

INTEGRATION OF GPS WIRELESS INTERNET TECHNOLOGY TO GIS DATABASE BUILDER

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Abstract:

A database of natural resources baseline data was uploaded through a system integrating wireless technology, GPS satellite technology, internet map server and a spatial database engine. Wireless-based GPS-acquisition was integrated with data-transfer, spatial database management and an internet map server. The aim was to; a) examine distributed GIS at depth and integrate the technology into Client/Server computing system, b) create a cross-platform of interoperable distributed GIS interacting with a web server, c) implement a data warehouse from internet GIS fundamentals. Innovative integrated data acquisition and formatting methodologies were developed. The system was tested on two ongoing projects, the Southern University Tree Inventory exercise and the Atchafalaya Flatlake Project. The whole project was accomplished via several components including wireless internet technology using (Bluetooth®), the Java platform (J2SE, J2EE, J2ME, J2SDK), and HTML codes. Finally, a data warehouse was created that allows for viewing and distributing of spatial data through a web server.

INTRODUCTION

This project created an integrated system coupling wireless technology, GPS satellite technology, an internet map server and a spatial database engine. The project's end result integrated scientific data from various Southern University Research Projects into a spatial data warehouse. The major aim of this study was to: a) examine distributed Geographic Information Systems (GIS) at depth and see how this technology can be integrated into a Client/Server computing system, b) examine how distributed GIS interacts with a web server, and how it can be cross-platform interoperable, c) implement the Southern University data warehouse from the understanding of the internet GIS fundamentals and web client server architecture and the distributed framework .NET with the TCP/IP model over WLAN.

The major aims of this study was to; a) Examine Distributed GIS deeply and see how this technology integrated Client/Server computing system, b) Examine how Distributed GIS interact with the web server, and how can it be a cross-platform interoperable, c) Implement the Southern University Data warehouse from the understanding of the

internet GIS fundamentals and web client server architecture and the distributed framework .NET with the TCP/IP model over WLAN and d) Design the above mentioned platform with Wireless internet technology using (Bluetooth®), and Java platform (J2SE, J2EE, J2ME).

Spatial data from the study areas was acquired, formatted and converted digitally to GIS formats as a major component of this project. Integrated data acquisition and formatting methodology has been developed. A database of baseline data is now ready.

Statement of the Problem

Southern University GIS Research Maps stored in uncoordinated data banks. There is lack of a central GIS data warehouse for clients to access data. GIS data acquisition logistics outdated, inefficient and require physical connection of GPS's , servers, workstations .

To address the identified problem, a strategy to build an internet based map provision system was adopted. Eventually this system will be a foundation for a seamless coordinated data. To improve data acquisition logistics, wireless based GPS acquisition was integrated with data transfer, management and an internet map server . The system was tested on two ongoing projects: the *Southern University Tree Inventory* exercise and the multi-institution *Atchafalaya Flatlake* project. The system was designed with wireless internet technology (using Bluetooth®), a Java platform (J2SE, J2EE, J2ME), and HTML codes.

Objectives of the Study

- i)Integration of GPS System as foundation of GIS data warehouse builder.
- ii)Provision of Client/Server environment model for GIS applications.
- iii)Use the GIS over the internet (LAN) or (WLAN) for GIS data transfer, management and client distribution.
- iv)Integration of Wireless mobile GIS for GIS data warehousing and management.
- v)Application of GPS-driven Internet Geographic information in databases applied to Urban Tree Inventory.

BACKGROUND

The idea of this project arose from the problem that the maps and data generated for various Southern University projects are stored in uncoordinated data banks on several computer labs around campus while stored in several machines. Furthermore, most of the data available on CD's and websites is in different formats and types. This problem was to be tackled by storing data in one data warehouse having easy access- all allowing people to access the data whenever they want it. This process will save the time looking for desired data, and since "time is money", this will save a lot of money too.

This project helped the Flat Lake Water Management Unit team to get easy access to the data but it will also help a client to access my data warehouse to view, upload and download the data desired on this project or on any other project that we will do in the future. This was achieved by creating several links relating to different projects. The client would have a special username and a password to access the data that they need, hence guaranteeing security and confidentiality of the data.

Providing this service not only saves time and money for the clients to access and get what they want from GIS data whenever they want, but also saves them from purchasing the expensive GIS software to view or analyze the GIS data online. It also provides them with the tools that they need for operations such as GIS acquisition and query functions, as well as more GIS features such as measuring the distance between points, finding a buffer around specific feature.

REVIEW OF RELATED LITERATURE

Geographic Information Systems

This project relates Geographic Information Systems (GIS), Global Positioning Systems, Wireless Communications, Remote Sensing and the Internet. GIS is a set of computer hardware, software and databases for the capture, storage, and display of spatial data ([3], [12]). There are two components of GIS. They consist of the map (graphic) and the data (non-graphic) [15]. GIS systems perform complex operations of spatial analysis on multiple data sets using analytical mapping tools. This makes a GIS to be an effective management and planning tool, but, one that is highly dependent on to the information in its database [23]. Improvement in the management strategies of natural resources by use of GIS has resulted in a continual process of updating the databases with new information [4], which enhances planning and management techniques [9].

Remote sensing applications directly upload data to a GIS [19]. GIS is rooted in the stimulus provided by the development of remote sensing as a potential inexpensive source of earth observation ([5], [14]). While many techniques for processing images are highly specialized, the more general GIS techniques become important in combining information from remote sensing with other information ([5], [6]). The advent of ESRI ArcGIS has created an opportunity to re-think the way in which urban forestry resource data is represented in GIS [13]. Using GIS techniques, for example, allows aerial photos of forested areas to be integrated with geographical features (roads, streams, wildlife areas) and their locations and boundaries [14]. Using aerial photos and GIS techniques, a vegetative classification for green spaces and woodlands areas may be developed [10].

Wireless GIS Technology

Wireless GIS technology is defined as automated mapping and GIS for mobile systems [2]. It provides database access, mapping, GIS, and global positioning system (GPS) integration to users in the field via handheld and mobile devices such as a "GIS pad". It supports multilayer environment with industry-standard vector map and raster image displays which can be of aerial photographs and satellite imageries. Data from the internet can also be provided via wireless technology [18]. A GIS pad is a handheld mobile computer with GIS functionality. The combination of online and existing offline data capabilities makes "GIS pad" an invaluable tool for users out in the field [21]. The GIS pad supports the following data formats; a) ESRI Shapefiles, b) MrSID by lizardTech, c) Windows bit map, d) JPEG, and e) IMS image services via the internet.

The GIS pad has a number of map navigation display and query tools, also the GPS and differential GPS, which can provide one with the navigational information from the current GPS position to the destination. Also one can edit and create one's spatial data using input from mouse pointer, pen, or GPS. The supported operating system is MS Windows® CE 2.11

Basic components of mobile GIS are: a) mobile device client, b) wireless communication networks, c) gateway services, and d) internet GIS server [17]. Bluetooth Wireless® technology can connect up to 7 devices at the same time, utilizes USB powering with no external power supply needed [22]. The technology is supported by Microsoft Windows/Mac OS making it very adaptable. It has an operating distance of up to 100 meters (333 feet) with point to multipoint connections. It supports data rates up to 721 kbps with security up to 128-bit encryption and authentication. Its operating frequency ranges from 2.4 to 2.4835 GHz. With the USB adapter support, the technology also has facility for file transfer and access dial-up networks. It connects to local area network and performs ActiveSync® sessions. It connects to serial ports, mice and keyboard and printers [22].

Global Positioning Systems

As satellites orbit the earth, information can be digitally collected and continuously relayed to earth. *Global positioning systems*, or GPS, were developed to accurately establish the location of geographical positions of particular natural resources data operations such as the location of a sampling point, land boundaries, forest trails and roads, fire boundary lines, and timber sale areas [11]. The system uses 24 space-based satellites originally developed for the military. The satellites are used in conjunction with hand-held or stationary computers to provide foresters with continuous data, anytime of

the day or night, in all kinds of weather. GIS and GPS are powerful and essential tools that natural resources managers have at their disposal [20]. For example tree GIS can take advantage of base data and software that already exist within the municipality, allowing for more cost-effective use of available resources [7].

Selected GPS Application

The selected GPS application for data acquisition was GeoXM™ GPS (Trimble®) which combines GPS and a powerful Windows CE operating system into one rugged unit for collecting and maintaining high-quality GIS data [22]. The GeoXM data logger has Windows Mobile software and integrated Bluetooth® that gets the user wireless connectivity. It is possible to use a Bluetooth-enabled cell phone to access e-mail and the Internet while in the field. Trimble's GPS PathFinder® software enables the user to create a Data dictionary that can then be uploaded to a receiver [22]. Attribute values can be attached to features as they are captured.

Internet Map Server (IMS)

IMS is defined as the solution for distributing mapping and geographic information system (GIS) data and services on the web [1]. It provides support for a variety of different data types including shape files, coverage, and the spatial database engine (SDE) layer. A variety of image formats [16] and many additional data types are supported including CAD drawings, GRID data, and more [8]. The basic components of an Internet GIS system are: a) Client, b) Web Server and Application server, c) Map Server and d) Data Server.

METHODOLOGY

The methodology for this project was implemented in four major steps a) Development of data management system of ware house, b) Data transfer from GPS to Data Ware house, c) Feed back and updating system and maintenance and d) Implementation for Southern University Tree Inventory project . The purpose of this project was to study distributed

GIS at depth and integrate the technology with a Client/Server computing system, design its interaction with a web server, and implement an interoperable cross-platform.

Utilizing our understanding of the internet GIS fundamentals and web client server architect and the distributed framework .NET with the TCP/IP model over WLAN (IEEE 802.11) this platform was distributed using the Internet map server using XML and HTML or JAVA script. Data acquisition and management was enhanced with Wireless internet technology using WLAN (802.11) and Bluetooth.

The overall purpose was to implement a Client/Server environment model for GIS applications and try to use the internet GIS over (LAN) to transfer and receive GIS Data, and publish GIS maps on the internet on the Internet Map Server (IMS), save all the collected data from raster, vector, and CAD file in the Database Management Server using Microsoft SQL server which is called the Spatial Database Engine (SDE), that follow using the Wireless mobile GIS to send/receive GIS data too over the wireless connection.

Data for the study area was acquired from the DOQQ, LIDAR DEM's and Contour lines, plus all the GIS data features for the surrounding area like Streams, Parishes, Oil and gas wells, pipeline crossing, and roads. all the data should be projected to the UTM Zone 15 so it will be overlap the rest of the GIS features and this can be done through the projection utility tool And then make those features viewable in the webpage through the Flat Lake site using HTML viewer or JAVA.

Procedure of Projects

Project 1: Southern University Tree Inventory

The project utilized the tree inventory sheet provided in the Citygreen™ manual to craft a customized tree inventory data dictionary for GPS data acquisition for this project. One can design the data dictionary that one wants depending on the project that one is working on. The customization was achieved by using a previous data dictionary was designed for Old South Baton Rouge area tree inventory for the area. A similar data dictionary was designed for Southern University Baton Rouge campus where tree inventory was done by the undergraduate students in the GIS class. The students were divided into groups and each group was given a GPS data logger with the same data dictionary file but with different Tree Id numbering for every group.

Group E started with ID 1000

Groups F started with ID 2000

Group G started with ID 3000 and so on

The same methodology was applied to other groups. One could then add as many attributes and different field to each feature and to different data dictionary tables that one creates. That is why the attribute table for Southern University and A&M College campus was slightly different from Old South Baton Rouge. It all depends on the purpose of the project and who is using the data. The Southern University campus data was used to test the system and to see how efficient this method was and test its capabilities.

Southern University and A&M College area was divided into 4 major areas:

Area number 1: the dormitory area and the back of campus.

Area number 2: the "Mini Dome" area.

Area number 3: the Agricultural Center and the North Gate.

Area number 4: the Bluff and the administration building.

Different groups were assigned to different areas and had to go around campus to collect the data. With the data dictionary completed the information was transferred to a Trimble GPS logging unit, where the data dictionary was saved with extension .ddf and thereon proceeding to the next step.

Creation of Data Dictionary

The wireless technology was integrated and built into an application to be used on any mobile or handheld using ArcPad for GeoXM Trimble GPS receivers Bluetooth service.

Creating the data dictionary was the first step in that project, and was created using the GPS Pathfinder TM software. The procedure to create the data dictionary is presented below. In this case the example used is the Tree Inventory:

The new data dictionary was created and named *Tree inventory*. The table included the following fields:

1. Tree ID #: which were a serial number for the tree and one can start with number 1000 and one increment by one for every new record.

2. Species: which is a field contain the tow or three letters code for every tree and one can get those codes from City Green book. Appendix

3. Class: DBH Class: diameter at breast height

1 = <10 inches

2= 10-20 inches

3= >20 inches

4. Ht Class: the height of the tree

1 = <15 feet

2 = 15-35 feet

3 = >35 feet

5. *Health Class: this give one information about the health of the tree*

1 = *Dead/Dying*

2 = *poor*

3 = *Fair*

4 = *Good*

5 = *Excellent*

6. *Maintenance: to see if the tree need any maintenance either yes or no field.*

Conflicts:

1 = *Pot. Overhead wires*

2 = *Ex. Overhead wires*

3 = *Structure (specify)*

4 = *Sidewalk*

5 = *Other tree*

7. *Species Name: give the Common Name for the tree*

8. *Street Name: give the street name where the tree at*

9. *Ground Cover: give the type for the ground cover around the tree*

1 = *shrub*

2 = *Grass*

3 = *Pavement*

4 = *Exp Soil*

5 = *Mulch*

10. *Direction: give the tree direction on the street if it is N for north and S for south and so on.*

Data Transfer by ActiveSync

ActiveSync® (Microsoft®) facilitates data transfer by a) synchronization software for Windows Mobile-based Pocket PCs and Smart phones, b) enhancing USB driver to improve connection stability and avoid crashes, c) improves detection of cradled devices d) improves the reliability of large file transfers, e) enhances Desktop Connection Wizard UI to make connection setup easier, f) improves stability to reduce application level crashes.

Transferring of Data Attributes to GPS

The traditional method transferred the Data Dictionary from one's office computer to one's Trimble data logger through the Serial port (Rs-232) but the new

method that was developed in this project unique was the application of the wireless Bluetooth technology (which makes it unique) to transfer the .ddf or the data dictionary filed from the office computer or the laptop to the handheld Trimble using *TerraSync* for handheld device. This method not only allows one to transfer data wirelessly only but also allows one to create data dictionary “on-the-fly” in the field and transfer it to the GPS Bluetooth integrated devices around one with out disturbing there work. This saves a lot of time, power and hardware pieces. One needs to connect the cradle to the power supply during the transfer using the old fashioned way. In the new setup one deal with a less mess of cables all the work place, a convenience especially when one is doing this in the field in with a truck having limited space. That makes this method more convenient and efficient.

On the other hand, the Bluetooth is not only used here to transfer data to or from the handheld, we can also use it to get connected to the IMS server on the laptop in the car. This will allow the client to use the GPS which is integrated with Bluetooth wireless technology and be able to log on to the IMS server which is installed on a machine on the local web server, and to go the local website where one posts all the DOQQ imagery data. This would allow the application of GPS using the ArcPad to log into the website and to get all the images and aerial photos of the area, as well as GIS features already there. This is how we can take advantage of the technology in scenarios where that the handheld computers cannot save volumes of data due to the lack of adequate memory depending on the size and the power supply.

Transferring Data Using Wireless

The Trimble GPS data logger is reconnected back again to the office desktop computer or laptop computer using the Bluetooth device which provides a short range wireless environment. One starts the data transfer process again but this time one should click on the receive tab to get the data file from the receiver unit. The received file from GPS should be with the extension .ssf. And it is imperative to make sure that the transfer is done when the files are successfully transferred.

Exporting Data to ArcView

This was a critical part of this process. After we got all the data imported from the Trimble unit we needed to export this data to use it in other GIS software. One has to pay attention on the projection of the data because if this was set wrong one is not going to see one’s data in the correct coordinate systems. You go to *utilities* again and select *Export* and then select the file one want to export from the field data files or .ssf to a sample ArcView shapefile format or .shp. Make sure that the GIS coordinate system is Lat/Long and the Datum is WGS 1984 and if not try to use the *properties* to correct those things or one are not going to export the correct form of data or in another word one are going to export a junk data which has no meaning or somewhere else on this planet. After one done exporting the program will notify one of how many successful objects one has transferred and one are now ready to go the next step.

Downloading Images

A very important site for access of Louisiana data imagery files is: <http://atlas.lsu.edu/>, one goes to this website and downloads DOQQ maps of Baton Rouge. You try to select the area that one got one's data from, in our case we download the part of Baton Rouge where Southern University is located, and this is the Scotlandville cartographic quadrangle. Of course we have to unzip the files and get the images so we can open this in ArcView.

Integrating GPS with GIS

Once we get the DOQQ map of Baton Rouge, the Shapefile exported from the Pathfinder and we are ready to go to ArcView GIS to overlapping features from Pathfinder and DOQQ images.

You open ArcView and select new view and one has to set the *extension* in *file* menu on MrSID, this allow one to view images files that one download from <http://atlas.lsu.edu/>, and before one open the image one has to set the projection in *view* menu and *properties go to projection UTM 1983* and select Zone 15, this is the Zone of Baton Rouge, Louisiana. Now one are ready to view one's images and Data features.

From one's view add theme of Baton Rouge image that one downloaded already and unzipped saved in one's folder, and then add another theme of one's Features and one can see that the featured one got from Trimble overlapped on the Image of Baton Rouge.

Project 2: Flatlake WMU IMS Webpage

Data Acquisition and Collating

Imagery data of the study area was identified at <http://atlas.lsu.edu/> website and downloaded as Digital Orthophoto Quarter Quadrangle (DOQQ). The acronym DOQQ is a color image of a section of Louisiana derived from aerial photography; however, the film recorded infrared light in addition to the normal visible light. Each photograph covers an area that is approximately four (4) miles across the top by over four and a half (4.5) miles on the side. The photographs are detailed in that each pixel or block of light on the photograph represents one (1) meter or about three (3) feet square on the ground. The photographs are digital in that they have been scanned to create electronic files that are somewhat like the images one see on the web but not exactly. An image on the web is small - usually 3 Kilobytes (Kb) to 100Kb in size. In contrast, each DOQQ is normally 150 Megabytes (Mb) in size, which is approximately 1,500 times larger than most web images. To make the DOQQs manageable and downloadable, the DOQQs were compressed into MultiResolution Seamless Image Database (*MrSid*) image format. These MrSid files allow the DOQQs to be compressed from 150Mb to about 3Mb - about 50 times smaller, making the images available through standard modem Internet connections.

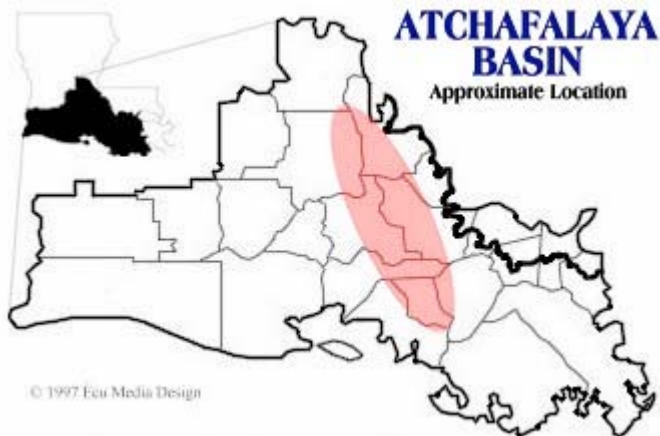


Figure 1 Atchafalaya Basin

Secondly, these MrSID files are georeferenced, that is, they fit on the earth's surface so that one can measure distances and positions using GIS software. With GIS software, one can read coordinates - latitudes and longitudes - from the images. One can measure distances along features such as roads and buildings on the photographs. One can even combine the photographs with other digital maps to print scaled maps.

Therefore, to view these DOQQ images, one has to download the zipped file of the area, extract the zipped files then use the MrSid extension to view the files from the GIS software (or any MrSid viewer).

One can also download LIDAR data. LIDAR stands for Light Detection And Ranging data. LIDAR represents elevation data with accuracy and dense coverage. LIDAR data can be represented in many forms. I downloaded the contour files (as shape files), the DEM form data. After one downloads all the data one has to convert the Dem files to grid files with the ArcGIS toolbox so it can be readable with ArcMap.

In addition data was gathered from two critical data CD's from Louisiana Oil spill Project, Louisiana GIS (north and south CD's). These CD's contain all the GIS features as Shape files are needed to my project from Streams, roads, Oil and gas wells, pipeline crossing, and parishes borders.

Design of IMS Webpage

A webpage for Atchafalaya Flat Lake WMU was design by applying ArcIMS procedures showed all the Spatial Data that I got and publish it through the Flat Lake Website. The data can be accessed through the data warehouse at the Engineering Server domain using the Microsoft SQL database server and is managed through the ArcSDE. The Database management server contains all the collected data from aerial photos or DOQQ's and topography from the LIDAR and CAD files.

RESULTS AND SYSTEM IMPLEMENTATION

The wireless system selected for this project was the Bluetooth Wireless®. It was selected because of availability of several capabilities. Bluetooth Wireless can connect up to 7 devices at the same time. It has USB powering with no external power supply needed. It is supported by Microsoft Windows/Mac OS. It had an operating Distance up to 100 M (333 feet), with point to multipoint connections. It is able to support data rates up to 721 kbps. Its security has up to 128-bit encryption and authentication and an operating Frequency 2.4 to 2.4835 GHZ. The Bluetooth Wireless device that was applied had a USB adapter support to facilitate file transfer, and enable access to dial-up networks, and hence connect to local area network. It was able to interface well with Trimble GPS systems due to its ability to perform ActiveSync® sessions, a direct connection to serial ports, mice and keyboards, as well as printer devices.

ArcIMS

ArcIMS was the main tool to add and connect to the GIS data services on the web server and the internet. It allows GIS users to use GIS tools, query, analysis with out having an expensive GIS software using the internet. It facilitates the distribution of high-end geographic information System (GIS) and mapping via the internet. It enables enables users to integrate local data source with internet data sources for display, query, analysis and easy to use Web browser. ArcIMS Route Server offers fast and accurate routing capabilities within the ArcIMS framework ArcIMS uses multitier architecture where Web browsers or other clients are used to view data

Application of Model

The model developed was applied to two ongoing projects a) The Southern University Tree Inventory and b) Flatlake Water Management Unit Project. A data warehouse holding spatial data for both projects was built as part of this project. Additional data for the Southern University Tree Inventory was acquired using the

integrated wireless GPS system. The existing data for Flatlake was extensive. This report describes at length the data acquisition and database development for the Southern University Tree Inventory project, and uses the Flatlake project's IMS server to demonstrate in detail the process for setting up an ArcIMS server. It should be noted that while in certain cases data may have existed, the data conversion to spatial databases, its formulation and establishment on an IMS server was done as part of this project. All the source code for maintenance of the IMS server website was original script developed by this author.

Southern University Tree Inventory

This project is one of the projects done at the Urban Forestry program with data acquired, formatted and managed by Southern University's CCZARS GIS Laboratory. The project was implemented by distributed GIS technology along with GPS data loggers using wireless Bluetooth technology to transfer the data to/from a GPS handheld device.

There was a need to define the data needed for each sub-project. Tree data was collected from Southern University. In this case the inventory required was the number of trees on the campus, the types of trees, the nature of roads, and parking lots. It was very important to know what one wanted to do because everything after that would be based on the data dictionary. Taking extra time in this part was efficient because good planning often prevents one from doing extra jobs and saves time and, of course, money.

Flatlake Project

This project involves a contract among Southern University, Shaw Group, and the U.S Army Corps of Engineers. The purpose of the contract was to study the Atchafalaya Basin Floodway System Project Development of Water Management Unit- Preliminary Planning and

Investigation

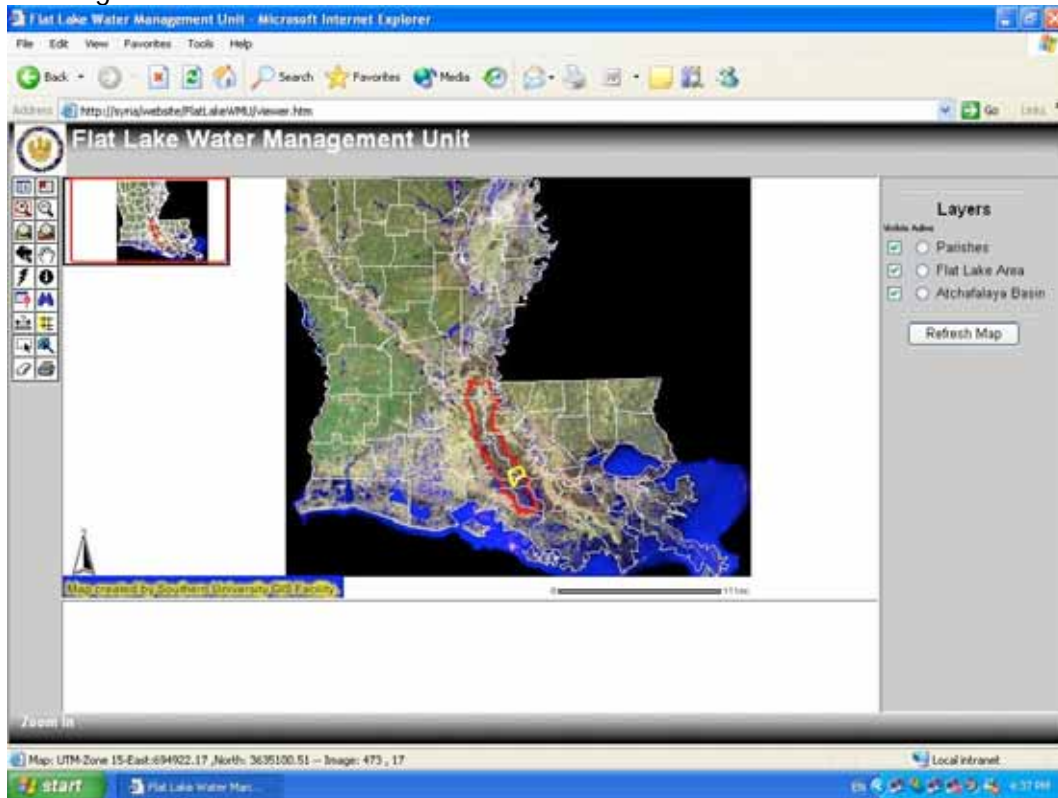


Figure 2 - Webpage view

Project Data: Atchafalaya Basin Floodway System Project Development of Water Management Unit- Preliminary Planning and Investigation, New Orleans, Louisiana.

Project Name and location – the name of the project was “Preliminary Planning and Investigation for the Flat Lake Water Management Unit”. The region studied by the project is the Lower Atchafalaya Basin, which intersects Iberia, Iberville, and Upper St. Martin parishes, Louisiana.

CONCLUSIONS

This project facilitated the

i) Distribution of the GIS Map of the Atchafalaya basin Flat Lake Water Management Unit on the internet using ArcIMS on the World Wide Web

- ii) A scenario where a client does not have to purchase an expensive GIS software to view and analyze the GIS map
- iii) Ability to save and restore all the data in centralized Database Management Unit (data warehouse)
- iv) Access the IMS from any handheld device support thin client GIS as (mobile, Palm, ArcPad) using the WLAN.

What was Achieved

- a) Acquisitions and organization of the GIS data better automated by Integrated system.
- b) System tested in building GIS IMS for US Army Corps of Engineers Flat lake Project
- c) Finally, the integrated system tested on Southern University Tree Inventory system

Future Endeavors

Now that the data warehouse is up and running, in the future ArcIMS and ArcSDE will work together as an integrated back office solution for fast internet access to vector, raster, and survey data stored in relational database. In that scenario it will be possible to update, maintain the data without stopping the server.

From the creation of the Data Dictionary to collecting data from field then transfer of this data from one's Trimble GPS to one's office desktop, then exporting this data to ArcView and overlaying these Data features on DOQQ images, we achieved integration between the GPS features and GIS using the wireless Bluetooth technology. Now we are able to use this method to distribute the GIS over the Internet and let anyone use it and have access to it any time any where.

This application of Bluetooth technology as a data transfer mechanism is new. Information garnered (private communication with Trimble GPS personnel in Lafayette, Louisiana in April 2004) indicates that even though Bluetooth wireless technology is integrated in their devices no one had yet used this technology. IEEE 802.11 is a wireless technology that communicates between the server and a handheld GPS device using a wireless router. The router is connected to a stand-alone GPS. The previously existing setups involved too much equipment in the field. The new technology setup reduces the

number of components of the system and makes it more efficient - especially when working outdoors. It will let several users connect to the server at the same time.

We used this method to generate a tree inventory for Southern University and A&M College and the Baton Rouge Green and many more. We established a backbone method of how to use the technology and make it easy to use for other people to get more data and increase our data warehouse of thousands of features that we can create a database or a data dictionary and make our life easier and more convenient. There are a lot of applications already made in this field and there are much more creative ideas we can apply this science in many aspects of our life.

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