRght	LEVELTHREE	1	1	13	13	-1	1	1	-1	1	1	1	1	0	0	0.80	1	x
lvl3Room0RghtWall	LEVELTHREE	-8	-8	-8	-8	-1	1	1	-1	1	1	-1	-1	0	0	0.80	1	z
lvl3Room0/1RghtWall	LEVELTHREE	-8	-8	-8	-8	-1	1	1	-1	-3	-3	-7	-7	0	0	0.80	1	z
lvl3Room1/2RghtWall	LEVELTHREE	-8	-8	-8	-8	-1	1	1	-1	-9	-9	-13	-13	0	0	0.80	1	z
lvl3Room2/3RghtWall	LEVELTHREE	-8	-8	-8	-8	-1	1	1	-1	-15	-15	-19	-19	0	0	0.80	1	z
lvl3Room3RghtWall	LEVELTHREE	-8	-8	-8	-8	-1	1	1	-1	-21	-21	-23	-23	0	0	0.80	1	z
lvl3Room7LftWall	LEVELTHREE	8	8	8	8	-1	1	1	-1	1	1	-1	-1	0	0	0.80	1	z
lvl3Room7/6LftWall	LEVELTHREE	8	8	8	8	-1	1	1	-1	-3	-3	-7	-7	0	0	0.80	1	z
lvl3Room6/5LftWall	LEVELTHREE	8	8	8	8	-1	1	1	-1	-9	-9	-13	-13	0	0	0.80	1	z
lvl3Room5/4LftWall	LEVELTHREE	8	8	8	8	-1	1	1	-1	-15	-15	-19	-19	0	0	0.80	1	z
lvl3Room4LftWall	LEVELTHREE	8	8	8	8	-1	1	1	-1	-21	-21	-23	-23	0	0	0.80	1	z
lvl3Ceiling	LEVELTHREE	-13	-13	13	13	1	1	1	1	1	-23	-23	1	0.70	0.70	0.70	1	0
lvl3Floor	LEVELTHREE	-13	-13	13	13	-1	-1	-1	-1	1	-23	-23	1	0.70	0.70	0.70	1	0
lvl3Room0/1Divid	LEVELTHREE	-13	-13	-8	-8	-1	1	1	-1	-5	-5	-5	-5	0	0	0.80	1	x
lvl3Room1/2Divid	LEVELTHREE	-13	-13	-8	-8	-1	1	1	-1	-11	-11	-11	-11	0	0	0.80	1	x
lvl3Room2/3Divid	LEVELTHREE	-13	-13	-8	-8	-1	1	1	-1	-17	-17	-17	-17	0	0	0.80	1	x
lvl3Room7/6Divid	LEVELTHREE	13	13	8	8	-1	1	1	-1	-5	-5	-5	-5	0	0	0.80	1	x
lvl3Room6/5Divid	LEVELTHREE	13	13	8	8	-1	1	1	-1	-11	-11	-11	-11	0	0	0.80	1	x
lvl3Room5/4Divid	LEVELTHREE	13	13	8	8	-1	1	1	-1	-17	-17	-17	-17	0	0	0.80	1	x
lvl3FrntWall	LEVELTHREE	-13	-13	13	13	-1	1	1	-1	-23	-23	-23	-23	0	0	0.80	1	x
lvl3InnerLftWall	LEVELTHREE	-3	-3	-3	-3	-1	1	1	-1	-2	-2	-20	-20	0	0	0.80	1	z
lvl3InnerRghtWall	LEVELTHREE	3	3	3	3	-1	1	1	-1	-2	-2	-20	-20	0	0	0.80	1	z
lvl3Room0LftWall	LEVELTHREE	-13	-13	-13	-13	-1	1	1	-1	1	1	-1	-1	0	0	0.80	1	z
lvl3Room0/1LftWall	LEVELTHREE	-13	-13	-13	-13	-1	1	1	-1	-3	-3	-7	-7	0	0	0.80	1	z
lvl3Room1/2LftWall	LEVELTHREE	-13	-13	-13	-13	-1	1	1	-1	-9	-9	-13	-13	0	0	0.80	1	z
lvl3Room2/3LftWall	LEVELTHREE	-13	-13	-13	-13	-1	1	1	-1	-15	-15	-19	-19	0	0	0.80	1	z
lvl3Room3LftWall	LEVELTHREE	-13	-13	-13	-13	-1	1	1	-1	-21	-21	-23	-23	0	0	0.80	1	z
lvl3Room7RghtWall	LEVELTHREE	13	13	13	13	-1	1	1	-1	1	1	-1	-1	0	0	0.80	1	z
lvl3Room7/6RghtWall	LEVELTHREE	13	13	13	13	-1	1	1	-1	-3	-3	-7	-7	0	0	0.80	1	z
lvl3Room6/5RghtWall	LEVELTHREE	13	13	13	13	-1	1	1	-1	-9	-9	-13	-13	0	0	0.80	1	z
lvl3Room5/4RghtWall	LEVELTHREE	13	13	13	13	-1	1	1	-1	-15	-15	-19	-19	0	0	0.80	1	z
lvl3Room4RghtWall	LEVELTHREE	13	13	13	13	-1	1	1	-1	-21	-21	-23	-23	0	0	0.80	1	z
lvl3Entrance	LEVELTHREE	-1	-1	1	1	-1	1	1	-1	1	1	1	1	0.29	0.29	0.29	1	x
lvl3Room0FakeDoor	LEVELTHREE	-13	-13	-13	-13	-1	-1	-1	-1	-1	-1	-3	-3	0.5	0.5	0.5	1	z
lvl3Room1FakeDoor	LEVELTHREE	-13	-13	-13	-13	-1	1	1	-1	-7	-7	-9	-9	0.5	0.5	0.5	1	z
lvl3Room2FakeDoor	LEVELTHREE	-13	-13	-13	-13	-1	1	1	-1	-13	-13	-15	-15	0.5	0.5	0.5	1	z
lvl3Room3FakeDoor	LEVELTHREE	-13	-13	-13	-13	-1	1	1	-1	-19	-19	-21	-21	0.5	0.5	0.5	1	z
lvl3Room7FakeDoor	LEVELTHREE	13	13	13	13	-1	1	1	-1	-1	-1	-3	-3	0.5	0.5	0.5	1	z
lvl3Room6FakeDoor	LEVELTHREE	13	13	13	13	-1	1	1	-1	-7	-7	-9	-9	0.5	0.5	0.5	1	z
lvl3Room5FakeDoor	LEVELTHREE	13	13	13	13	-1	1	1	-1	-13	-13	-15	-15	0.5	0.5	0.5	1	z
lvl3Room4FakeDoor	LEVELTHREE	13	13	13	13	-1	1	1	-1	-19	-19	-21	-21	0.5	0.5	0.5	1	z
lvl3Room8BckWall	LEVELTHREE	-3	-3	3	3	-1	1	1	-1	-12	-12	-12	-12	0	0	0.80	1	x
lvl3Room9BckWall	LEVELTHREE	-3	-3	3	3	-1	1	1	-1	-15	-15	-15	-15	0	0	0.80	1	x
lvl3Room8FrntWallLft	LEVELTHREE	-3	-3	-1	-1	-1	1	1	-1	-2	-2	-2	-2	0	0	0.80	1	x
lvl3Room8FrntWallRght	LEVELTHREE	3	3	1	1	-1	1	1	-1	-2	-2	-2	-2	0	0	0.80	1	x
lvl3Room9FrntWallLft	LEVELTHREE	-3	-3	-1	-1	-1	1	1	-1	-20	-20	-20	-20	0	0	0.80	1	x
lvl3Room9FrntWallRght	LEVELTHREE	3	3	1	1	-1	1	1	-1	-20	-20	-20	-20	0	0	0.80	1	x
lvl4Room0LftWall	LEVELFOUR	-5	-5	-5	-5	-1	1	1	-1	-2	-2	2	2	0.29	0.29	0.29	1	z
lvl4Room0RghtWall	LEVELFOUR	5	5	5	5	-1	1	1	-1	2	2	-2	-2	0.29	0.29	0.29	1	z
lvl4Room0BckLft	LEVELFOUR	-5	-5	-1	-1	-1	1	1	-1	2	2	2	2	0.29	0.29	0.29	1	x
lvl4Room0BckRght	LEVELFOUR	1	1	5	5	-1	1	1	-1	2	2	2	2	0.29	0.29	0.29	1	x
lvl4Room0Ceiling	LEVELFOUR	5	5	-5	-5	1	1	1	1	2	-2	-2	2	0.70	0.70	0.70	1	0
lvl4Room0Floor	LEVELFOUR	5	5	-5	-5	-1	-1	-1	-1	2	-2	-2	2	0.70	0.70	0.70	1	0
lvl4Entrance	LEVELFOUR	-1	-1	1	1	-1	1	1	-1	2	2	2	2	0.5	0.5	0.5	1	x
lvl4Room1LftWall	LEVELFOUR	10	10	10	10	-5	5	5	-5	-2	-2	-12	-12	0.60	0.60	0.60	1	z
lvl4Room1RghtWall	LEVELFOUR	-10	-10	-10	-10	-5	5	5	-5	-2	-2	-12	-12	0.60	0.60	0.60	1	z
lvl4Room1FrntWall	LEVELFOUR	10	10	-10	-10	-5	5	5	-5	-12	-12	-12	-12	0.60	0.60	0.60	1	x
lvl4Room1BckLftWall	LEVELFOUR	-10	-10	-5	-5	-5	5	5	-5	-2	-2	-2	-2	0.60	0.60	0.60	1	x
lvl4Room1BckRghtWall	LEVELFOUR	10	10	5	5	-5	5	5	-5	-2	-2	-2	-2	0.60	0.60	0.60	1	x
lvl4Room1Ceiling	LEVELFOUR	10	10	-10	-10	5	5	5	5	-2	-12	-12	-2	0.70	0.70	0.70	1	0
lvl4Room1Floor	LEVELFOUR	10	10	-10	-10	-5	-5	-5	-5	-2	-12	-12	-2	0.70	0.70	0.70	1	0
lvl4Room0FrntWall	LEVELFOUR	-5	-5	5	5	-1	1	1	-1	-2	-2	-2	-2	0.1	0.1	0.1	0.90	x
lvl2LftBckWindowLft	LEVELTWO	-15	-15	-11	-11	1	-1	-1	1	-12	-12	-12	-12	0	0.80	0	1	x
lvl2BckWindowTop	LEVELTWO	-11	-11	-9	-9	0.5	1	1	0.5	-12	-12	-12	-12	0	0.80	0	1	x
lvl2BckWindowBot	LEVELTWO	-11	-11	-9	-9	-0.5	-1	-1	-0.5	-12	-12	-12	-12	0	0.80	0	1	x
lvl2RghtBckWindowLft	LEVELTWO	15	15	11	11	1	-1	-1	1	-12	-12	-12	-12	0	0.80	0	1	x
lvl2RghtWindowTop	LEVELTWO	11	11	9	9	0.5	1	1	0.5	-12	-12	-12	-12	0	0.80	0	1	x
lvl2RghtWindowBot	LEVELTWO	11	11	9	9	-0.5	-1	-1	-0.5	-12	-12	-12	-12	0	0.80	0	1	x
lvl2lftWindow1	LEVELTWO	-11	-11	-9	-9	-0.5	0.5	0.5	-0.5	-1	-1	-1	-1	0	1	1	0.29	x
lvl2lftWindow2	LEVELTWO	-11	-11	-9	-9	-0.5	0.5	0.5	-0.5	-5.5	-5.5	-5.5	-5.5	0	1	1	0.29	x
lvl2lftWindow3	LEVELTWO	-11	-11	-9	-9	-0.5	0.5	0.5	-0.5	-12	-12	-12	-12	0	1	1	0.29	x
lvl2RghtWindow1	LEVELTWO	11	11	9	9	-0.5	0.5	0.5	-0.5	-1	-1	-1	-1	0	1	1	0.29	x
lvl2RghtWindow2	LEVELTWO	11	11	9	9	-0.5	0.5	0.5	-0.5	-5.5	-5.5	-5.5	-5.5	0	1	1	0.29	x
lvl2RghtWindow3	LEVELTWO	11	11	9	9	-0.5	0.5	0.5	-0.5	-12	-12	-12	-12	0	1	1	0.29	x

7.2.2 Doors

ID	LEVEL	X1	X2	X3	X4	Y1	Y2	Y3	Y4	Z1	Z2	Z3	Z4	R	G	B	A	axis
room0room1Door	LEVELZERO	5	5	5	5	-1	0.5	0.5	-1	-2.5	-2.5	-0.5	-0.5	0.90	0.90	0.90	1	z
lvl0ExitDoor	LEVELZERO	-1.5	-1.5	1.5	1.5	-1	0.70	0.70	-1	-4	-4	-4	-4	0.5	0.5	0.5	1	x
lvl1HangerHallDoor	LEVELONE	1	1	-1	-1	-1	1	1	-1	5	5	5	5	0.90	0.90	0.90	1	x
lvl1Room2Door	LEVELONE	3	3	3	3	-1	1	1	-1	11	11	13	13	0.90	0.90	0.90	1	z
lvl1Room0Door	LEVELONE	-3	-3	-3	-3	-1	1	1	-1	17	17	15	15	0.90	0.90	0.90	1	z
lvl1Room1Door	LEVELONE	-3	-3	-3	-3	-1	1	1	-1	10	10	8	8	0.90	0.90	0.90	1	z
lvl1Room3Door	LEVELONE	6	6	4	4	-1	1	1	-1	10	10	10	10	0.90	0.90	0.90	1	x
lvl1Room4Door	LEVELONE	1	1	-1	-1	-1	1	1	-1	19	19	19	19	0.90	0.90	0.90	1	x
lvl1ExitDoor	LEVELONE	1	1	-1	-1	1	-1	-1	1	29	29	29	29	0.5	0.5	0.5	1	x
lvl2Room0Door	LEVELTWO	-15	-15	-15	-15	-1	1	1	-1	-2	-2	-4	-4	0.90	0.90	0.90	1	z
lvl2Room1Door	LEVELTWO	-15	-15	-15	-15	-1	1	1	-1	-8	-8	-10	-10	0.90	0.90	0.90	1	z
lvl2Room2Door	LEVELTWO	15	15	15	15	-1	1	1	-1	-8	-8	-10	-10	0.90	0.90	0.90	1	z
lvl2Room3Door	LEVELTWO	15	15	15	15	-1	1	1	-1	-2	-2	-4	-4	0.90	0.90	0.90	1	z
lvl2ExitDoor	LEVELTWO	-1	-1	1	1	-1	1	1	-1	-20	-20	-20	-20	0.5	0.5	0.5	1	x
lvl3Room0Door	LEVELTHREE	-8	-8	-8	-8	-1	1	1	-1	-1	-1	-3	-3	0.13	0.5504	0.13	1	z
lvl3Room1Door	LEVELTHREE	-8	-8	-8	-8	-1	1	1	-1	-7	-7	-9	-9	0.13	0.5504	0.13	1	z
lvl3Room2Door	LEVELTHREE	-8	-8	-8	-8	-1	1	1	-1	-13	-13	-15	-15	0.70	0.13	0.13	1	z
lvl3Room3Door	LEVELTHREE	-8	-8	-8	-8	-1	1	1	-1	-19	-19	-21	-21	1	0.5504	0	1	z
lvl3Room7Door	LEVELTHREE	8	8	8	8	-1	1	1	-1	-1	-1	-3	-3	1	0.5504	0	1	z
lvl3Room6Door	LEVELTHREE	8	8	8	8	-1	1	1	-1	-7	-7	-9	-9	1	0.5504	0	1	z
lvl3Room5Door	LEVELTHREE	8	8	8	8	-1	1	1	-1	-13	-13	-15	-15	0.70	0.13	0.13	1	z
lvl3Room4Door	LEVELTHREE	8	8	8	8	-1	1	1	-1	-19	-19	-21	-21	1	0.5504	0	1	z
lvl3Room8Door	LEVELTHREE	-1	-1	1	1	-1	1	1	-1	-2	-2	-2	-2	0.90	0.90	0.90	1	x
lvl3Room9Door	LEVELTHREE	-1	-1	1	1	-1	1	1	-1	-20	-20	-20	-20	0.90	0.90	0.90	1	x

7.2.3 Switches

ID	LEVEL	target	xt	yt	zt	xr	yr	zr	type	startOn
lvl0Door1	LEVELZERO	room0room1Door	5	0	-3	0	90	0	DOOR	1
lvl0Door2	LEVELZERO	t˙lvlzero˙room1	7	0	-4	0	0	0	TERMINAL	1
lvl0END	LEVELZERO	NULL	-2	0	-4	0	0	0	LEVEL˙END	0
lvl1END	LEVELONE	NULL	1.5	0	29	0	0	0	LEVEL˙END	0
lv1Door1	LEVELONE	lvl1HangerHallDoor	1.5	0	5	0	0	0	DOOR	1
lvl1Door2	LEVELONE	lvl1Room2Door	3	0	10	0	90	0	DOOR	1
lvl1Door3	LEVELONE	lvl1Room0Door	-3	0	18	0	90	0	DOOR	1
lvl1Door4	LEVELONE	lvl1Room1Door	-3	0	11	0	90	0	DOOR	1
lvl1Door5	LEVELONE	lvl1Room4Door	1.5	0	19	0	0	0	DOOR	1
lvl1Door6	LEVELONE	lvl1Room3Door	6.5	0	10	0	0	0	DOOR	0
lvl2Door0	LEVELTWO	lvl2Room0Door	-15	0	-5	0	90	0	DOOR	1
lvl2Door1	LEVELTWO	lvl2Room1Door	-15	0	-7	0	90	0	DOOR	0
lvl2Door2	LEVELTWO	lvl2Room2Door	15	0	-7	0	90	0	DOOR	1
lvl2Door3	LEVELTWO	lvl2Room3Door	15	0	-5	0	90	0	DOOR	0
lvl2END	LEVELTWO	NULL	-1	0	-18	0	90	0	LEVEL˙END	0
lvl3Room0	LEVELTHREE	lvl3Room0Door	-8	0	-0.5	0	90	0	DOOR	1
lvl3Room1	LEVELTHREE	lvl3Room1Door	-8	0	-6.5	0	90	0	DOOR	1
lvl3Room2	LEVELTHREE	lvl3Room2Door	-8	0	-12.5	0	90	0	DOOR	0
lvl3Room3	LEVELTHREE	lvl3Room3Door	-8	0	-18.5	0	90	0	DOOR	0
lvl3Room7	LEVELTHREE	lvl3Room7Door	8	0	-0.5	0	90	0	DOOR	0
lvl3Room6	LEVELTHREE	lvl3Room6Door	8	0	-6.5	0	90	0	DOOR	0
lvl3Room5	LEVELTHREE	lvl3Room5Door	8	0	-12.5	0	90	0	DOOR	0
lvl3Room4	LEVELTHREE	lvl3Room4Door	8	0	-18.5	0	90	0	DOOR	0
lvl3Room0END	LEVELTHREE	NULL	-13	0	-0.5	0	90	0	LEVEL˙END	0
lvl3Room1END	LEVELTHREE	NULL	-13	0	-6.5	0	90	0	LEVEL˙END	0
lvl3Room2END	LEVELTHREE	NULL	-13	0	-12.5	0	90	0	LEVEL˙END	0
lvl3Room3END	LEVELTHREE	NULL	-13	0	-18.5	0	90	0	LEVEL˙END	0
lvl3Room7END	LEVELTHREE	NULL	13	0	-0.5	0	90	0	LEVEL˙END	0
lvl3Room6END	LEVELTHREE	NULL	13	0	-6.5	0	90	0	LEVEL˙END	0
lvl3Room5END	LEVELTHREE	NULL	13	0	-12.5	0	90	0	LEVEL˙END	0
lvl3Room4END	LEVELTHREE	NULL	13	0	-18.5	0	90	0	LEVEL˙END	0
lvl3Room8	LEVELTHREE	lvl3Room8Door	-1.5	0	-2	0	0	0	DOOR	0
lvl3Room9	LEVELTHREE	lvl3Room9Door	1.5	0	-20	0	0	0	DOOR	1

7.2.4 Terminals

ID	LEVEL	tag	xt	yt	zt	xr	yr	zr
t˙lvlzero˙room1	LEVELZERO	lv0TM1.tm	7	0	-2	0	0	0
t˙lvl1Room0	LEVELONE	lvl1TM0.tm	-13	0	15	0	180	0
t˙lvl1Room1	LEVELONE	lvl1TM1.tm	-13	0	8	0	180	0
t˙lvl1Room3	LEVELONE	lvl1TM2.tm	17	0	-2	0	90	0
t˙lvl2Room0	LEVELTWO	lvl2TM0.tm	-6	0	-3	0	0	0
t˙lvl2Room1	LEVELTWO	lvl2TM1.tm	-6	0	-9	0	0	0
t˙lvl2Room2	LEVELTWO	lvl2TM2.tm	6	0	-9	0	180	0
t˙lvl2Room3	LEVELTWO	lvl2TM3.tm	6	0	-3	0	180	0
t˙lvl3Room0	LEVELTHREE	lvl3TM0.tm	-10	0	-4	180	-90	0
t˙lvl3Room1	LEVELTHREE	lvl3TM1.tm	-10	0	-10	180	-90	0
t˙lvl3Room2	LEVELTHREE	lvl3TM2.tm	-10	0	-16	180	-90	0
t˙lvl3Room3	LEVELTHREE	lvl3TM3.tm	-10	0	-22	180	-90	0
t˙lvl3Room4	LEVELTHREE	lvl3TM4.tm	10	0	-22	180	-90	0
t˙lvl3Room5	LEVELTHREE	lvl3TM5.tm	10	0	-16	180	-90	0
t˙lvl3Room6	LEVELTHREE	lvl3TM6.tm	10	0	-10	180	-90	0
t˙lvl3Room7	LEVELTHREE	lvl3TM7.tm	10	0	-4	180	-90	0
t˙lvl3Room8	LEVELTHREE	lvl3TM8.tm	0	0	-11	0	90	0
t˙lvl3Room9	LEVELTHREE	lvl3TM9.tm	0	0	-16	0	-90	0

7.2.5 Triggers

ID	LEVEL	Trigger	Target	TriggerType	TargetType
tr˙lvl0End	LEVELZERO	t˙lvlzero˙room1	lvl0END	TERMINAL	SWITCH
tr˙lvl1Switch	LEVELONE	t˙lvl1Room0	lvl1Door6	TERMINAL	SWITCH
tr˙lvl1End	LEVELONE	t˙lvl1Room3	lvl1END	TERMINAL	SWITCH
tr˙lvl2Door1	LEVELTWO	t˙lvl2Room0	lvl2Door3	TERMINAL	SWITCH
tr˙lvl2Door2	LEVELTWO	t˙lvl2Room3	lvl2Door1	TERMINAL	SWITCH
tr˙lvl2End	LEVELTWO	t˙lvl2Room1	lvl2END	TERMINAL	SWITCH
tr˙lvl3Sec1	LEVELTHREE	t˙lvl3Room9	lvl3Room3	TERMINAL	SWITCH
tr˙lvl3Sec2	LEVELTHREE	t˙lvl3Room9	lvl3Room4	TERMINAL	SWITCH
tr˙lvl3Sec3	LEVELTHREE	t˙lvl3Room9	lvl3Room6	TERMINAL	SWITCH
tr˙lvl3Sec4	LEVELTHREE	t˙lvl3Room9	lvl3Room8	TERMINAL	SWITCH
tr˙lvl3Sec5	LEVELTHREE	t˙lvl3Room8	lvl3Room5	TERMINAL	SWITCH
tr˙lvl3Sec6	LEVELTHREE	t˙lvl3Room8	lvl3Room2	TERMINAL	SWITCH
tr˙lvl3End	LEVELTHREE	t˙lvl3Room2	lvl3Room2END	TERMINAL	SWITCH
tr˙lvl3Sec7	LEVELTHREE	t˙lvl3Room8	lvl3Room7	TERMINAL	SWITCH

7.2.6 Cylinders

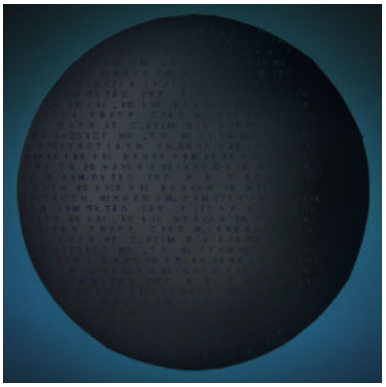
ID	XT	YT	ZT	XR	YR	ZR	base Radius	top Radius	height	stacks	slices	R	G	B	A	LEVEL
lifePodCenter	-4	1	-1.5	90	0	0	0.5	0.5	2	50	50	0	0.80	0.8195	1	LEVELZERO
lifePodBot	-4	0	-1.5	90	0	0	0.0503	1	1	50	50	0.5	0.5	0.5	1	LEVELZERO
lifePodTop	-4	1	-1.5	90	0	0	1	0.5	0.5	50	50	0.5	0.5	0.5	1	LEVELZERO
kiosk1	5	1	25	90	0	0	0.5	0.5	2	50	50	0	0.75	1	0.598	LEVELONE
kiosk2	-5	1	25	90	0	0	0.5	0.5	2	50	50	0	0.75	1	0.598	LEVELONE
power1	-2	1	-5	90	0	0	0.5	0.5	2	50	50	1	0.8397	0	1	LEVELTHREE
power2	2	1	-5	90	0	0	0.5	0.5	2	50	50	1	0.8397	0	1	LEVELTHREE
power3	-2	1	-18	90	0	0	0.5	0.5	2	50	50	1	0.8397	0	1	LEVELTHREE
power4	2	1	-18	90	0	0	0.5	0.5	2	50	50	1	0.8397	0	1	LEVELTHREE
power1BaseBot	-2	0	-5	90	0	0	0.70	0.70	1	50	50	0.201	0.201	0.201	1	LEVELTHREE
power1BaseTop	-2	1	-5	90	0	0	0.70	0.70	0.5	50	50	0.201	0.201	0.201	1	LEVELTHREE
power2BaseBot	2	0	-5	90	0	0	0.70	0.70	1	50	50	0.201	0.201	0.201	1	LEVELTHREE
power2BaseTop	2	1	-5	90	0	0	0.70	0.70	0.5	50	50	0.201	0.201	0.201	1	LEVELTHREE
power3BaseBot	-2	0	-18	90	0	0	0.70	0.70	1	50	50	0.201	0.201	0.201	1	LEVELTHREE
power3BaseTop	-2	1	-18	90	0	0	0.70	0.70	0.5	50	50	0.201	0.201	0.201	1	LEVELTHREE
power4BaseBot	2	0	-18	90	0	0	0.70	0.70	1	50	50	0.201	0.201	0.201	1	LEVELTHREE
power4BaseTop	2	1	-18	90	0	0	0.70	0.70	0.5	50	50	0.201	0.201	0.201	1	LEVELTHREE

7.3 Images

7.3.1 Main Menu

7.3.2 Terminal Banner

7.3.3 Game Icon



7.4 Music

1. Dark Fog—Kevin MacLeod
2. Mismer—Devin Powers
3. One Sly Move—Kevin MacLeod
4. Hypnothis—Kevin MacLeod
5. Cold Hope—Arseniy Shkljaev
6. Spacial Harvest—Kevin MacLeod