

# CONSTRUCTION OF A UNIVERSITY NAVIGATIONAL MOBILE APPLICATION

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**Abstract** - The 2011–2012 Mobile Database Team created a campus navigational mobile web application for the campus of Elizabeth City State University. The application provides the students and visitors with an up-to-date campus map that has the capabilities to generate walking directions.

To accomplish this task, the team first gathered historical data and specifications for the forty-six buildings located on the campus. This information was then stored into a database using My Structured Query Language (MySQL) and PHP Hypertext Preprocessor (PHP) that was accessed by the application. Next, the team updated the map using Google Map Maker. The new map provides users with an aerial view of the campus displaying the buildings, roads, and parking lots. The final step was the creation of the actual application.

The application was created using a jQuery template and HTML5. The application obtains the user's latitude and longitude coordinates from their mobile device before directing them to the map via Google Maps. From here, using the stored coordinates, the application is able to generate walking directions to the user's building of choice. Users also have access to the information recorded in the created database.

*Keywords-Browsers; Database; Dreamweaver; Google Maps; Google Map Maker; HTML5; jQuery Template; Mobile Communication; MySQL; PHP; Web Application; Web services*

## I. INTRODUCTION

### A. Overview

The Center of Excellence in Remote Sensing Education and Research (CERSER) is part of several national and international research projects involving undergraduate and graduate students participating in remote sensing research. The movement-taking place in computer visualization of data towards handheld mobile devices has led to the development of smaller applications. This project seeks to break into this development by creating a compact mashup of local building information with a map service to create an informative navigational aid to students and visitors.

### B. Project Goal

The final goal of this project was to create an application by which users could quickly locate information and directions to specific buildings on the campus of Elizabeth City State University (ECSU) using mobile devices. Several tasks needed to be accomplished to support this goal and were achieved through the collaboration of two research teams. The first task

was to construct databases along with forms to gather information regarding each building to be used in the project. The next was to create the map of the University to be displayed in the map service Google Maps. This involved the deletion of incorrect data and the creation of roads, buildings, sidewalks, and other features of the campus. The final task was to bring the data and map together in a site allowing users to access both. The second research group was to take this product a step further to provide walking directions from a user's position to the desired building on campus.

## II. BUILDING THE DATABASE

### A. Overview

The first task to be completed was the gathering of information from various sources. This entailed building a database on the nia.ecsu.edu server capable of accepting data from various users. The fields used for this database were the following:

- **ID**  
An auto-generated field used as the "key" field.
- **Full Name**  
The official name of the building.
- **Abbreviated Name**  
The unofficial name commonly used by students, faculty, and staff.
- **Identifier**  
The group of letters is used by the Registrar's office for class schedules.
- **Latitude**  
The latitude of the building.
- **Longitude**  
The longitude of the building.
- **Year Built**  
The year that the original building was built.
- **Description**  
What is located in the building and the building attributes such as AC, laundry, hours, etc...
- **Department/Programs**  
Departments and programs located within this building.

- **Facts**  
General information about the building and its history.

### B. Data Sources

The **ID** is automatically generated by the Structured Query Language (SQL) and used to identify each record. This prevents duplication of records during the data gathering process.

The **Identifier** is an abbreviation used by the University for each building and appears on students' class schedules. This is often a confusing factor for new students on campus who are not familiar with the building names.

The **Latitude/Longitude** entries were obtained through the Google Maps Lab "LatLng Marker" option which drops a latitude/longitude marker on a selected feature. The latitude/longitude entries allow the program to interact with the map service Google Maps.

Much of the information for this database was obtained from the ECSU student handbook. However, there were gross errors in this information that had to be corrected or removed. Some specific information such as whether a dormitory was male or female, was removed due to the changing nature of the material.

Other information was obtained through a variety of sources. For building construction facts, such as the Year Built and the Full Name, a spreadsheet provided by Mr. Charles Hall, ECSU Director of Design and Construction was used. This information included details such as square footage, floors, construction date. The data for this spreadsheet was obtained through the University of North Carolina Data Additions Validations, Edits (DAVE) Facilities Data Management System. This system is a web-based application, which enables Universities to maintain building and room characteristics for state and federal reporting.

### C. Database Construction

The database used for this project was created using phpMyAdmin, a web based application written with PHP to perform administrative tasks for My Structured Query Language (MySQL). The software provides a user interface, which executes SQL commands for managing databases, tables, fields, users, permissions, etc...

The database was populated using a PHP form created in Adobe Dreamweaver. Once the data was entered, it was displayed in a second PHP file allowing for review of the data. The data could be modified by the use of a PHP form allowing an authorized user to update or add records. An example of a single entry is shown in Figure 1.



Figure 1 Example of building data entered

## III. CREATION OF THE CAMPUS MAP

### A. Overview

Google Map Maker is an online map service launched by Google in 2008, which allows users to easily add to the coverage of the current service offered by Google Maps. The additional coverage produced by users serves as high quality-mapping data, which after processed, is reviewed and published into Google Maps. The Google Map Maker application was used as part of this project to create the necessary locations needed for navigational directions for the Campus of ECSU. Building, roads, and walking paths were created using Google Maps satellite imagery. Additionally, edits were made to the existing roads located on the Campus.

### B. Creating the Map

Utilizing Google Map Maker, the structural attributes on the campus of ECSU, which included buildings, sporting areas, roads, walking paths, and parking lots were identified and created within Google Maps. These locations are represented by polygons and lines and were all created on an individual basis. Figure 2 displays the campus on Google Maps before this project began.

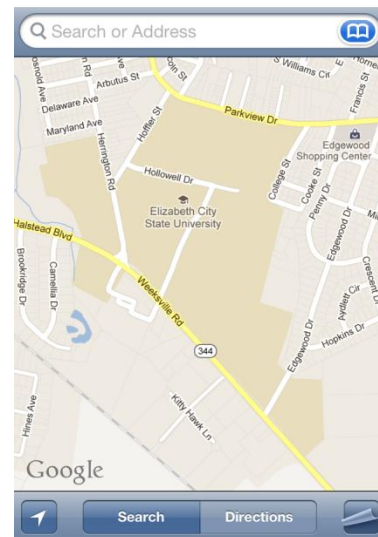


Figure 2 ECSU Campus before project start

Locations were drawn directly onto the Google Map base through the use of the Google Map Maker interface. Using the "Add New" tool in Google Map Maker attributes were added to the Map. The definitions of attributes are added to the map by way of three different "Add New" commands.

- **Add Place** – Adds a new point of interest
- **Draw Line** - Adds roads, walking paths, bike lanes and more to the map
- **Draw a Shape** - Allows the user to add new buildings, boundaries of parks, lakes cities and more

Using the "Draw Line" of Google Map Maker as shown in Figure 3, roads and walking paths were identified on the campus of ECSU. To add a line:

1. The “ADD NEW” tool is first selected
2. Then the “Draw a Line” from the drop-down menu
3. A line category is then selected

To begin drawing a line, locate an appropriate location and place a node in alignment with Google Maps satellite imagery. To end a line simply double click on the location or either press the enter key. After the line is drawn Google Map Maker ask users for details concerning the line. Attribute information for road and walking paths included name, type, size condition, bicycle and pedestrian information surface type and others.

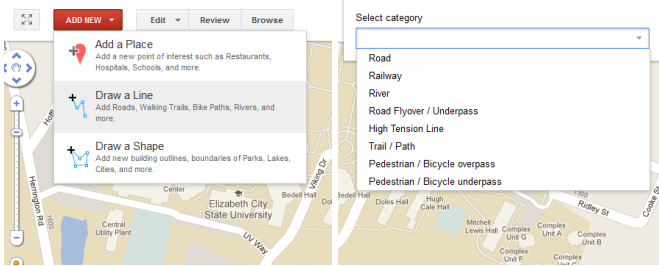


Figure 3 Adding lines in Google Map Maker

The “Draw a Shape” tool as shown in Figure 4, was used to identify and represent buildings, sporting areas and parking lots throughout the campus. To add a shape:

1. The “ADD NEW” tool is first selected
2. Then “Draw a Shape” from the drop-down menu
3. Choose “Building Outline” or “Boundary”
4. A shape category is then selected

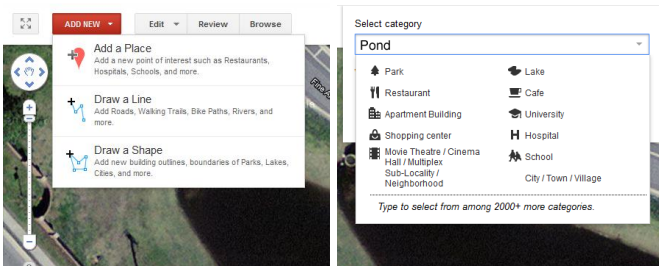


Figure 4 Adding shapes in Google Map Maker

The user then, from the satellite of imagery of Google Maps, identified a desired location and traced its shape. It is important to note that for all buildings and other such locations the base of the building was used in drawing the shape. This was done as to not distort the actual girth of any such location, and in addition to represent the actual land to ground ratio. After the figure was drawn to specifications the user is then directed to provide further detail on the location. Most details for category locations were identical. Common details included name, address, phone, website, categories (identified in “Add New” process) working hours, additional information description and comments.

### C. Review Process

During the review process Map edits remain in a pending status. The new users’ contributions are moderated by experienced Google Map Maker users or reviewers at Google. Reviews may note corrections needed to be made, ask for clarifications on certain input, and etc. After the review process is completed contribution are published to Google Maps and readily accessible to all users. Figure 5 shows the updated campus map.

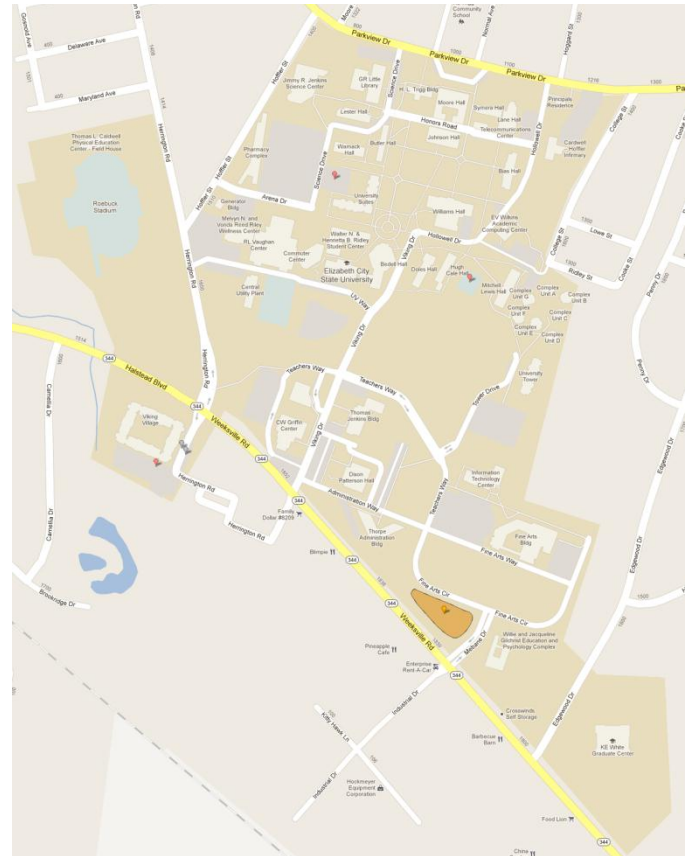


Figure 5 Updated campus map in Google Maps

## IV. THE APPLICATION

### A. Overview

The Mobile Database Team created a mobile web application that provides students and visitors with a mobile, visual guide to the ECSU campus through a combination of Google Maps API and SQL database implementations. Utilizing HTML5, jQuery, and Cascading Style Sheets 3 (CSS3), the presentation of newly added buildings, streets, sidewalks, and parking lots will enable individuals to quickly navigate the campus.

The current version of the application provides users with information on upcoming events for the CERSER program at ECSU and once the campus has been re-indexed by Google Maps, the application will be able to generate walking directions to the buildings on campus.

## B. HTML5

HTML was first introduced to the Internet in the early 1990s. Since then, it has undergone constant updates that have improved glitches and added new features.

Launched in 2004 as a study of contemporary HTML implementations and deployed content, HTML5 is the fifth revision of HTML. Its purpose is to amplify the web's core strengths of interactivity and connectivity as well as to:

1. Define a single language that can be written as a combination of HTML and XML syntax.
2. Define detailed processing models to foster interoperable implementations.
3. Improve markups for documents.
4. Introduce markup and APIs for emerging idioms, i.e. web applications.

As a collection of features, technologies, and APIs that brings the power of the desktop and the vibrancy of multimedia experience to the web, HTML5 is the joint efforts of a community of people interested in advancing the web and a consortium of technological leaders including Google, Microsoft, Apple, Facebook, IBM, and many more. The force behind HTML5 continues to collaborate to ensure that the next generation of web apps can run high-performance graphics, work offline, store large amounts of data, performance calculations at fast speeds, and take interactivity and collaboration to the next level.

HTML5 replaced HTML4 in aims to provide enough information to build implementations that interoperate neither with each other nor with a mass amount of deployed content. HTML5 also saw the introduction of new features to the World Wide Web. The new features were introduced to help web application authors improve interoperability.

In 1997, HTML4 became a W3C Recommendation—the final stage in the ratification process of the World Wide Web Consortium (W3C) group concerning a technical standard—and today continues to serve as a rough guide to many of the core features of HTML. Despite this, HTML4 did not... Since then HTML5 has replaced HTML4 in aims to fix these issues.

According to John Muller of Google, HTML5 makes for a cleaner code that is more applicable to add meta formats to. Although it does not apply to the algorithms used by Google, Muller notes that clean markups makes it easier to maintain a website and add new elements like microformats, and frequently makes pages more portable across a variety of browsers and devices.

The ABI Research group has projected that at least forty-four billion apps will be downloaded by 2016. Although HTML5 will not be ratified until 2017 and the fact that older browsers are not able to support it to its full potential, seventy-nine percent of mobile developers are planning to integrate HTML5 in their apps this year. Developers will either use HTML5 entirely to create apps or create “hybrid apps,” applications that combine HTML5 features—enhanced animations and transitions—with performance oriented abilities

of native apps to achieve the best individual user experience across phones, tablets, desktops, and even kiosks.

## C. Benefits of HTML5:

Although there are no direct benefits of HTML5, with its introduction the Internet has become fast, secure, responsive, and interactive.

Some indirect benefits include a faster process time; the ability to pick up more relevancy/entity information; ability to display a higher quality Search Engine Research Page listing; etc. The main downside to HTML5 comes with the type of device your app users own. Newer device/browsers will support HTML5 better than older formats. Therefore, if you have a moderate to high percentage of users using an older browser, then HTML5, or rather specific features, may not be fully/properly supported.

The latest version of HTML introduced new features that have enabled developers to create apps and websites with the capabilities of desktop applications. The apps built on the new platform have the ability to reach a broader audience using a variety of devices.

## D. HTML5 within the Mobile Application

HTML5 has a built-in Geo-location API that allows mobile device's geographic location to become available to a web application. Beforehand this would have been retrieved using JavaScript. The 2011 – 2012 Database Team focused on this portion of the research.

Released in 2006, jQuery is a cross-browser JavaScript Library that was designed to simplify HTML scripting. jQuery branched from JavaScript and is composed of different functions/tags developers can use to create a custom template for applications' specific needs. It is free and open sourced under the second version of the GNU General Public License.

Similar to JavaScript, jQuery is used to help with the interaction, effects, and functionality of development code. Its syntax is designed to make it easier to navigate a document, select DOM elements, create animations, handle events, and more. The library also allows developers to create plug-ins and abstractions for low-level interaction and animation, advanced effects and high-level, theme-able widgets.

The simplicity of jQuery's syntax allows developers to create high quality applications with a minimum amount of code. Some common effects achieved with jQuery include drop down menus, drag and drop elements, animations, and form validation. The language is also harmonious with other coding languages, i.e. PHP, JSP, and CGI.

Benefits of jQuery include: small file size; compatibility to all popular web browsers and other coding languages; and it supports all version of CSS.

## E. jQuery Template

The team used a jQuery template designed by Chris Converse of the Codify Design Studio. The template uses a combination of jQuery, HTML5, and CSS3. Within the template is a reference to a Google-powered JavaScript file, html5shiv JavaScript that allows older versions of Internet Explorer to run HTML5 properly. The script has a built-in

conditional comment that is understood by all versions of Internet Explorer and is only called when using Internet Explorer 8 or an earlier version.

CSS rules are then specified using media queries and are based on how much space a user's browser has available. Features of the template include: absolute positioning, float properties, CSS sprites, varied image compression, and the ability to activate and deactivate absolute positioning.

The template uses CSS to load imagery based on the screen size of the device being used. Because most devices support images of 140ppi resolution or better, developers can use images that are very small in size without changing the integrity of the original image. These images then adjust to fit accordingly to the screen of the device and/or browser window.

CSS has also been used to create the rounded corners, gradients, and adjustment to the color palette.

## V. RESULTS

The web application created during this project is now fully operational and usable on several types of mobile platforms. The database connections with the "Upcoming Events" and "Building" databases are completely functional and easily updated via modification and addition forms located on the server.

The campus map located on Google Maps has been updated to the current satellite views and approximate locations for new buildings have been put in position until updated satellite views are in place. The connection with Google Maps is fully operational with the reduced size map being pulled into the application and a link for a larger view available to users.

The "walking directions" selection is available and accurate for mobile devices with minor updates needed on some walking paths and roads to facilitate a more direct route to destinations.

## VI. CONCLUSION

The use of the jQuery template was a highly useful addition to this project enabling the insertion of database and Google Maps information to occur with ease. Updating the campus map was a learning experience as the documentation is fragmented and reviewers did not always agree with each other. The process of updating the map is very comparable to working with a Wiki site where any user has the capability to modify features making the review process a very necessary tool.

Updates to the "Building" database and the Google Map view of the campus will need to take place on a regular schedule to provide users with accurate information. As the Google Map Maker tool matures the documentation should also improve making this task less complicated for future developers.

## VII. FUTURE WORK

The mobile application now has a foundation on which enhancements and refinements can be added. One of the first tasks to be accomplished should be the completion of the campus maps in Google Maps. There are sidewalks and new buildings to be added along with the correction of misplaced or unconnected sidewalks and roads.

The next improvement to the application would be the addition of links to frequently used campus web sites. These would include Email, Banner, Blackboard, and other needed information. While these pages are not currently set up for mobile devices, some, such as Blackboard, are moving quickly to mobile display of their sites and information.

Another program improvement would be the addition of data from the Center for the Remote Sensing of Ice Sheets (CReSIS). This would enable researchers to access visualizations from mobile devices. This would entail reformatting current visualization sites to the CSS3 style sheet used in this project. This format would make ice sheet data more readily available to a wider range of users from scientists to students.

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## REFERENCES

- [1] UNC Data Additions Validations Edits, <https://apps.northcarolina.edu/dave/wayf.php>, retrieved from the World Wide Web on November 4, 2011
- [2] Google Maps Help, <http://support.google.com/maps/?hl=en>, retrieved from the World Wide Web on November 14, 2011
- [3] N. Cogbill, M. Seymore Research and Implementation of Data Submission Technologies in Support of CReSIS Polar and Cyberinfrastructure Research Projects at ECSU, <http://nia.ecsu.edu/ur/0910/teams/mmt/mmt0910paper.pdf>, retrieved from the World Wide Web on January 3, 2012
- [4] UNC Facilities Inventory & Utilization, [http://www.northcarolina.edu/ira/fac\\_util/](http://www.northcarolina.edu/ira/fac_util/), retrieved from the World Wide Web on February 4, 2012
- [5] C. Converse, "Dreamweaver templates: Customizable starter design for multiscreen development | Adobe Developer Connection", 11 July 2011, <http://www.adobe.com/devnet/dreamweaver/articles/dw-template-media-queries.html>, retrieved from the World Wide Web on January 4, 2012
- [6] ABA Banking Journal, 5 Disruptive Trends Changing the Mobile Landscape, <http://www.abajournal.com/tech-topics-plus/5-disruptive-trends-changing-the-mobile-landscape-2855.html>, retrieved from the World Wide Web on March 1, 2012