**Web GIS Final Paper**

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**Introduction: Relegated Graduate Students and the 20%**

Texas A&M University has seen a steady growth in the number of undergraduate and graduate students in the last decade. To meet the housing needs for this increased number of students the university has built student housing on campus and encouraged the construction of student housing in close proximity to campus. However, this construction has been entirely focused on undergraduate student housing, in fact, the university has demolished graduate student housing in order to increase its undergraduate student housing.

Since graduate students comprise nearly 20% of the student population at Texas A&M, there is an unmeet need for housing catered and marketed to graduate students. Anecdotal evidence suggests that graduate students have a difficult time finding housing that meets their needs. Therefore, this project sought to find a solution to this problem by meeting graduate student needs. These needs are generally defined as affordable housing, walking or biking distance to either campus or bus stop, and a yard for pets. These needs set the parameters for our project: find a way to give the appropriate detail on properties while showing their geographic relation to campus and/or bus stops. Concomitantly, this project seeks to capitalize on the 20% of students who might be enticed by housing that is strictly catered and marketed to their demographic.

The following sections describe the steps taken and tools used to implement the project: database, website interface, and mobile version.

**Tools and Data**

**Section I: The Database**

A Database Management System, or DBMS, in short, is a program designed for the purpose of storing, retrieving, and running queries on data. Along with that, a DBMS also secures the data as well as makes it available to multiple users. One of the greatest features of the DBMS is its ability to be queried. This is done through the Structured Query Language, or SQL, which is the standard language for relational database management systems. Communication with the database through SQL gives the user the ability to easily make changes to, or simply ask questions, of the data.

The database management system used to store the data for our project was SQL Server. The data set we used contained information on the houses which were to be published on the website, such as the address, description, and location. The locations of the houses, however; were not initially included and therefore needed to be geocoded. This was done through the Texas A&M Geoservices batch geocoding service. Once the location for each house was obtained, the data was imported into SQL Server. The last step was to create an HTML form for the purpose of adding and deleting houses to and from the database. This was a precaution taken to minimize the risk of corrupting the data. The form made it possible to make changes to the database from the website without having to make changes inside the database itself. The data is now securely stored inside of SQL Server and is able to be managed and queried by the user.

**Section II: The Website**

To accomplish our WebGIS project we needed to implement IIS and SQLServer on our virtual machine. There were no real issues in the setup of this architecture as it was a pretty straight forward installation. For the web service itself we utilized Visual Studio 2013 to create an asp.net/C# project. Connecting to the database on SQLServer was accomplished via rest pages in C# and jquery posts from an aspx page. Property values were returned from the rest page in JSON format and processed with JavaScript commands that updated content holders via dynamic html strings. Points on the map of properties were obtained using Google maps APIs to process the returned JSON data into markers and infowindows. The general layout of the site was created using simple html divs, tables, and css. Within the table dropdown boxes were used within a list to create search features. Selected values from this list were passed in the jquery post when retrieving property data to filter based on number of bedrooms, square feet, rent amount and availability. Another option in this list selected bus stops, which called a separate rest call to a bus stop database. The returned data was processed via Google maps APIs and markers created. From the infowindow we also implemented a directions option utilizing Google maps DirectionsService to display route, time and distance from the property location to the A&M campus. Popup images available for each property in a link from the infowindow were created utilizing the fancybox JavaScript. These images were stored in a local images folder based on the property ID. Property management was accomplished via a secure form using a webconfig authorization technique which directed the user to a login page when the form was accessed. Login was obtained via a validation procedure stored on the SQL server that verified the user as having administrative access to the database.

**Section III: Mobile** **Version**

The first step that needs to be in place for the mobile version of the website to be viewed on mobile devices is for there to be a user agent string block of code in the source code of the main website. The purpose of the user agent string is to direct mobile users to the mobile site instead of the main desktop website in order to have a more favorable viewing experience. When a person is on their mobile device and accesses the main graduate housing site, their web browser identifies itself to the server, providing information about itself such as: operating system, application type, and software version among other things. Based on the information that is provided by the client to the server, the server will direct the client to the appropriate version of the website. Our user agent string is one function that includes multiple separate functions that are based off of operating systems that run on popular cell phones: iOS, Android, Blackberry, Windows, and Opera. The functions search for matches in the user agent string given by the client and if it matches key words in the functions then our function identifies the client as a mobile user and the server directs them to the mobile site.

Another step that needs to be in place for a mobile friendly version is a map optimized for mobile devices. To accomplish this, we utillized Leaflet.js, a mobile-optimized Javascript mapping API. Within Leaflet.js we were able to add markers to the map for each home but just having markers on the map just felt cluttered. To address this we utilized map clustering within Leaflet.js to combine markers that were close spatially. Once touched, these clusters expanded out to reveal the homes that can then be clicked and viewed by the user. But the map was just a fraction of the overall mobile experience we had to address, we also had to have a touch-friendly interface that would allow the user to quickly browse and navigate to the various homes on our site. For this we used a sliding menu known as Mmenu to allow for a sleek header bar that expands from the left to reveal a list of homes the user can select from. Once clicked, the map will zoom to the appropriate home and display to the user information about the home such as monthly rent, bedrooms and baths, square footage, as well as pictures of the home. The last component we used to offer a lean, mobile site was a Javascript based image gallery, Magnific Popup. Using Magnific Popup, we were able to add a button to the dialog of every home that, when clicked, opens a lightbox that shows pictures of the home and allows the user to scroll through the various pictures with ease.

**Conclusion and Reflection**

The purpose of the project was to meet the supposed needs of graduate students in order to pull from the much maligned demographic to help both graduate students and leasing efficiency. The objectives of creating spatial relations, distance, and travel time to campus from the respective housing locations were met, and with great success.

The client is very satisfied with the product as long as it is launched successfully to a publically accessible site. At this time the project surpasses the capabilities of other websites available to students to find housing in terms of Web GIS functions.

In reflection the project surpassed our own expectations, we are happy to have created a project that met our goals and used the tools that were taught in the course.