



GIS Career Awareness Learning Module # 3
Version 3.0 November 26, 2007

The Cutting Edge and Future of GIS

- **Estimated Time: 1.50 hours**
- **Password Required:** Please contact with Dr. Tsou (mtsou@mail.sdsu.edu) or Ting-Hwan Lee (lee60rohan@gmail.com) for student accounts and passwords to complete this module.
- **Learning Goal:** This module will introduce various GIS applications which involve the cutting edge of technological innovations currently in use or being developed for the near future. Research applications that will be introduced include Mobile GIS (Computerized Navigation and Habitat monitoring of Mission Trails Regional Park), and Participatory (Collaborative) GIS applications (Mapping Where You Want to Visit in the World in Web-Based Collaborative Maps). The module is designed to acquaint students with some advanced and applied uses of GIS that will be prevalent in society, government, and industry in the near future.
- **Platforms:** PC, Mac, or UNIX.
- **Software Tools Required:** Web browser with high-speed Internet access. A multimedia video player is required. (Formats available: .QT (Apple QuickTime), .WMV (Microsoft Windows Media), .MPG (MPEG Video))

Note: This Web-based GIS learning module was developed with support from a National Science Foundation – Advanced Technological Education Program Research Grant (NSF-ATE DUE # 0401990): “A Scalable Skills Certification Program in Geographic Information Systems (GIS).” (<http://geoinfo.sdsu.edu/hightech>)

**ANSWER ALL QUESTIONS ON THE SEPARATE
ANSWER SHEET**

Section 1 – Mobile GIS - Small and Portable GIS

Part 1 – Mobile GIS – Application Scenario: Computerized Navigation

Mobile GIS technology is basically taking a smaller version of powerful GIS mapping tools into the “field.” It usually consists of four components:

1. A small and portable computer like a PDA (personal digital assistant) or laptop which runs the software application and stores information about places in computer memory (Figure 3-1).
2. GIS software that manages and maps the information about places (Figure 3-2).
3. A GPS Receiver (Global Positioning System) (Figure 3-3) that helps the GIS software figure out where you are located.
4. A computer database (computer data) (Figure 3-4) that holds all of information about places. This database part can be in the computer’s PDA or on a network like the Internet.

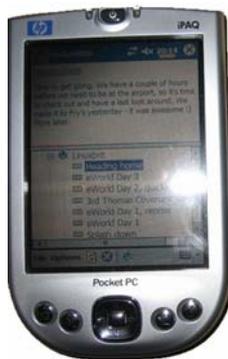


Figure 3-1: A Pocket PC-Personal Digital Assistant (PDA)



Figure 3-2: Mobile GIS Software (Arc PAD)



Figure 3-3: A Portable GPS Receiver

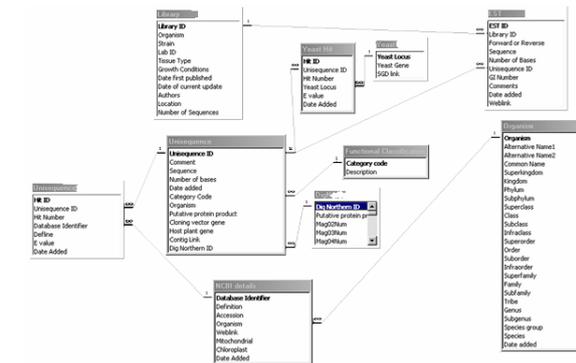


Figure 3-4: A Computer Database

You can also think of Mobile GIS as a very powerful map that knows where you are and has information stored in it about many places.

A-1: Name one significant difference between using “Mobile GIS” versus using a “paper map” and a “list of data?” (In the example above, the list of data---the database---was a phone book.)

Part 2 - Application Scenario: Plant Species Monitoring the Fragile Habitat of Mission Trails Regional Park, San Diego

Let’s quickly look at an application of Mobile GIS, recording the growth of “invasive” plant species. Invasive plants grow into the territory of native plants and can harm the native plants by taking up precious and limited nutrients and the water from the native plants. Thus, native plants may be endangered and it is important to protect these plants.

The following is a screen shot of an actual Mobile GIS application running on a Pocket PC (Figure 3-5). The image displayed on the screen was taken with a GIS-related technology called “Remote Sensing.” In Figure 3-5, the red dots represent vegetation and the white lines represent destructive BMX bike trails.

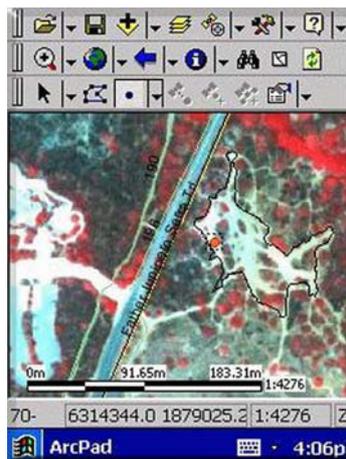


Figure 3-5: Mobile GIS Software Displaying Locations and Types of Ground Cover

This Mobile GIS application will help the park rangers track the growth, movement, and types of vegetation and make decisions about what to do if an invasive plant species is taking over or if the BMX riders are destroying any of the precious vegetation within the park.

- Navigate to <http://geoinfo.sdsu.edu/hightech/LearningModules/MTRP> and watch the video demonstrations of Mobile GIS for habitat monitoring (or watch this video on youtube: http://www.youtube.com/watch?v=4ij_ZZLMzxc)

A-2: What else do you think Mobile GIS can be used for and why would it be useful? Be specific and think about how a portable computer, mapping software, database, and GPS (displaying a user’s live location) might help

Section 2 – Participatory (Collaborative) GIS – Application Scenario: Web-Based Community Mapping of Where You Want to Visit in the World

STEP 1: VIEW CURRENT COLLABORATIVE MAP

o A Collaborative GIS Map

In this section you will create a feature and add it to a Web-based collaborative GIS map. Your feature will be one of many that will become a **permanent** part of an online GIS. Before we begin, let's define some terms.

o Map Features

A map feature is a natural or man-made object or place of interest. It is something that exists at a specific place in a specific time. An example of a feature can be a single school, a single business, a city, a landmark, or even a country. A feature class is the entire set of grouped features on the map. A GIS map may have a feature class of schools, creeks, and rivers, a feature class of landmarks, a feature class of countries, etc.

In the map you will be contributing to, the feature that you will be mapping can be any natural or manmade place or object in the world. Examples include “The Eiffel Tower in Paris,” “The Great Wall in China,” or “The State of Hawaii.” Notice that the examples included unique places (cities, states, etc.) as well as unique “objects” (The Great Wall, etc.) around the world. Please carefully think about the following question. You will create a feature on the Collaborative GIS map based on this response.

It will be very helpful to examine the map you will be creating a feature for. We will also describe some of the map controls at the same time.

- Navigate to the following URL: <http://geoinfo.sdsu.edu/hightech/LM3/>
- Click on the link called, “STEP 1: VIEW CURRENT COLLABORATIVE MAP” (See Figure 3-7.)



Figure 3-7: Clicking on STEP 1: VIEW CURRENT COLLABORATIVE MAP

The actual Collaborative Web map should eventually appear along with all of the mapped features (the places or things people want to visit).



Figure 3-8: The Collaborative Web Map

o Map Navigation and Zooming In and Out

- Click on and drag the map with your mouse from one side to the other to move the map.
- Click on and drag the little overview map in the inset at the bottom-right corner to move the map.
- Click on the pan controls on the top-left of the map window to pan the map.
- Double-click on any place on the map and the map will zoom in and center on that location.
- Use the zoom control on the left to zoom in and out.

“Zoomed in” is not available for the entire planet. Extremely high resolution is, generally, only available for the larger cities and notable places of interest.

o Investigating Existing Mapped Features

Now, you are going to view a couple of features that have been mapped by other students. You can look at the details of a feature by clicking on its name in the feature list (see Figure 3-9) or by clicking on its red feature marker. The feature list on the right quickly lists all of the mapped places.



Figure 3-9: Mapped Feature Details

The creator of the feature provided most of the information associated with the feature. They provided the location in latitude and longitude, named it, described it, and explained why they want to go there. They also selected a Website with more information about the feature and selected an image from the Web to be displayed with the feature.

After a couple of minutes of exploring the map, you will be creating a feature for, decide on a unique place or object to visit in the world and answer the following question:

B-1 (“Name Your Chosen Place”): *If you can visit anywhere or anything in the world, where or what would YOU visit? Name it in 10 words or less.*

Example: *The Eiffel Tower in Paris, France.*

Notice the question number above (B-1). You will use the answers to these questions to map your selected place based on these question numbers.

- Map Feature Attributes

Feature attribute data consist of any information related to the associated feature. Think of it as specific information about individual features. If a group of features are streets, the attribute data can include the name of the street, the number of lanes, whether the street is a one-way street, the length of the street, etc. Another example can include the attributes of a group of countries. The attributes can include the country name, the population of the country, the type of government, the date the country was founded, etc. In this collaborative GIS map, the features will consist of “places or objects that people want to visit.” Your feature will be one of many on a single Web map. Now, you are going to include some attribute data with your feature. We will now create some attributes for your feature.

B-2 (“Description of Your Chosen Place”): *Briefly (in three sentences or less) describe the place or object that you specified in Question B-1 above?*

Example: *The Eiffel Tower is an iron tower built on the Champ de Mars beside the River Seine in Paris. It is the tallest structure in Paris and among the most recognized symbols in the world. It is named after its designer, engineer Gustave Eiffel (from the Wikipedia Website.)*

B-3 (“Why Do You Want to Visit This Place or Object?”): *Why do you want to visit the place or object that you specified in Question B-1 above? Please limit your response to a maximum of two sentences.*

Example: *It is a very famous landmark which I have seen in many movies.*

Your responses to questions B-1, B-2, and B-3 above are some **attributes** that are associated with your chosen place. Other attributes include you, the author of the feature; the date it was created; and the location of your chosen place. The location is probably the most important attribute of any feature in a GIS map.

o The Location Attribute

In order to map your chosen place which you described above, you need to know its approximate location, the latitude and longitude coordinates. In this collaborative GIS map, you can quickly and easily obtain them by simply entering the name of the place.

There are other options for obtaining latitude and longitude coordinates for more advanced user, and the advanced options are listed here and are explained in more detail in the Appendix of this document:

Advanced Options for Obtaining Latitude and Longitude Coordinates (Detailed instructions are in the Appendix)

1. Finding and using latitude and longitude coordinates from a Web search and converting coordinates, if necessary
2. Obtaining the latitude and longitude coordinates by using the U.S. Street Address (Can be used only when your chosen place is located in the U.S.).
3. Obtaining the latitude and longitude coordinates by zooming in and clicking on your chosen place directly on a Web map.

STEP 2: SEARCH FOR THE COORDINATES OF MY CHOSEN PLACE

- Navigate to <http://geoinfo.sdsu.edu/hightech/LM3> and click on the link called, “STEP 2:” (See Figure 3-10, See Figure 3-11.)



Figure 3-10: Clicking on STEP 2:

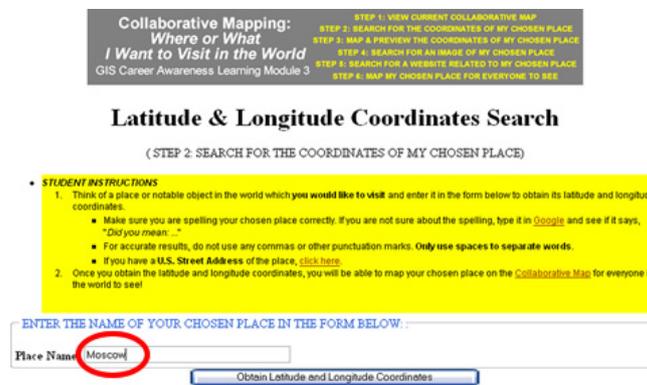


Figure 3-11: STEP 2: search for the coordinates of my chosen place

- Think of the general name or location of your chosen place; enter it in the Place Name field. Examples can include the cities or towns (Moscow, San Diego, etc.); countries (Tibet, Liechtenstein, etc.), and specific features (Disneyland (Amusement Park), Okeechobee (Lake), Everest (Mountain), Yellowstone (National Park), etc.). To get the most accurate location, you may have to enter a single word instead of multiple words.
- After entering and searching for your chosen place, now it will be your responsibility to scroll through the list and find the closest match, if any. Following the student instructions in yellow, verify that your place is in the appropriate country. As an example, in Figure 3-12, you will notice that there is a Moscow in Russia AND Idaho.
- If you were searching for Moscow, Russia, click on the link, “Go to Step 3 and Preview **THESE** Coordinates on a Map.” If the tool did not generate appropriate results or no results at all, return to STEP 2 and try a different name or combination of names.

(Results of [STEP 2: SEARCH FOR THE COORDINATES OF MY CHOSEN PLACE](#))

STUDENT INSTRUCTIONS

1. Choose the closest matching place name (Choose only one set of latitude and longitude coordinates.)
 - You are going to use these coordinates to map your chosen place.
 - Make sure the place is in the correct country. Many different places have identical names.
 - If you are not happy with the results, [click here to enter different information and search again.](#)
 - Instead of using this Web tool, you can search for coordinates on [Google](#) by entering the name of your chosen place and the words, latitude longitude coordinates but it's not recommended.
2. Copy down the LATITUDE and LONGITUDE coordinates (with all of the decimal part) of the closest matching place name so you won't lose them.
3. If you are happy with your coordinates, go to [STEP 3: MAP & PREVIEW THE COORDINATES OF MY CHOSEN PLACE](#) to preview the coordinates.

Four search resulted in 120 results.
Search results are limited to 100 listings. Results Derived from [GeoNames](#)

<p>- Moscow</p> <p>COUNTRY ABBREVIATION: RU (What country is this?)</p> <p>LATITUDE (DECIMAL DEGREES): 55.752222</p> <p>LONGITUDE (DECIMAL DEGREES): 37.615556</p> <p style="text-align: center;">Go to STEP 3 and Preview THESE Coordinates on a Map.</p>	 <p>Moscow, RUSSIA</p>
<p>- Moscow</p> <p>COUNTRY ABBREVIATION: US (What country is this?)</p> <p>LATITUDE (DECIMAL DEGREES): 46.7325</p> <p>LONGITUDE (DECIMAL DEGREES): -116.99917</p>	 <p>Moscow, IDAHO (U.S.A.)</p>

Figure 3-12: Latitude and Longitude Coordinates Search Results for Moscow

B-4: What word or words did you enter in the text search field in STEP 2: SEARCH FOR THE COORDINATES OF MY CHOSEN PLACE?

Example: Moscow

STEP 3: MAP & PREVIEW THE COORDINATES OF MY CHOSEN PLACE

Your browser will now be directed to the STEP 3 Web page where you can preview the coordinates you have selected in STEP 2 (See example in Figure 3-13).

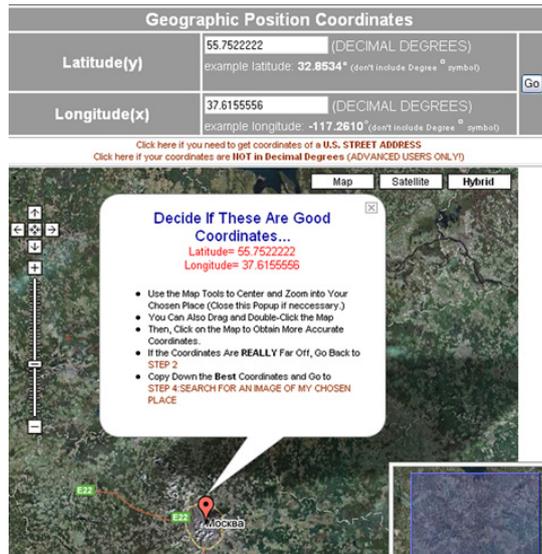


Figure 3-13: Example of Previewing Coordinates for Moscow in STEP 3: MAP & PREVIEW THE COORDINATES OF MY CHOSEN PLACE

- Now we need to zoom in and click on the map to get more accurate coordinates of this “smaller” map feature. Once you single-click on another location on the map, new coordinates will be generated (Figure 3-14).

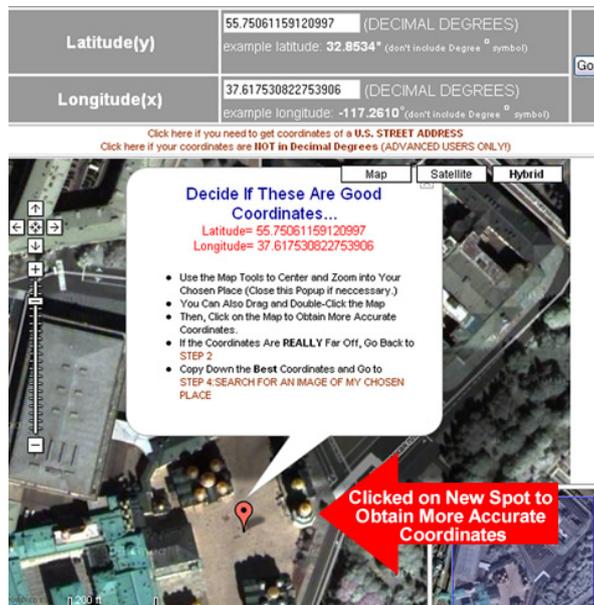


Figure 3-14: Zoomed in and Clicked on the Center of Red Square (Moscow, Russia)

- If you do not know what the place you’ve chosen looks like or its precise location, you do not need to zoom in that close. You can just obtain for the coordinates for its general location (like the city or town in which it is located).

- Now, after you are satisfied with the latitude and longitude coordinates which you generated in STEP 3, copy them down below (Do not forget any negative signs, if any, and, copy down the ENTIRE decimal number for each).

B-5 (“Latitude Coordinate”): Write down the latitude coordinate of the place or object you want to visit:
LATITUDE (in Decimal Degrees only and don’t forget the negative sign, if any):

Example: 55.75061159120997

B-6 (“Longitude Coordinate”): Write down the longitude coordinate of the place or object you want to visit:
LONGITUDE (in Decimal Degrees only):

Example: 37.617530822753906

STEP 4: SEARCH FOR AN IMAGE OF MY CHOSEN PLACE

Once you are done copying down the coordinates, you will quickly search for and select an image on the Web to associate with your selected place. (This is an advanced function and is not recommended if this is your first time using the collaborative mapping system.)

- Click on the link called, “STEP 4:” (See Figure 3-15, Figure 3-16).



Figure 3-15: Clicking on STEP 4: SEARCH FOR AN IMAGE OF MY CHOSEN PLACE



Figure 3-16: STEP 4: SEARCH FOR AN IMAGE OF MY CHOSEN PLACE

- Enter a very specific name or words to describe your chosen place in the STEP 4 search field. If your browser allows it, a new window will pop up with a list of image thumbnails (Figure 3-17).

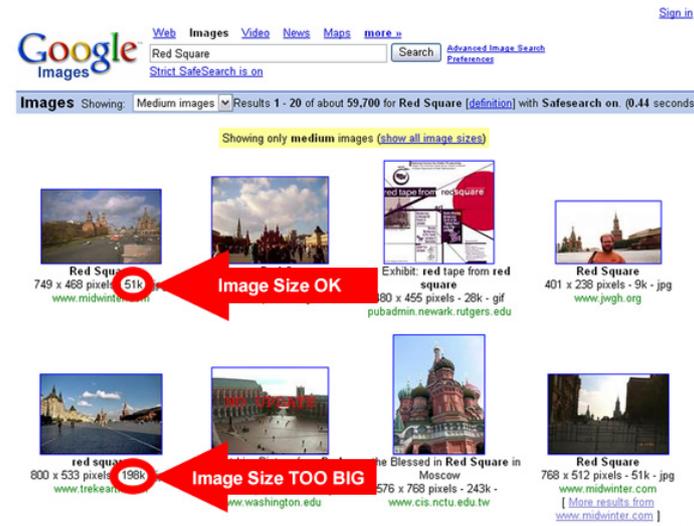


Figure 3-17: Image Search Results (Images that are larger than 75k is too big)

- Browse the thumbnail images and choose one too. (Two examples are highlighted in Figure 3-17). Do not select any images that are over 75k. Click on the image you are interested in (See Figure 3-18).



Figure 3-18: Source Image Website with “See full-size image” URL Link

- Click on the link named “See full-size image” to obtain the image URL (Uniform Resource Locator) -- also known as Web address.
- The resulting URL is the Web address of the standalone image. You will need to copy down this ENTIRE URL, including the <http://> part. As an added “safety measure,” leave this Web browser window (with the standalone image and its URL) open for the rest of this activity so you can copy and paste the Web URL of the image when you need it a little later (See Figure 3-19).

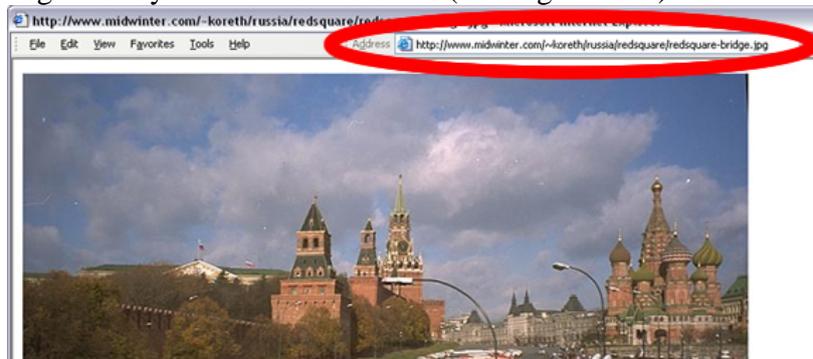


Figure 3-19: Standalone Image URL (Web Address)

B-7 (“Image of Your Chosen Place”): Write down the full Web URL (including the “http://” part) of the image. (If you obtained a valid URL, it should end with one of the following: “.png”, “.gif”, “.jpeg”, “.jpg.”):

Example: <http://www.midwinter.com/~koreth/russia/redsquare/redsquare-bridge.jpg>

B-8 (“Description of the Image of Your Chosen Place”): Write down a few words or a very short sentence describing the image in Question C-7

Example: The Red Square in Moscow, Russia

Remember: KEEP THE WEB PAGE WITH YOU IMAGE OPEN!

STEP 5: SEARCH FOR A WEBSITE RELATED TO MY CHOSEN PLACE

Now, you are going to select a Website that is associated with your chosen place. A Web link will be created with your mapped feature that will take users to more information.

- Click on the link called, “STEP 5:” (See Figure 3-20, Figure 3-21).



Figure 3-20: Clicking on STEP 5: search for a website related to my chosen place

- See Figure 3-21; choose a search engine; enter a VERY SPECIFIC name or words to describe your chosen place. In this collaborative Web mapping application, we have provided you with Yahoo, Ask Jeeves, and Google.

2. Step-By-Step Instructions

- Choose [Yahoo](#), [Ask Jeeves](#), or [Google](#) to perform your search (Search engines not included here are okay too).
- Enter a few words to accurately describe your chosen place and click the "Search for Websites" button.
 - A separate window will pop up with the resulting list of Web links.
 - Determine if any of them have interesting or useful information related to your chosen place.
 - Microsoft Internet Explorer Users: If the pop-up window was blocked, try holding down the Ctrl button while clicking on the button
- From the resulting list, select a Web link by clicking on it
 - The browser will navigate to the source Website and the Web address will be listed in the Web address field of your browser.
- If you are satisfied with this Website, copy down the full Web address.
 - If the Web address of the image is too long, it might be easier to just keep the window with the Web address open until you need it in STEP 6. You can then just copy and paste it where it's required!

3. After choosing a Web link and copying down its Web URL (or keeping the Website window open), go to [STEP 6: MAP MY CHOSEN PLACE FOR EVERYONE TO SEE](#)

- YAHOO WEB SEARCH
ENTER A BRIEF DESCRIPTION OF YOUR CHOSEN PLACE

Place Name:

Search for Websites with Yahoo

- ASK JEEVES WEB SEARCH
ENTER A BRIEF DESCRIPTION OF YOUR CHOSEN PLACE

Place Name:

Search for Websites with Ask Jeeves

- GOOGLE WEB SEARCH
ENTER A BRIEF DESCRIPTION OF YOUR CHOSEN PLACE

Place Name:

Search for Websites with Google

Figure 3-21: STEP 5: SEARCH FOR A WEBSITE RELATED TO MY CHOSEN PLACE

- From a list of Websites, you need to select a SINGLE Website to associate with your chosen place. If you like one, copy down the entire URL of the Website.

B-9 (“Related Website”): Write down the full Web URL (including the “http://” part) of the.

Example: <http://www.geographia.com/russia/moscow03.htm>

B-10 (“Description of the Related Website”): Now write down a few words or a VERY short sentence describing the Website you selected in Question C-9

Example: Official Red Square Website of the Russian Tourism Office

STEP 6: MAP MY CHOSEN PLACE FOR EVERYONE TO SEE

Now, you have all of the information you need to instantly map your chosen place for the entire world to see. Your mapped feature will be on this Web map for everybody to see.

- Click on the link called, “STEP 6:” (See Figure 3-22).



Figure 3-22: Clicking on STEP 6: MAP MY CHOSEN PLACE FOR EVERYONE TO SEE

- Once you have logged in, a Web page should appear with your name and a bunch of input form fields (See Figure 3-23, Figure 3-24).

Collaborative Mapping: Where or What I Want to Visit in the World
GIS Career Awareness Learning Module 3

STEP 1: VIEW CURRENT COLLABORATIVE MAP
STEP 2: SEARCH FOR THE COORDINATES OF MY CHOSEN PLACE
STEP 3: MAP & PREVIEW THE COORDINATES OF MY CHOSEN PLACE
STEP 4: SEARCH FOR AN IMAGE OF MY CHOSEN PLACE
STEP 5: SEARCH FOR A WEBSITE RELATED TO MY CHOSEN PLACE
STEP 6: MAP MY CHOSEN PLACE FOR EVERYONE TO SEE

Map a Feature on the Collaborative Map
(STEP 6: MAP MY CHOSEN PLACE FOR EVERYONE TO SEE)

STUDENT INSTRUCTIONS

1. This is it! You will now take all of the information you have gathered and selected and map your chosen place for the entire world to see and read.
 - As part of this learning exercise, you will only be able to map **one** chosen place.
 - **You will not be able to make any changes after it is mapped** so be careful what you type and watch your spelling.
2. Log on with the User ID Number and User Password provided to you and click the “Submit” button.

User ID Number:

User Password:

Figure 3-23: STEP 6 Log In Page

Figure 3-24: STEP 6 Input Form

Using what you wrote down in Questions B-1, B-2, B-3, B-5, B-6, B-7, B-8, B-9, and B-10. Please DO NOT forget to click on the button, “CLICK TO SAVE YOUR WORK NOW” whenever you finish filling in the form fields above it.

We will now describe this process step-by-step:

Question B-1, B-2, B-3, B-5, B-6, B-7 (Figure 3-25, Figure 3-26, Figure 3-27, Figure 3-28, Figure 3-29, Figure 3-30)

Copy down your response for the Questions. Save your work by clicking on the button.

Figure 3-25: Response for Question B-1

Figure 3-26: Response for Question B-2

Figure 3-27: Response for Question B-3

Figure 3-28: Response for Question B-5



Figure 3-29: Response for Question B-6



Figure 3-30: Specifying an Image for Question B-7

- After clicking on the link, you will be taken to a Web page where you can specify the Web address of the image you chose for Question B-7 (Figure 3-31).

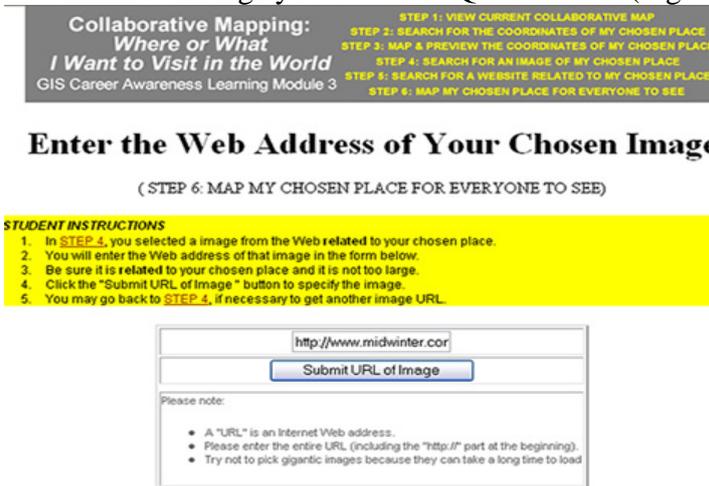


Figure 3-31: Submitting URL (Web Address) of Image Specified in Question B-7

- After entering the ENTIRE URL (including the “http://” part), click on the Submit URL button; the Figure 3-32 should appear.



Figure 3-32: Image URL Accepted (Arrow Indicates Instructions to REPLACE Image URL)

- If you are happy with the image you have specified for your chosen place, click on the link, “Click Here to Use this Image and Continue Creating a Map...” and you will be taken back to the form which you were working on previously (Figure 3-33).
- If you need to replace or re-enter the URL, scroll down to the bottom of the image and repeat this step.
- If there is any problem with your image URL, follow the instructions that appear on the Web page.



Figure 3-33: After Successfully Specifying an Image URL for Question B-7

Question B-8, B-9, B-10 (Figure 3-34, Figure 3-35, Figure 3-36)

Please Copy Down your response for the questions and Save your work by clicking on the button.



Figure 3-34: Response for Question B-8



Figure 3-35: Response for Question B-9 (Be sure to include the “http://” part)



Figure 3-36: Response for Question B-10

- Now, it’s time to create your feature! Click on the button to permanently map your chosen place (Figure 3-37).



Figure 3-37: MAP MY CHOSEN PLACE

If you followed all of the steps correctly, the Web page should return to the collaborative GIS Web map with all of the mapped features visible (Figure 3-38).

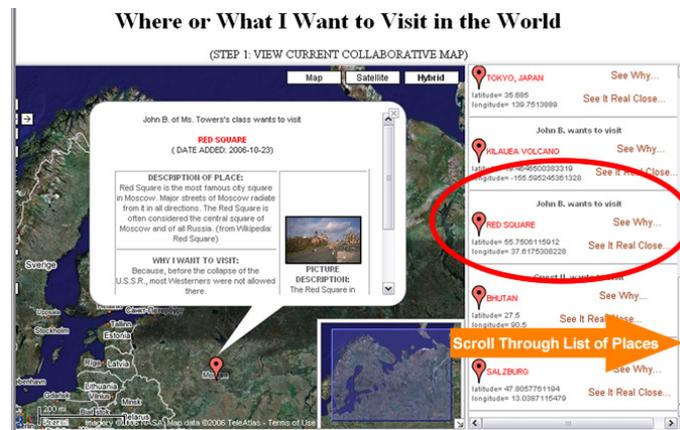


Figure 3-38: Checking Out the Newly-Mapped Chosen Place!

Alternatively, click on the actual “place marker” on the map to bring up the information about your chosen place. Zoom in and examine your mapped chosen place. Be proud that you have carried out all of the steps necessary for the world to see your contribution to this map made by several people.

Now, you are almost done with this learning module. There are just a few more questions left. Please answer the following:

B-11: Briefly write down the steps you took to obtain the latitude and longitude coordinates of the place or object you want to visit.

B-12: Explain why mapping your chosen place can be called “Public Participatory GIS,” “Collaborative GIS,” “Collaborative Mapping,” “Community Mapping,” or “Community GIS.” Why is it useful?

Section 4 – Written Assignment

Now that you have seen several examples of cutting-edge and upcoming GIS technology, it is time to take a few moments to think about and write a summary paragraph about the future of GIS and what might the future technology be useful for. Please spend 30 minutes writing a summary paragraph (250 words) about what you have learned in this section.

C-1: In your paragraph, quickly describe the three cutting-edge GIS applications that were discussed. Recall that they included Mobile GIS and Collaborative Mapping.

C-2: In your paragraph, please give one example use not discussed for one of the two GIS applications described (Mobile GIS and Collaborative Mapping.) Describe how it will help and be useful to people, businesses, or governments.

C-3: In your paragraph, describe what place you mapped with the Participatory GIS map and how could such a technology be useful for mapping other things besides where you want to visit. Could this Web-based technology be useful to other people, businesses, or governments? Why?

Student Survey

This learning module was developed specifically for you---the students---in order to expose you to GIS and related geospatial technologies.

GIS and related geospatial technologies, similar to what you worked with in this learning module, are major components of one of the most important new industries for career growth. Businesses, organizations, and governments are increasingly seeking skilled talent in this industry.

Now, to benefit other students and the authors of this learning module, you are required to finish this Student Survey and please send it back to the San Diego State University NSF-ATE team. We would greatly appreciate your input. Please take time to answer these questions as openly and honestly as possible. **They will not affect your grade or score.** You can provide your feedback to your teacher/educator along with the learning module answers on the separate answer sheet.

Thank you for helping us improves our modules!

S-9: What did you like best about this learning module three? Why?

S-10: What did you like least about this learning module three? Why?

S-11: Was there anything that was really hard to understand or difficult to complete in this module three? What was it? Why?

S-12: Is there anything in this learning module three that we can add, exclude, or change to make it better? What is it? Why?

Appendix

The Appendix provides a brief review of latitude and longitude coordinates and provides some alternative and advanced techniques for finding latitude and longitude coordinates of your chosen place.

Latitude and Longitude Coordinates

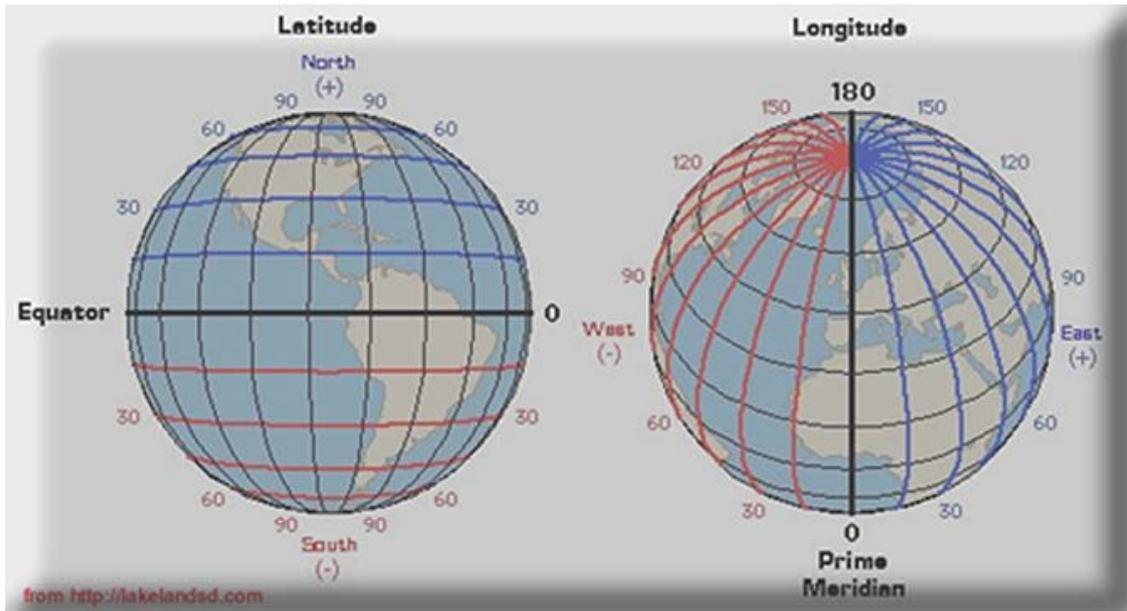


Figure A-1: Parallels of Latitude (Left) and Meridians of Longitude (Right)

Latitude and longitude, like x and y coordinates on a Cartesian map, can uniquely specify a location on the spherical globe that we call earth.

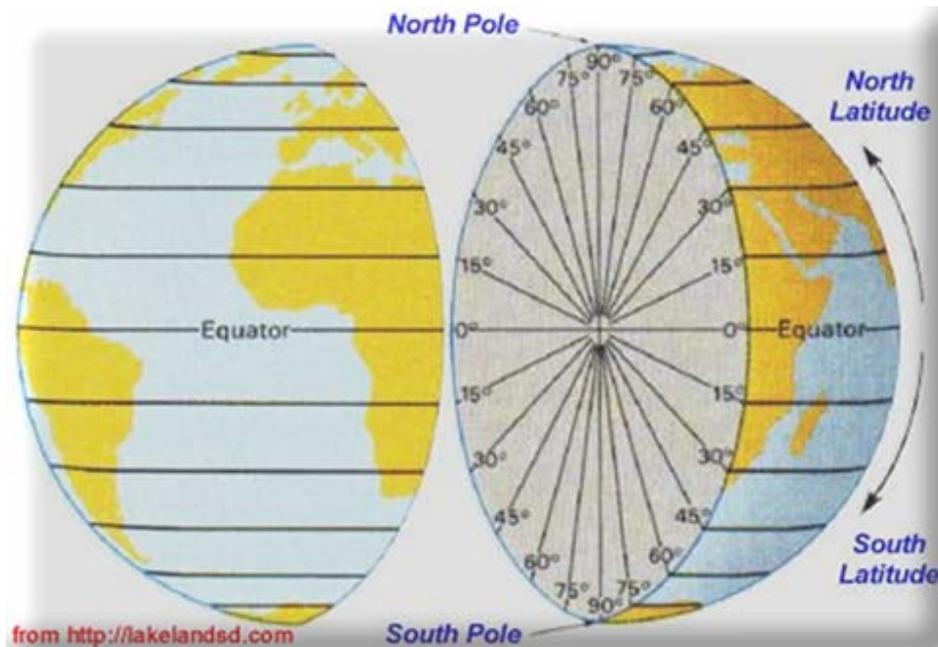


Figure A-2: Parallels of Latitude

Latitude lines are imaginary lines on the earth's surface. They run east and west around the globe and tell you your distance north or south of the Equator. As you can see in Figure A-2 above, latitude lines encircle the entire globe like a ring. Think of them as belts around the earth. The latitude lines (also known as parallels of latitude) range from 0 to 90 Degrees running north or south of the equator. The equator, which runs exactly between the North and South Poles, is at 0 Degrees latitude. If you move north toward the North Pole, the latitude will increase -- in other words, it will become greater (or more positive).

If you go to the very “top” of the planet---where the North Pole is located -- you will be at “90 Degrees north latitude.” You can also call this “90 Degrees latitude” since all latitude values north of the equator are considered positive values (See Figure A-1).

If you go to the very “bottom” of the planet---where the South Pole is located---you will be at “90 Degrees south latitude.” This is often called “-90 Degrees latitude” since all values south of the equator are considered negative values (See Figure A-1). Notice the negative sign is a substitute for the “south” hemisphere designation.

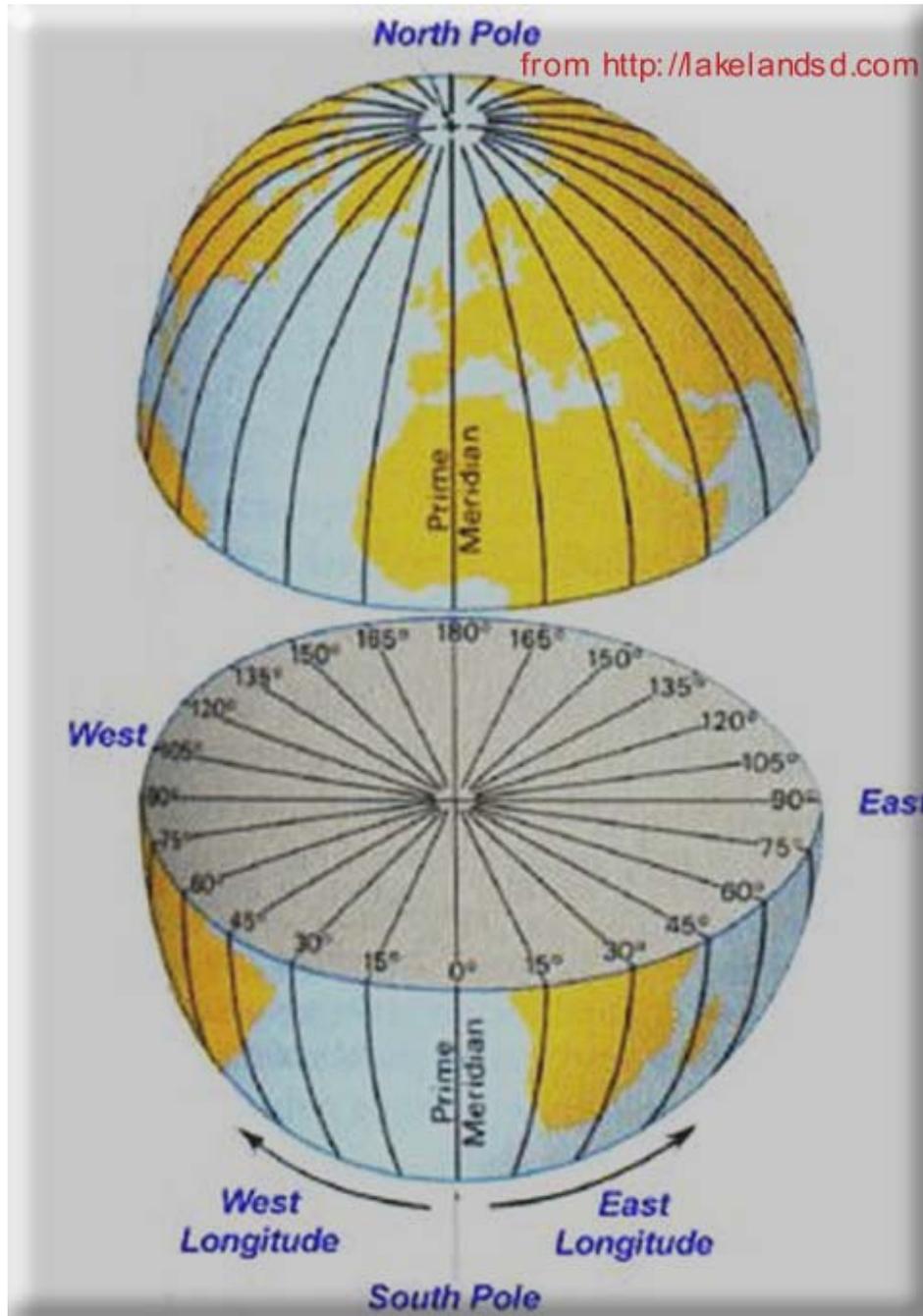


Figure A-3: Meridians of Longitude

Longitude lines are imaginary lines on the earth's surface that run from pole to pole around the globe and tell you your distance east or west of the Prime Meridian (Figure A-3). Each longitude line does NOT encircle the entire globe like a ring. They only go from pole to pole.

The Prime Meridian is an imaginary line that runs north to south through the Royal Astronomical Observatory in Greenwich, England. The Prime Meridian is designated as 0 Degrees longitude.

If you go west or east of the Prime Meridian, the longitude values will decrease or increase, respectively.

“60 Degrees west longitude,” which lies close to the east coast of the United States and is west of England across the Atlantic Ocean, can also be described as “-60 Degrees longitude” (See Figure A-1) because it is west (or to the “left”) of the Prime Meridian. Notice the negative sign is a substitute for the “west” hemisphere designation.

“60 Degrees east longitude,” which lies close to the east coast of Africa and is east of England, can also be described as “60 Degrees longitude” (See Figure A-1). It is a positive value because it is east (or to the “right”) of the Prime Meridian.

“180 Degrees longitude” is the farthest meridian of longitude from the Prime Meridian (See Figure A-3). It is also called the International Date Line. It is an imaginary line that runs approximately in the middle of the Pacific Ocean between Asia and North America. It can be described as +180 or -180 Degrees longitude but it is usually just called “180 Degrees longitude” or the International Date Line. The International Date Line is approximately an equal distance away from the Prime Meridian going either east OR west.

This concludes our brief review of latitude and longitude coordinates. Now we will describe how you can obtain latitude and longitude coordinates by using alternative means such as using coordinates from a Web search, using coordinates not in Decimal Degrees format (in Degrees Minutes Seconds format instead), or using latitude and longitude coordinates obtained from a U.S. street address.

Obtaining and Using Coordinates from a Web Search

Latitude and longitude coordinates can be used to specify a unique point on the earth’s surface. One of the best ways of obtaining coordinates is by doing a Web search at a search engine like <http://www.google.com>. All you really have to do is do a Web search of the **name of the place or object you are looking for** followed by the two words **latitude** and **longitude**. If the place is not too obscure, you will probably find some or many Websites with very accurate coordinates for it. You can then use these coordinates to map your feature. We’ll show you how to do this later with another map and other tools specially designed for doing this.

As an example, we did a quick Google Search for the coordinates for the famous Golden Gate Bridge in San Francisco, California (Figure A-4).



Figure A-4: Google Search for Latitude and Longitude Coordinates for the Golden Gate Bridge

On the very first page of search results, we got several sets of accurate coordinates (Figure A-5).



Figure A-5: Latitude and Longitude Coordinates for the Golden Gate Bridge Found with Google (Note the 2 Sets of “Decimal Degree” Coordinates Circled in Black and the Single Set of “Degrees Minutes Seconds” Coordinates Boxed in Black)

So, by checking out the first set of coordinates form Figure A-5 in our special map tool, which you can use later, you can see that the latitude and longitude coordinates that were found on Google for the Golden Gate Bridge were really accurate (see Figure A-6). Please note that the negative sign, if any, is EXTREMELY important. If you don't copy the negative sign, you feature could be mapped to the "opposite side" of the earth by mistake (See Figure A-1 again if you forgot why).

Figure A-6: Checking Coordinates Found with Google for the Golden Gate Bridge

Using Coordinates in Degrees Minutes Seconds Format

Now, this is an excellent opportunity to talk about that strange set of coordinates which we found with our Google search. While we prefer that you find "Decimal Degrees"

coordinates, you will often encounter latitude and longitude in “Degrees Minutes Seconds” format. As an example, the boxed coordinates in Figure A-5 are the following:

Longitude: -122°28'40" Latitude: 37°49'8"

Believe it or not, that is the equivalent of **-122.4777778 Degrees Longitude** and **37.8188889 Degrees Latitude** in “Decimal Degrees” format---our preferred format. If we used those coordinates in “Degrees Minutes Seconds” format, they first, have to be **converted** to “Decimal Degrees” format. We can do this with another tool that you will have a chance to use.

The coordinate conversion tool is specifically made for converting “Degrees Minutes Seconds” format to “Decimal Degrees” format. To access the coordinate conversion tool, be sure you click on **STEP 3: MAP AND PREVIEW THE COORDINATES OF MY CHOSEN PLACE** and click on the link, “Click here if your coordinates are **NOT in Decimal Degrees (ADVANCED USERS ONLY!)**” (See Figure A-7).

Collaborative Mapping: Where or What I Want to Visit in the World
GIS Career Awareness Learning Module 3

STEP 1: VIEW CURRENT COLLABORATIVE MAP
STEP 2: SEARCH FOR THE COORDINATES OF MY CHOSEN PLACE
STEP 3: MAP & PREVIEW THE COORDINATES OF MY CHOSEN PLACE
STEP 4: SEARCH FOR AN IMAGE OF MY CHOSEN PLACE
STEP 5: SEARCH FOR A WEBSITE RELATED TO MY CHOSEN PLACE
STEP 6: MAP MY CHOSEN PLACE FOR EVERYONE TO SEE

Click on Step 3

Get & Check Latitude & Longitude Coordinates
(STEP 3: MAP & PREVIEW THE COORDINATES OF MY CHOSEN PLACE)

- STUDENT INSTRUCTIONS**
 - Not all latitude and longitude coordinates are accurate. This map tool will help you get more precise coordinates so you can accurately map your chosen place for everyone.
 - Your goal is to get the most precise latitude and longitude coordinates of your chosen place.** Think of it as “homing in” to your chosen place.
 - Enter your current latitude & longitude coordinates in the fields below and click on the Go button. (These coordinates may have already been “entered” for you.)
 - Use the map navigation tools on the left of the map and the overview map to **get closer** to your chosen place.
 - Once you are close enough, **click directly on the map location** where you want to get the new coordinates.
 - If your chosen place is a large area like a country, try to obtain the coordinates of the **approximate center** of your chosen place. You may have to zoom out for this.
 - After verifying your coordinates or getting more accurate coordinates, **copy them down** and move to **STEP 4: SEARCH FOR AN IMAGE OF MY CHOSEN PLACE**

Geographic Position Coordinates

Latitude (DECIMAL DEGREES)
example latitude: 32.8534° (don't include Degree ° symbol) **Go**

Longitude(x) (DECIMAL DEGREES)
longitude: -117.2610° (don't include Degree ° symbol)

Click to Convert Coordinates

[Click here if you need to get coordinates of a U.S. STREET ADDRESS](#)
[Click here if your coordinates are NOT in Decimal Degrees \(ADVANCED USERS ONLY!\)](#)

Figure A-7: Accessing the Coordinate Conversion Tool

Once you click access the coordinate conversion tool, you will be able to convert latitude and longitude given in Degrees Minutes Seconds format to latitude and longitude given in Decimal Degrees format---the format acceptable to the collaborative mapping application (See Figure A-8). Note in the figure that, since the “Degree Minutes Seconds” longitude value from the Google search has a negative sign in the front, we have to follow some special instructions on the coordinate conversion tool (See Figure A-8 text circled on the right side). The instructions state to leave out the negative sign and, instead change the hemisphere to “West,” if it isn’t already west. Remember, the Western Hemisphere is in the “negative longitude” direction; and the Southern Hemisphere is in the “negative latitude” direction. Fortunately, you don’t have to remember this because the tools remind you. Anyway, the end result of the coordinate conversion tool is nearly the same as the coordinates that were in “Decimal Degrees” to begin with.

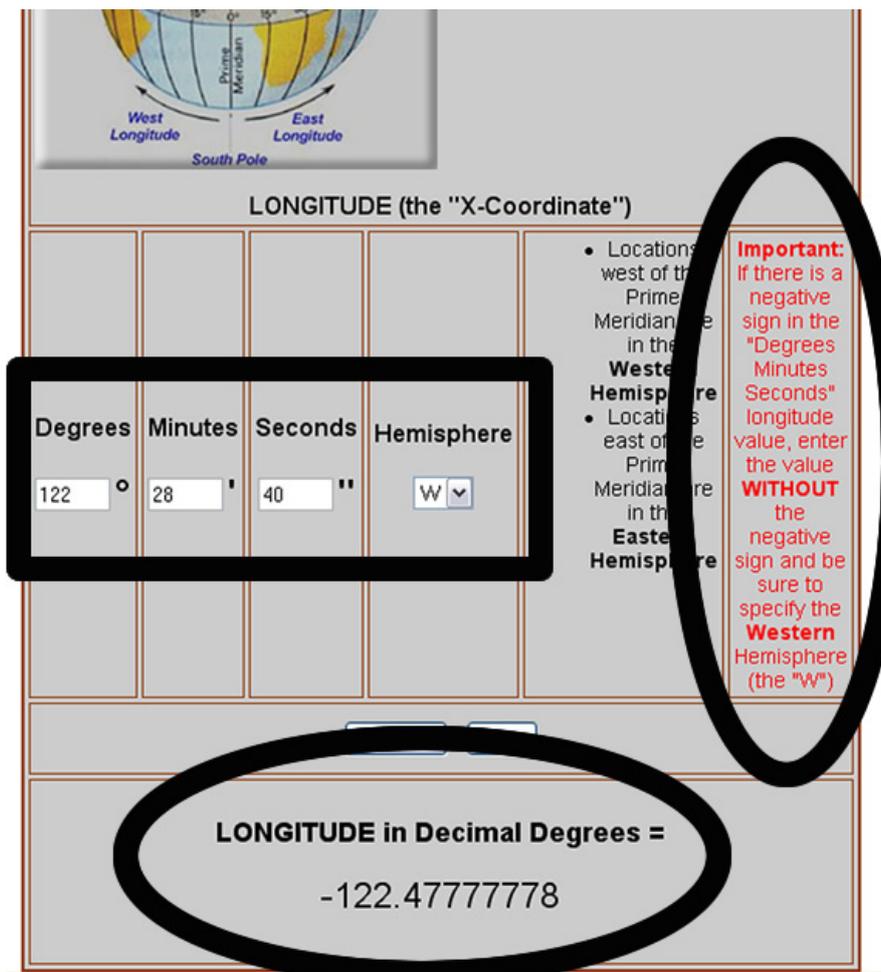


Figure A-8: Conversion of “Degrees Minutes Seconds” Format Longitude to “Decimal Degrees” Longitude (The Input is Boxed in Black. The Warning Circled at the Center-Right Applied Because the “Degrees Minutes Seconds” Longitude Had a Negative Sign. The Result is circled at the Bottom.

Obtaining Latitude and Longitude Coordinates by U.S. Street Address

If the location you specify is in the U.S. and you know its address, you can specify the location by street address and the mapping application will automatically generate the approximate latitude and longitude coordinates of that street address for you.

As an example, suppose we wanted to visit the White House in Washington, D.C. and map it as a place or object that we want to visit. Well, we did a Google Search with the words **White House Address** and eventually came up with the following:

**1600 Pennsylvania Avenue NW
Washington, DC 20500**

With the special map tool, we found the White House and zoomed in even closer (Figure A-9). From this, we can zoom in more and directly obtain more accurate “Decimal Degrees” coordinates by clicking directly on the White House.

Get Latitude & Longitude for U.S. Street Address, City, State, or ZIP

1600 Pennsylvania Avenue NW
Washington DC 20500

Find

Enter As Much Information as Possible and click "Find." Avoid Using Punctuation Marks.

Geographic Position Coordinates

Latitude(y)	38.898758 (DECIMAL DEGREES) example latitude: 32.8534° (don't include Degree ° symbol)	Go
Longitude(x)	-77.037691 (DECIMAL DEGREES) example longitude: -117.2610° (don't include Degree ° symbol)	

[CLICK HERE TO RETURN TO PREVIOUS INSTRUCTIONS](#)

Map Satellite Hybrid

The Address Was Found...
1600 Pennsylvania Avenue NW Washington DC 20500

Latitude= 38.898758
Longitude= -77.037691

- Use the Map Tools to Center and Zoom into Your Chosen Place(Close this popup if necessary)
- You Can Also Drag and Double-Click the Map
- Then, Click on the Map to Obtain More Accurate Coordinates.
- Copy Down the Best Coordinates and Go to **STEP 4:SEARCH FOR AN IMAGE OF MY CHOSEN PLACE**

Figure A-9: Using the Address Search Tool to Zoom In and Obtain Latitude and Longitude Coordinates

Access the U.S. address coordinate search tool by clicking on STEP 3: MAP & PREVIEW THE COORDINATES OF MY CHOSEN PLACE and then click on the link, “Click here if you need to get coordinates of a **U.S. STREET ADDRESS**” (Figure A-10).

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STEP 4: SEARCH FOR AN IMAGE OF MY CHOSEN PLACE
STEP 5: SEARCH FOR A WEBSITE RELATED TO MY CHOSEN PLACE
STEP 6: MAP MY CHOSEN PLACE FOR EVERYONE TO SEE

Get & Click on Latitude & Longitude Coordinates
(STEP 3: MAP & PREVIEW THE COORDINATES OF MY CHOSEN PLACE)

STUDENT INSTRUCTIONS

- Not all latitude and longitude coordinates are accurate. This map tool will help you get more precise coordinates so you can accurately map your chosen place for everyone.
- Your goal is to get the most precise latitude and longitude coordinates of your chosen place.** Think of it as "homing in" to your chosen place.
 - Enter your current latitude & longitude coordinates in the fields below and click on the Go button. (These coordinates may have already been "entered" for you.)
 - Use the map navigation tools on the left of the map and the overview map to **get closer** to your chosen place.
 - Once you are close enough, **click directly on the map location** where you want to get the new coordinates.
 - If your chosen place is a large area like a country, try to obtain the coordinates of the **approximate center** of your chosen place. You may have to zoom out for this.
- After verifying your coordinates or getting more accurate coordinates, **copy them down** and move to STEP 4: SEARCH FOR AN IMAGE OF MY CHOSEN PLACE

Geographic Position Coordinates

Latitude (y) (DECIMAL DEGREES)
example latitude: 32.8534° (don't include Degree ° symbol)

Longitude(x) (DECIMAL DEGREES)
example longitude: -117.2610° (don't include Degree ° symbol)

[Click here if you need to get coordinates of a U.S. STREET ADDRESS](#)
[Click here if your coordinates are NOT in Decimal Degrees \(ADVANCED USERS ONLY!\)](#)

Map navigation: Map, Satellite, Hybrid

Figure A-10: Accessing the Tool to Obtain Latitude and Longitude from a U.S. Street Address

The address search tool could be very picky and, sometimes, it will refuse to work. If that is the case, try another address or leave out additional information such as suite number, apartment number, etc. Try not to put punctuation marks such as periods and commas in the address.

Obtaining Latitude and Longitude Coordinates by Knowing the Approximate Location on a Map

If you can find the place or object you want to visit directly on a world map, you can obtain latitude and longitude coordinates this way. First, be sure to go to the map by clicking on STEP 3: MAP & PREVIEW THE COORDINATES OF MY CHOSEN PLACE.

Remember, you can zoom in really close to many places and objects on the map. This special map has been set up so when you click on any location on this special map, the

latitude and longitude coordinates will automatically be displayed for whatever location you clicked on.

As an example, if you know the general location of something like the Statue of Liberty in New York City. You can zoom into New York City until you find it; get as close as possible by zooming in more, and then obtain very accurate latitude and longitude coordinates by clicking right on it. This technique (Location by Selecting a Point on the Map) generally works if you know where something is on a map. The Statue of Liberty is in New York Harbor so we zoomed all the way into New York Harbor until we found it. Then, we zoomed in as close as we could. When we were happy how close we were, we mouse-clicked directly on top of the Statue of Liberty and copied down its coordinates in “Decimal Degrees” (See Figure A-11 below). The coordinates were the following:

Latitude: 40.68915614801549 Degrees
Longitude: -74.04459536075592 Degrees

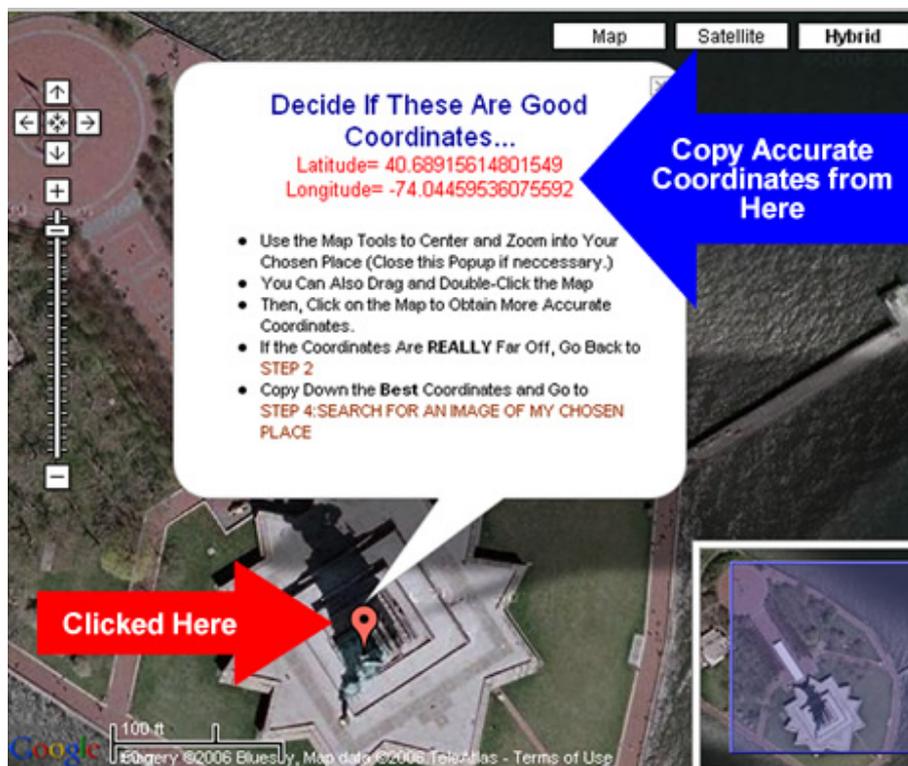


Figure A-11: Obtaining Latitude and Longitude Coordinates by Clicking on the Map

So with this special map tool and some general knowledge of a place or object’s location on a world map, you can determine the latitude and longitude coordinates of your chosen place.