Brady High School GeoPod Project

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Client: Troy Braley, of Brady High School

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Introduction

Client Description

Brady High School is an alternative school in Jeffco Public Schools. Their mission is to find students who have dropped out, been expelled, or are not attending school and get them a diploma and off to college. If they cannot hook the students within a 3 week window, they will most likely not be successful with them. They have been very successful with their mission to educate the students, but could use another tool to further excite the students and engage them in learning. The principal Troy Braley has developed an idea to use Google Earth in a flight simulator type setup to allow the students to explore the world, and foster a desire to continue learning and coming to school. The client has also requested the aid from the educators that will be using the program, and has had them develop ideas and functionality requests for the project.

Product Vision

The Brady GeoPod is for Brady High School who need for a way to capture the student's attention and promote staying in school, while delivering a system that allows the students to learn and experience social science classes in a fun and exciting way. The Brady GeoPod will utilize Google Earth to allow the students to explore the Earth in various places and allow them to enjoy the learning process though the program and technology. The GeoPod will allow the educators of various classes to develop interactive lessons that engage the student, as well as creating a positive learning environment for the students through the use of the Google Earth implementation. The students and educators will also have access to a control panel to assist in controlling the software and also features that can be used to facilitate the students learning and interest in education.

Requirements

Functional Requirements:

The Geo-Pod program will allow users through the use of Google Earth, to experience the exploration of the earth through the use of a flight simulator as well as incorporate history elements for the students learning.

Specific Functionality:

- Allow users to interface with Google Earth through the use of a Joystick controller
- Secure access, with each student having a unique login to use the system
- Allow the use of Program Plans/Lesson Plans
- Use a minimum three screens to immerse the students
- Synchronized sound effects
- Ability to land the simulator at the site

Non - Functional Requirements:

To complete the Geo-Pod project many requirements were made that would be deemed nonfunctional but important to the completion of this project.

Specific Functionality:

- The program must be simple and durable, as no support will be used after delivery
- The students login data must be secure
- Must allow the educators to develop lessons for specific classes
- Ensure that Microsoft Group Policy and Active Directories are correct and allow for the project to be run

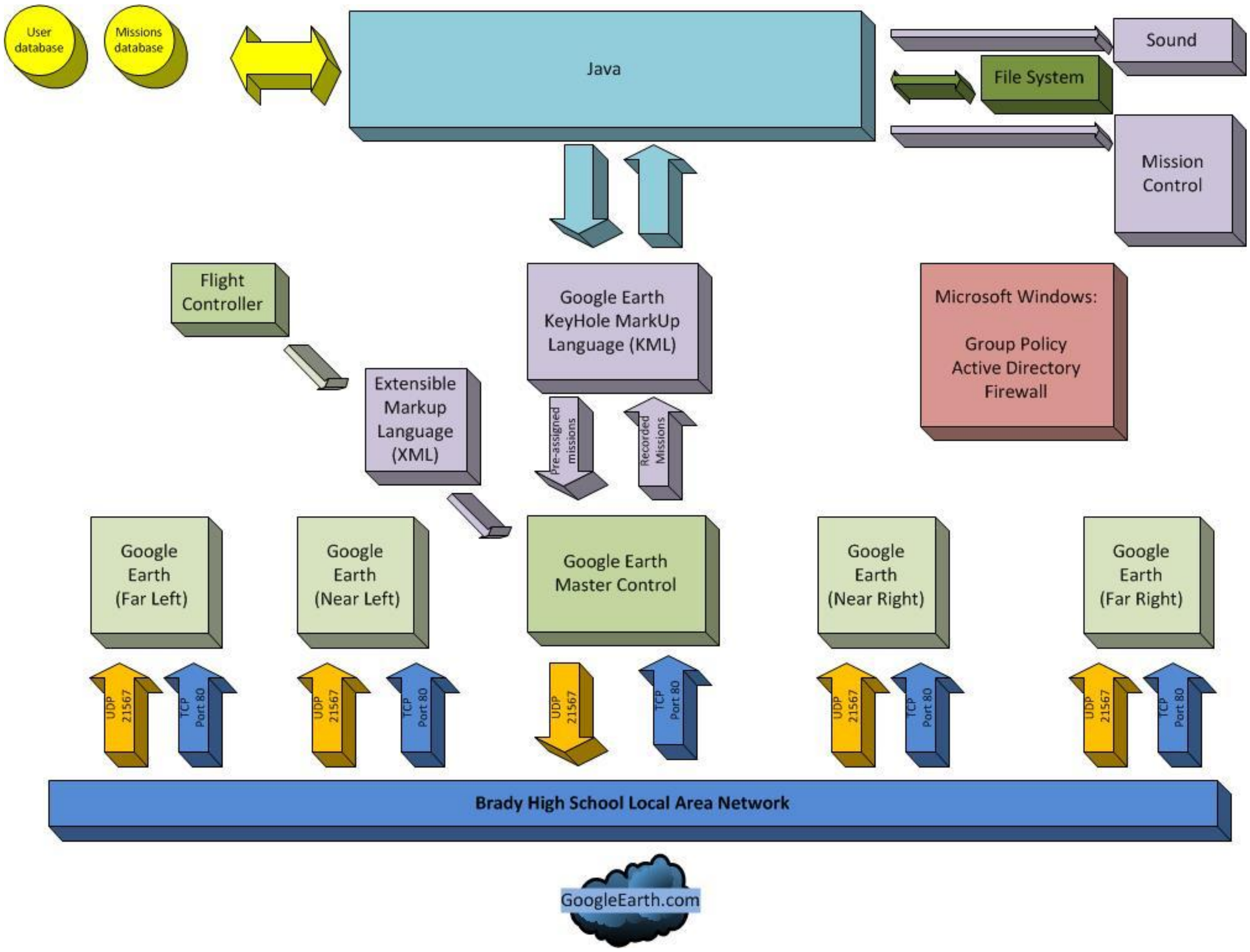
Potential project risks:

- The project will be delivered as a complete package that requires no maintenance or patching
- There will be no one to maintain the project, so it must be able to tolerate future OS patches and version releases
- Aspect ratios of the side monitors may drive up the costs
- Physical durability must be considered

- We must plan for frequent changes by the clients request

- Student’s Personally Identifiable Information (PII) must be secured

System Architecture



Architecture and Flow Decisions

Our solution consists of three layers: Google Earth is at the physical layer; java code is at the control layer, and KML files join Google Earth at the Java Control Layer. Starting at the bottom, there is internet connectivity to GoogleEarth.com, panaramio.com, YouTube.com, and other Google Earth-related external destinations.

The next two levels describe the traffic on the network. Commands from the Master Computer to the slave computers occur over UDP port 21567, and all of the computers communicate with GoogleEarth.com. The Master sends broadcast packets to the Slave computers. To eliminate interference with the rest of the Brady High School network, the

Google Earth computers are on their own IP subnet. The Master broadcasts about 11 datagrams a second, where each datagrams contains a counter, latitude, longitude, altitude, heading, tilt, roll, time start, time end, and planet name.

The next level is the Google Earth level. An independent copy of Google Earth is loaded on each computer, and there is one computer per display. To make them work as a unit, the program's “drivers.ini” file has some additional lines added that control Master or Slave, and the geometry of each display. “ViewSync” instructions are added to the files. This is the first level that requires modifications to the Windows Operating System. “Drivers.ini” is a protected system file, and the system administrator requires the rights to modify it.

At a sub-level above Google Earth is the customized XML (Extensible Markup Language) code the interfaces the joystick to Google Earth. The XML code programs the joystick to provide some of the features that Brady High School asked for, as well as basic flight simulator capability.

The Keyhole Markup Language (KML) layer is where the lesson plans for Google Earth are added. The KML files are created by the instructor with Google Earth and are stored for later use by the students.

Alongside the KML layer is the Microsoft layer. Several modifications needed to be made to the computers. Jeffco Group Policy blocks JAR files, so an exception had to be added for the Google Earth System. The Google Earth system administrator needed rights to modify protected files, and ports needed to be opened in the local firewall.

The top level is the Java Control Layer that the CSM team created to tie all of the elements together. The system uses flat text files for a user database, where the database has user ID, password and user type. For the missions database, the program opens a Windows file dialog box. Other elements include the ability to edit lesson plans and edit the user database.

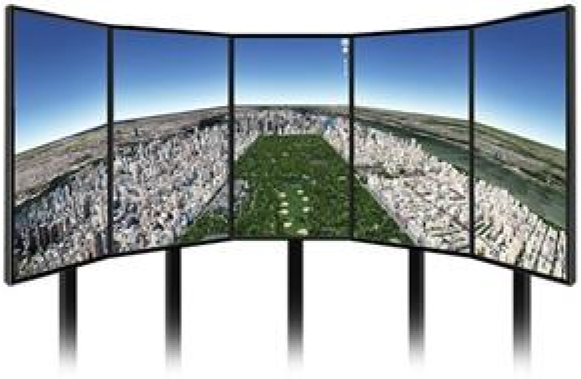
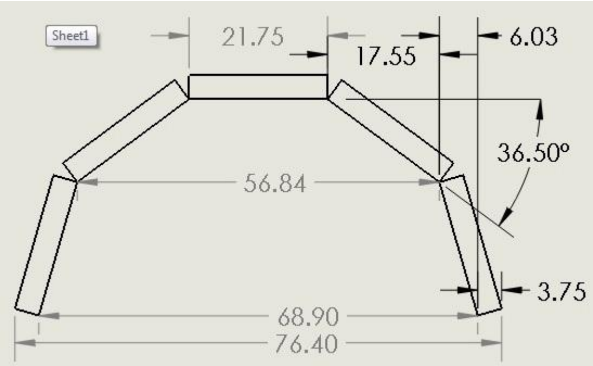
Languages and technologies used: Java, KML, ViewSync, XML, .INI, Microsoft Active Directory, Microsoft Group Policy.

Technical Design

An early aspect of our design was the use of 36.5 degrees between each screen. The next section describes how 36.5 degrees was done, and this section describes why.

First, an understanding of Google Earth's Liquid Galaxy is needed. Liquid Galaxy is a methodology rather than a product. Its purpose is to skew, offset and warp the data on multiple displays so that an array of screens gives a realistic image. Liquid Galaxy was designed by Google engineers on 20% time, which is a time slot where the engineers are encouraged to work on their own projects. The engineers built Liquid Galaxies in several corporate offices, and it was so popular that they shared it with the rest of the world. But, Liquid Galaxy is not a Google Corporate product, and there is no support for it. That fact is one of our larger design challenges because after delivery, there will be no one to support the system.

The next two figures show a typical Liquid Galaxy array the spans 180 degrees. This example is using 40 inch displays.

 http://www.google.com/earth/explore/showcase/liquidgalaxy.html	 Sheet1 21.75 17.55 6.03 36.50° 56.84 3.75 68.90 76.40 Physical Geometry at Brady High School

In the photograph on the left side, you can notice a bit of distortion where the curvature of the earth is seen as a straight line. And on the drawing, notice that the far displays don't face each other. The horizontal Field-of-View at the ends of the screen is 180 degrees.

The perceived distortion goes away as the viewer gets closer to the screen. If only three screens were used around the arc then the distortion would be overwhelming at any distance. Also, the angle between each display would be about 60 degrees, and the rear ends of the arc would not look realistic. If seven screens for 180 degrees are used then there is a small amount of improvement, but it is not worth the extra cost. The following graph shows that improvements to the horizontal Field-of-View start to drop after 5 screens around a 180 degree arc.

Number of screens	Angle between screens
3	60.5
5	36.5
7	25.5
9	20.5
11	16.5

Why not use 36.0 degree angles, and what is the extra half degree for? There is no documented answer to that question. An assumption is that the half degree accounts for the width of the display’s bezel.

KML

When developing code for use with Google Earth typical programing languages would not work due to the lack of spatial data needed to interact with two dimensional and three dimensional maps. So to solve this lack of support Google developed the Keyhole Markup Language, or better known as KML.

KML is an XML based language that details geographic data and allows for the inclusion of points, lines, images, polygons, and models to be read by Google Earth as well as Google Maps and other applications. This file format to manage Google Earth leaves users easily able to take their own custom KML files and easily use them with the software. This language is very similar to the way that an HTML file is read by the browser, making Google Earth more of a browser that can explore the files in a display of the world.

KML instead of focusing upon browser formatting and other various aspects that other languages do it uses the three dimensional coordinates and relative locations upon the earth. To achieve this a KML file uses a set of tags in a similar manner to denote the actions and customizations that are being modified through the file. Many specialized customizations can be made through the expansive KML language from denoting a fly by tour of a location to the inclusion of data to allow the user to get a better understanding of the location.

Google Earth functions the same as a browser with the KML file and reads these tags to set up the mapping environment to suit the specifications made with the KML file. This makes this language ideal for displaying information that involves geographic data in a way that is easy to understand and view. And example of what can be accomplished would be adding overlays to countries or the entire earth showing population or any other statistic fathomable. Without this language the effectiveness of communicating geographic data to many users would be drastically decreased, as well as the ease in which these files can be distributed and run.

Although KML is the default and only language that Google Earth can recognize, the effectiveness of this language to convey the data and information to the public makes it an ideal choice to use when a three dimensional representation of earth is used.

Design & Implementation Decisions

Liquid Galaxy Decision

To try and meet the client's requirements for an immersive simulator we explored many options to accurately display the screen presented though Google Earth. One of the major issues when trying to display a picture upon multiple monitors is the aspect ratio. If a curved setup is used, like the design we decided to choose this image becomes a static flat image. To fix this aspect we decided to use Google's Liquid Galaxy program. This implementation was developed by Google and has details to modify the viewing angles on each screen. Once these are modified the picture can be shown with the correct aspect ratio. This seemed to be the correct design decision for us, as it was created by the same company as the program, and also accurately addresses our problems in a concise and functional way.

Hardware Decisions

The original request was to run Google Earth on three 60-inch monitors that were at 90 degree angles to each other, all controlled by one computer. The three monitors were to give the students a 180 degree field of view. After evaluation, Google Earth's Liquid Galaxy methodology was proven to be the only viable solution. Liquid Galaxy requires one computer per monitor, and each monitor's horizontal Field of View spans 36.5

degrees. A total of five computers and monitors are needed to achieve a realistic 180 degree field of view.

Liquid Galaxy needs a vertical orientation on its monitors, but the computers that are being provided by Brady High School all use Windows XP. Tests were conducted and the installed copy of XP is aware of vertical monitors, but the monitors will not be delivered until after this project ends on July 21.

LAN Configuration

By school policy, Brady's computer room only allows wireless computer connectivity. Initial tests showed erratic motion when the computers were connected via a wireless connection. Brady High School staff is discussing the possibility of changing their policy to allow wired connections to the GeoPod system.

Liquid Galaxy uses broadcast packets to communicate instructions from the master computer to the side computers. To isolate the traffic, Jefferson County IT department allocated a private IP subnet for the system.

Development Language Decisions

Google Earth has a direct interaction with Keyhole Markup Language (KML) files, and can be controlled by Java, JavaScript and JQuery. The CSM team chose Java as the language for the control layer because it is better suited for a contained package of user interfaces, instructor controls, and student activity.

JQuery and JavaScript were originally the languages that were proposed for this project. With our beginning idea, the thought to use the Browser version of Google Earth was decided but later changed due to the understanding of the KML language. To use the KML files which store the lesson plans and description, a desktop application of Google Earth would need to be run. Because of this the use of two web based languages did not fit our design. This is the reason that java was selected for the final languages used.

Results

This project has been tested on Windows XP, Windows 7 and Windows 8, and worked well on all three - but java JAR files do not run on computers that were provided for the simulation. The problem was corrected when the computers were upgraded to Windows 7.

To date, the functional requirements have passed tests on the development computers and our XP test computer.

At one point during the demonstration, we showed one of the teachers how to create an example lesson with various features, and he was comfortable with the structure and had a good understanding of the mechanism under the system. A detailed document is provided to make sure future users are clear on what to do.

We also showed the client the main program interfacing between users and Google Earth. They agreed that the program is user friendly and easy to understand. In addition, the program covered exactly what they want and they requested a couple more features. By the final delivery day, we had all the required features implemented.

There were several requested features that could not be implemented - The ability to land on the site could not be done because of limitations within Google Earth. Another requirement was a webcam to monitor student's behavior, but the main equipment has not arrived yet. The webcam should be relatively easy for the school to set up by themselves, as they have plenty of existing surveillance technology in place.

Lessons learned: The problem with the JAR files caught us by surprise. We should have tested the ability to run them. Also, we realized that client communication is very crucial in reaching to the final design. In last couple meetings, we were able to ask the right questions and determine specific features that the client wants.

Appendix A: Program Detail

GoogleEarth Class – Control most interaction with Google Earth

VOID openGE()
- Check current system (x86 or x64) then open Google Earth with the corresponding path.

VOID openGE(File f)
- Open the KML file provided, this will bring up Google Earth with settings from the KML file

VOID flightMode()
- Send the combination Ctrl-Alt-A to Google Earth in order to open Flight Simulator Mode

VOID closeGE()
- Shut down Google Earth process

PROCESS getProcess ()
- Return the process handler of Google Earth

SoundThread Class – Responsible for the sound layer on the background of Google Earth

INT load()
- Load the audio clip into the system, return 0 if succeed

VOID run()
- Play the audio clip continuously until receive a stop signal

VOID stopSignal()
- Send out the signal to stop playing the audio clip

User Class – Define a user for the database

CONSTRUCTOR User(String name, String password, Boolean right)
- Set up a user with name, password, and right (true for student, false for teacher)

UserDatabase Class - The core of the authorization system

CONSTRUCTOR UserDatabase()
- Load users' info into the system from a pre-determined file

INT authorize(String user, String pass)
- Look for a certified user, return 2 for a valid student account, 3 for a valid teacher account

UserInterface Class – Manage all the interfaces that users will encounter

CONSTRUCTOR UserInterface()
- Set up basic components and settings

VOID loginLayout()
- Display and respond to actions in login screen

VOID eraseLogin()
- Destroy the login screen

VOID studentLayout()
- Display and respond to actions in student’s screen

VOID teacherLayout()
- Display and respond to actions in teacher’s screen

VOID lessonReader()
- Read the description from a KML file

VOID setFile(File f)
- Save the file name and make it available to the whole class

Development Environment

System:	Windows 7 (also tested on Windows XP, Windows 8)
IDE:	Eclipse SDK 4.2.0
Joystick:	Logitech Extreme 3D Pro
Other:	Java JDK 7u13 (JRE also worked)
	Google Earth 7.1 (Desktop version)
	Wave audio file (other audio formats are not tested)

Appendix B: Hardware Cost

Displays

Several display types were evaluated. The project requires that the student have displays in front and on both sides in order to simulate an aircraft cockpit. The displays that represent the side windows should be as close as possible to a 90 degree angle in respect to the front display.

The first evaluation was a curved glass display that Samsung-Corning is still trying to design. The display is not ready for market yet – so far, all they have is a small, transparent screen that they are showing at trade shows.

Another type of display is a curved projection screen. We were not able to find a screen with a listed price of under $15,000. Also, the screens won’t surround the students on three sides; they only have about 20 degrees of curve.

The third option was multiple 60 inch monitors, with one screen in front and one to either side of the students. There are two ways to drive the monitor: the first is with graphics expansion module that splits the video display across three screens. The second is to use three separate video adapters in the host computer. The expansion module is the least expensive solution and is the best choice if Google Earth does not offer separate side views. A note about 60 inch monitors: they don’t accept VGA or DVI computer signals; they only accept HDMI or s-video. The graphics expansion module only outputs DVI, so three DVI to HDMI adapters will be needed. They are not expensive.

A major problem with a single video output is the aspect ratio. The side displays may not look like side displays. In other words, Google Earth may not have the option for 90 degree displays. We still need to research the aspect ratios. It is possible that Google Earth Pro or the graphics expansion card may have the aspect ratio settings that we need.

The fourth solution, and the one we selected, was to use one computer per screen, with synchronization between the computers.

Host Computer

The remainder of the cost analysis involves the third option. Physically, the host computer should have at least three PCI Express slots and a 450 watt power supply in order to operate the three video cards. If the graphics expansion module is used then any in-house computer will probably work. It is our understanding that Brady High School will provide the computer.

Game Controller

A sturdy game controller is the Logitech Extreme 3D Pro. This is a joystick-type of controller that can be mounted to the table in front of the students.

Headphone splitter

A headphone splitter will be needed for the three sets of headphones. The splitter will impedance-match the headphones and allows them to be operated from one headphone jack on the computer.

Webcam

A camera is required to monitor the students in the flight simulator. The webcam will be on top of front display.

Cost List

The following list assumes three 60 inch monitors and the graphics expansion module.

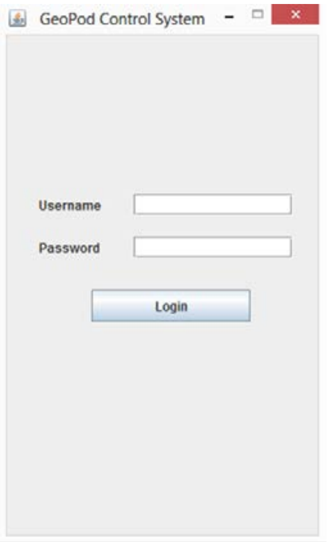
Qty	Item	Estimated Cost, Qty * individual price
1	Joystick	$ 35
1	Headphone splitter	$ 10
3	60 inch LCD display screens	$ 4,500
1	Graphics Expansion module	$ 350
3	mounting brackets	$ 390
1	USB Webcam	TBD
	Total estimated electronic hardware cost:	$ 5, 285

Appendix C: User Manual

Program Start

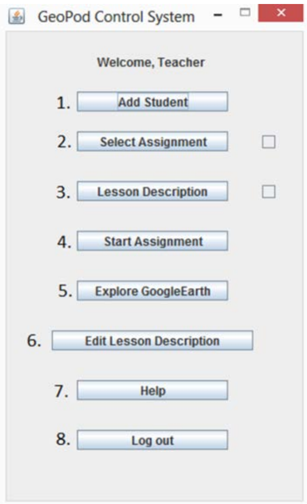
To access Google Earth start up the Java program by clicking on the Brady Blaster icon:

After opened enter the teacher login that is provided for you:



The Students will access the GeoPod though the same method using their given login.

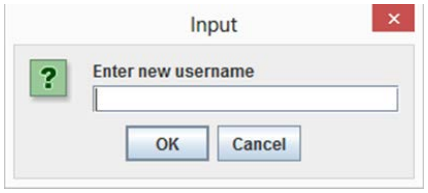
Teacher control system



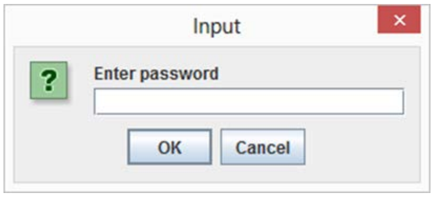
Please refer to the section of the desired information. A description of its use and operation will be detailed. There is also reference material to working in Google Earth as well as setting up the joystick.

Add students

-Shown only on the teachers menu



Input the student’s logins and passwords:

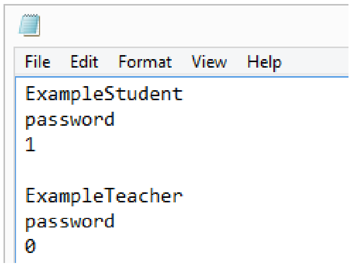


To manually update a student/teacher's name go to the data.txt file.

Using a text editor, you can adjust a student’s name:

The third line denotes a student or teacher.

0 is the Teacher   1 is the students



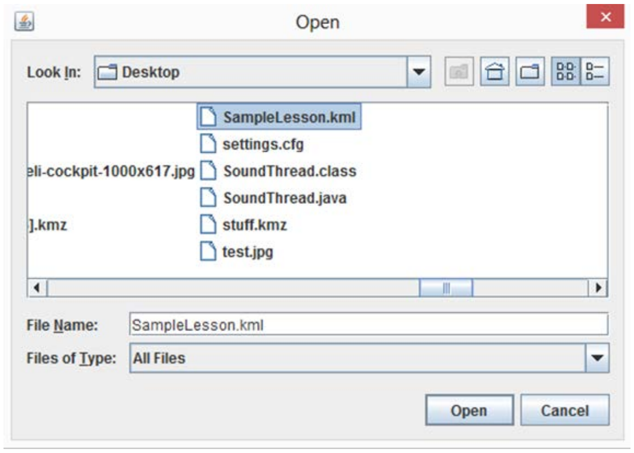
```
ExampleStudent
password
1

ExampleTeacher
password
0
```

Select Assignment

-Shown on both the students and the teachers menu

This is the button that is used to select the KML file for the lesson. Using this button, select the specific lesson and click open:



Look In: Desktop

File Name: SampleLesson.kml

Files of Type: All Files

The check box to the right of the Select Assignment button will be check to show a valid KML was selected.

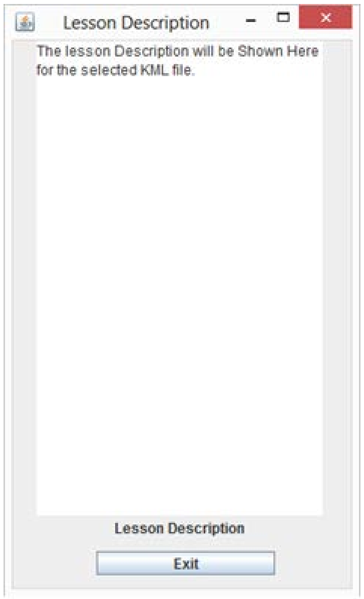
This selection is one of the requirements to use the Start Assignment button

There is also protection upon this menu to prevent students from selecting a file that is not a kml lesson file.

Lesson Description

-Shown on both the students and the teachers menu

This is the button that is used to read the description for the selected lesson. Using this button you can read about what is needed to do. It can be useful to leave this screen up:



The lesson Description will be Shown Here for the selected KML file.

The check box to the right of the Lesson Description button will be check to show the student has read the description.

This selection is one of the requirements to use the Start Assignment button

Start Assignment

-Shown on both the students and the teachers menu

This is the main way in which you can use the program to run the lessons that you create.

In order to use this button and actually start the simulator   with a lesson two conditions must be met. Both the Select Assignment, as well as Lesson Description must have been assessed to ensure you have a valid KML. It also verifies that the user understands the lesson needs and objectives.

Explore Google Earth

-Shown on both the students and the teachers menu

This button is used to start google earth without the need for a lesson plan. It can be used to create your lessons by using the Google Earth tools to develop a lesson.

When saving your lesson make sure to select Save As, and then select a KML file.

It is also highly recommended to save the newly created lesson into the class folder that will be using it. This prevents issues from students trying to find the lesson.

Edit Lesson Description

-Shown only on the teachers menu.

This menu will allow you to make the description of the lesson for your students:

When you are satisfied with the description that you want, click the Enter Lesson Description button:

By editing the description of the lesson text for the file, you will be overwriting the previous entry. Keep this in mind while editing the description for the lesson.

Help

-Shown only on the teachers menu

This button will open the help menu. Here you have access to the System Administration button.

Clicking on this will display the setup configuration needed to produce the 5 screen setup.

Logout

-Shown on both the students and the teachers menu

This button simply closes the entire interface and all associated windows that have been created.

Creating a new placemark

Position the 3D viewer to contain the spot you want to placemark. Select Placemark from the 'Add' Menu or click the Placemark icon on the toolbar menu at the the top of the screen

The 'New Placemark' dialog box appears and a 'New Placemark' icon is centered in the viewer inside a flashing yellow square. Position the placemark. To do this, position the Set the following properties for the new placemark:

- Name for the placemark
- Description, including HTML text (this is how you would embed the videos)
- Style, Color - Choose a color, scale (size) and opacity for the placemark icon
- View - Choose a position for the placemark.
- Altitude - Choose the height of the placemark as it appears over terrain

Setting Default starting Location

You can set your starting location by going to the menu and at the top Selecting View.Next scroll down on this menu until you find make this my starting place. This can be modified like any placemark you create.

You will always start in the chosen location. If you want to remove this as your starting place... look in the sidebar at the left at the Places section. There will be a place called "starting place". You can right click on this and choose "delete". After restart, the default start location will be back.

Appendix D: Installation Instructions

Installation

This chapter covers the initial installation of Google Earth Liquid Galaxy, BradyBlaster, and the Joystick software. The installer needs the have local or domain administrator rights in the computers.

Liquid Galaxy is not a product. It is a method of configuring Google Earth to surround the viewer with a realistic visual geographic display.

Recommended Minimum Hardware requirements

8 GB RAM

quad-core i5

80 GB SSD

Nidia g210GPU or equivalent.

One computer and one display per 36.5 degrees of rotation around an arc.

A game controller – Logitech Extreme 3D pro is used in this simulation.

Connectivity to the Internet is also needed to operation Liquid galaxy.

The computer/display at zero degrees is the front computer and covers 36.5 degrees of horizontal Field of View. Four more computer/displays are needed to achieve 180 degrees around an arc. The displays must be in a vertical orientation. Information about the physical positioning of the displays is discussed later.

Installation of Google Earth

Google Earth is part of Jefferson County default computer build, and should not have to be downloaded or installed.

Installation of BradyBlaster

The master computer needs a folder at the root of C:, “BradyBlaster” is a good name to call it. The files from the CD should be copied into the new folder, and all of the instructors need to be able to Modify and Write to the files and subfolders. After the files are copied, click on the JAR file and make a shortcut to the desktop.

Configuration of Liquid Galaxy

Each computer must have its own configuration, and the installer must have the rights to modify the files that are shown on the next five pages. These configurations will also have to be re-added if Google Earth is re-installed.

Computer 1: Far Left

Configuration files to modify – both are identical:

C:\Program Files [(x86)]\Google\Google Earth\client\drivers.ini

C:\Program Files [(x86)]\Google\Google Earth\plugin\drivers.ini

Add security rights to these files for the installer: Modify, Write.

```
SETTINGS { ; existing line

        ; ViewSync settings

        ViewSync/send = false

        ViewSync/receive = true

; For video caves, we typically want the slave screens to look to the left

; or right (yawOffset) of where the master is looking.

        ViewSync/yawOffset = -73.0 ; center angle

        ViewSync/pitchOffset = 0.0

        ViewSync/rollOffset = 0.0

        ViewSync/horizFov = 36.5 ; field of view

; end of ViewSync settings
```

Computer 2: Near Left

Configuration files to modify – both are identical:

C:\Program Files [(x86)]\Google\Google Earth\client\drivers.ini

C:\Program Files [(x86)]\Google\Google Earth\plugin\drivers.ini

Add security rights to these files for the installer: Modify, Write.

```
SETTINGS { ; existing line

        ; ViewSync settings

        ViewSync/send = false

        ViewSync/receive = true

; For video caves, we typically want the slave screens to look to the left

; or right (yawOffset) of where the master is looking.

        ViewSync/yawOffset = -36.5 ; center angle

        ViewSync/pitchOffset = 0.0

        ViewSync/rollOffset = 0.0

        ViewSync/horizFov = 36.5 ; field of view

; end of ViewSync settings
```

Computer 3: Center (Master)

Configuration files to modify – both are identical:

C:\Program Files [(x86)]\Google\Google Earth\client\drivers.ini

C:\Program Files [(x86)]\Google\Google Earth\plugin\drivers.ini

Add security rights to these files for the installer: Modify, Write.

```
SETTINGS { ; existing line

        ; ViewSync settings

        ViewSync/send = true

        ViewSync/receive = false

; If send = true, sets the IP where the datagrams are sent. Use a broadcast

; address for more than one slave display.

        ViewSync/hostname = x.x.x.255    ;where x is the first three octets of ; ;

        ViewSync/port = 21567

        ; the IP subnet.

; For video caves, we typically want the slave screens to look to the left

; or right (yawOffset) of where the master is looking.

        ViewSync/yawOffset = 0.0 ; center angle

        ViewSync/pitchOffset = 0.0

        ViewSync/rollOffset = 0.0

        ViewSync/horizFov = 36.5 ; field of view

; end of ViewSync settings
```

Computer 4: Near Right

Configuration files to modify – both are identical:

C:\Program Files [(x86)]\Google\Google Earth\client\drivers.ini

C:\Program Files [(x86)]\Google\Google Earth\plugin\drivers.ini

Add security rights to these files for the installer: Modify, Write.

```
SETTINGS { ; existing line
        ; ViewSync settings
        ViewSync/send = false
        ViewSync/receive = true
; For video caves, we typically want the slave screens to look to the left
; or right (yawOffset) of where the master is looking.
        ViewSync/yawOffset = 36.5 ; center angle
        ViewSync/pitchOffset = 0.0
        ViewSync/rollOffset = 0.0
        ViewSync/horizFov = 36.5 ; field of view
; end of ViewSync settings
```

Computer 5: Far Right

Configuration files to modify – both are identical:

C:\Program Files [(x86)]\Google\Google Earth\client\drivers.ini

C:\Program Files [(x86)]\Google\Google Earth\plugin\drivers.ini

Add security rights to these files for the installer: Modify, Write.

```
SETTINGS { ; existing line
        ; ViewSync settings
        ViewSync/send = false
        ViewSync/receive = true
; For video caves, we typically want the slave screens to look to the left
; or right (yawOffset) of where the master is looking.
        ViewSync/yawOffset = 73.0 ; center angle
        ViewSync/pitchOffset = 0.0
        ViewSync/rollOffset = 0.0
        ViewSync/horizFov = 36.5 ; field of view
; end of ViewSync settings
```

Local Firewall changes

Add UPD port 21567 as an allowed outbound and inbound rule.

Joystick Controls

The driver software for the joystick needs to be installed on the master computer, and can be downloaded at:

www.logitech.com/support/extreme3dpro

Click the downloads tab, and then click the “download software” button. “lgs510_x64.exe” should appear in the Downloads folder. If you have a 32-bit system then the file name may end with “x32.”

Double-click “igs510-x64.exe” to install the joystick software, and follow the on-screen instructions for

Installing and checking the joystick.

After the program finishes its checks, load the BradyBlaster configuration file by clicking File, Import.

Browse to the C:\BradyBlaster\Joystick folder and select BradyBlaster.XML, and click the OK button. The joystick will stay configured.

Common Installation Problems

A common problem is a lack of communication between the master and the slave computers.

1. Check the IP addresses. They must all be on the same subnet.
2. Check the master’s broadcast address in its drivers.ini file.

3. Check the spelling of “ViewSync/receive” in the drivers.ini files.
4. Check and make sure the firewall port is open.
5. The drivers.ini in both the clients and plugins subfolders need to be identical.