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UTILIZATION OF AUTOMATION TO DELIVER HISTORICAL ECONOMIC DATA TO CUSTOMERS THROUGH THE USE OF WEB TECHNOLOGIES

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I. Introduction

In recent years Dr. William Hall, a Senior Economist in the Swain Center for Business and Economic Services (SCBES) at the University of North Carolina Wilmington (UNCW), has had many publications and presentations to local business leaders based on his analysis and predictions on the economic status of the region. He is able to make these predictions through the analysis of various data sets that relate to the economy of southeastern North Carolina.

Through prior master and undergraduate projects, Dr. Hall has received assistance in development of an automated system to aid him in his analysis and forecasting as well as to communicate these statistics to the general public. The goal of this project was to expand the work of Josh Tobey, a 2008 Graduate of the MSCSIS program. Tobey assisted Dr. Hall in helping him gather, store and present the collected data in order to increase the efficiency of his analysis and predictions. Whereas Tobey's project was focused on the storage and presentation of the economic data to the public, this project will focus on automating the collection and entering of data in the data warehouse and to increase the efficiency at which data is gathered and entered into the database. This increase of efficiency will allow Dr. Hall and his associates to quickly increase the amount of data used in his predictions and will provide more time for analysis as well as reduce input errors

This paper covers the background and importance of this project to UNCW and the Cameron School of Business. It also analyzes current problems and areas for enhancement while discussing possible technical solutions to be researched. System development methodologies are compared for possible utilization in the project. A developed work plan and timeline is also presented for the chosen development methodology of the project.

II. Background

A. History

The Cameron School of Business and, specifically, Dr. Hall have been collecting economic data on Southeastern North Carolina for over 20 years. The

original collection of economic data was for Brunswick, Columbus, New Hanover, and Pender counties. It included the following data points:

- Air Traffic (ILM International)
- Port Traffic (Tonnage)
- Residential and Non-Residential Housing Permits
- Retail Sales and Retail Sales Tax Collections
- Employment, Unemployment and Unemployment Rates
- New Vehicle Sales

Dr. Hall is the Senior Economist for SCBES and has been a Professor of economics in the Cameron School of Business (CSB) at UNCW since 1974. Prior to coming to UNCW, he was a Research Economist and Editor of Publications in the Economic Development Center at Western Carolina University and served as the Editor of the Carolina Coast Business Review and the Director for the Office of Economic Development and Forecasting at the CSB. (Tobey 2007)

Dr. Hall is currently using his analysis of the captured data to study historical trends and to analyze the current and project the future economic health of southeastern North Carolina. Dr. Hall has had many of his projections and findings on the economic status of Southeastern North Carolina published, in which he utilized the collected economic data to assist in his projections. In addition, Dr. Hall is in demand by local and regional economic development agencies, chambers of commerce, and regional developers for presentation to their groups. Examples of these publications and recent presentations include:

- “Wilmington, area unemployment rate drops in March,“ Wayne Faulkner, Star News April 29, 2009.
- “UNCW study reveals Brunswick Nuclear Plant's "significant positive impacts" on local economy,” Progress Energy News Release, October 2004.
- “Resource partners join forces to help small business,” Abby Stewart, Greater Wilmington Business Journal, February 20, 2009.

- "Hall: Region may never see 9% growth again," Josh Spilker, Greater Wilmington Business Journal June 12, 2009.

In 2004, a Grid Computing Grant was created to promote undergraduate research in North Carolina Universities while enabling shared computer resources across the state. This grant included a portion of resources to be used for the development of the UNCW Economic Web data warehouse. This development involved building a prototype system to store and display the economic data via the web. The application was originally developed with a SQL 2000 database for data storage and ASP.NET 1.1 framework as the web front end. The project included the involvement of four undergraduate students (Josh Tobey, Bryan Foster, Jon Werner and Dianne Angeli) at different times from 2004 to 2006. (Tobey 2007)

Completed objectives of Grid Computing Project:

- Changed the data storage from individual spreadsheet files to one relational database.
- Created web front end to view stored data. This also included calculations of moving averages, comparisons and seasonally adjusted indices.
- Enabled data to be viewed from the database in graphical format.
- Added administrative editing/entering of data.

Tobey continued development of the UNCW Economic Web application from the summer of 2007 through the spring of 2008 as part of his capstone project for his Masters of Science in Computer Science and Information Systems degree from UNCW. The major goal of Tobey's capstone project was to assist Dr. Hall in the storage and web presentation of his collected data. These data were made available to the general public through a web site, which is promoted by the university during its annual economic conference held every October. This automation and presentation of data has made the information more accessible to the public without the need for Dr. Hall to respond to every question. The decrease in time spent entering data permits Dr. Hall more time to analyze and develop more efficient

forecasts through the automation of the majority of his forecasting processes. (Tobey 2007)

Completed objectives of Josh Tobey's Capstone Project:

- Upgraded site from ASP.Net 1.1 framework to ASP.Net 2.0.
- Upgraded database from SQL 2000 to SQL 2005.
- Converted site from a prototype to a production application.
- Purchased and installed graphical application package that added the ability to display data in table or graph format.
- Created administrative privileges to manage users via the web interface.
- Added export to excel feature of data for those clients who desire to do their own analysis.
- Redesigned the database to handle multiple types of data. Originally the database contained separate tables for each type of data such as home sales. After the redesign all types of data could be stored in a single table using a relational database design.
- Investigated touch-screen technology within the CBES center for guests to the center to be able to quickly find and display the data they seek

B. Existing Challenges

Data Gathering and Entry

The Center for Business and Economic Services currently receives and collects economic data from many different sources (from websites, emails and published reports) to generate their forecasts. One of the major challenges of automating data entry is that the data is received in many different formats such as excel, comma delimited (CSV) and portable document format (PDF). This requires Dr. Hall to parse the data and manually enter the data into the database (generally by a work study or graduate assistant). Table 1 details the type, source, and format of the data that is currently entered and stored in the data warehouse. It also shows which techniques of automated data entry have been completed through the work

of this project. The "Auto-Entry" column represents the automation of the raw source data. The column labeled "Seasonally Adjusted" represents the automation of seasonally adjusted data. The seasonally adjusted data is created by Dr. Hall using the SAS statistical analysis software. The seasonal adjustment of data is a statistical technique used to remove the effects of recurring seasonal patterns.

Collected Economic Data Overview

X=Complete N=Not Necessary

Data Type	Source	Source Type	Units of Measurement	Data Point Collected	Auto-Entry	Seasonally Adjusted
Airport Traffic	Email from ILM (Appendix A-1)	Excel	Person	Enplaned Passengers	N	X
	Email from ILM (Appendix A-1)	Excel	Person	Deplaned Passengers	N	X
	Email from ILM (Appendix A-1)	Excel	Ton	Enplaned Cargo	N	X
	Email from ILM (Appendix A-1)	Excel	Ton	Deplaned Cargo	N	X
Retail Sales	Web http://www.dor.state.nc.us/publications/monthlysales.html (Appendix A-3)	Excel	Dollar	Gross Tax Collections	X	
	Web http://www.dor.state.nc.us/publications/monthlysales.html (Appendix A-3)	Excel	Dollar	Taxable Sales	X	
Unemployment Rates	Web http://eslmi40.esc.state.nc.us/ThematicLAUS/clfasp/CLFaasy.asp (Appendix A-4)	CSV	Person	Labor Force	X	
	Web http://eslmi40.esc.state.nc.us/ThematicLAUS/clfasp/CLFaasy.asp (Appendix A-4)	CSV	Person	Employed	X	
	Web http://eslmi40.esc.state.nc.us/ThematicLAUS/clfasp/CLFaasy.asp	CSV	Person	Unemployed	X	

	(Appendix A-4)					
	Web http://eslmi40.esc.state.nc.us/ThematicLAUS/clfasp/CLFaasy.asp (Appendix A-4)	CSV	Percentage	Unemployment Rate	X	
Vehicle Sales	Email from NC Automobile Dealers Association (Appendix A-5)	Excel	Automobile	Truck	X	
	Email from NC Automobile Dealers Association (Appendix A-5)	Excel	Automobile	Car	X	
Single Home Sales	Web http://www.ncrealtors.com/market_statistics.cfm (Appendix A-2)	PDF	Houses	Sold		
	Web http://www.ncrealtors.com/market_statistics.cfm (Appendix A-2)	PDF	Dollar	Cost of Selling		
	Web http://www.ncrealtors.com/market_statistics.cfm (Appendix A-2)	PDF	Dollar	Total Sales		

Table 1. Collected Economic Data Overview

If there is an x in either of these columns then the data entry has been fully automated. If there is an N or nothing at then the automation was either determined to be non-beneficial to CBES or the automation has not been completed, respectively. Refer to Appendix A for source files.

Through past work on the website by Tobey, a relational database was created to store the data in a centralized location as well as to provide for tabular and graphical representation of the data. Although the storage and initial output challenges have been addressed, the ease of input of new economic data into the database remains a challenge. Currently, the data entry is done manually, one data item at a time. As items are manually input there is also a potential for incorrect data entry.

Extending the work of Tobey this project developed three major enhancements:

- Automation of data gathering and entry,
- Online touch screen map kiosk system, and
- Additional administrative privileges to add needed data set through the admin section of the website.

These enhancements enabled more timely input of data and increased user ease on the output of the data. The first enhancement of the project was to undertake the issue of parsing and entering the data into this database. This was a challenging task due to the many types of different sources and formats of the data that needs to be entered. To achieve this goal, concepts of automated entry such as web scraping, xml and Excel parsing were utilized and best solution was based on the data source.

Potential *Automated Entry Techniques*

Web Scraping

Web Scraping is a software technique used to extract information from websites using programs to simulate human behavior. This technique processes pages of html to parse out sought data. To retrieve the data from the html pages, specialized programs must be written to address style and format issues of the page to ensure that correct data is being gathered. If the format of the html page changes, the algorithm used to scrape the data from the html also needs to be changed. Web scrapping is, however, a very effective way of automating data collection via the web. It is one of the methods that was considered to assist in the collection of the economic data. After further analysis and experimentation, it was decided that web scraping would not be beneficial to this project primarily due to the need to monitor each site to insure they did not change their format of the data presentation. Here are a few links to websites containing information on web scrapping.

- http://www.rexx.com/~dkuhlman/quixote_htmlscraping.html
- http://aspalliance.com/236_NET_Screen_Scraping_in_depth.all

- http://www.codeproject.com/KB/aspnet/weather.aspx
- Legal Sources:
- http://pascal.vanhecke.info/2006/08/23/legal-aspects-of-screen-scraping/
- http://brendanhughes.ie/2008/04/02/is-screen-scraping-legal/

Excel/PDF /CSV File Parser

File parsing techniques were implemented during the execution of this project to extract needed data from specifically formatted sources. These techniques extracted data from such files as Excel, PDF and comma delimited files.

For CSV files, the parsing process is fairly straightforward since there are commas separating the data. The data is presented in the same format for each row of data received. Similar to other types of data parsing, any formatting change in the CSV file will require an algorithm change to parse the data correctly. This type of file parsing is achievable. Unfortunately, as Table 1 shows, only unemployment rate data is available in CSV form.

Excel files, as Table 1 shows, are the selected format for most of the data points currently being collected. . In the case of Excel files, XML was utilized to retrieve the data from the file. Excel files can be extracted through a process of 'zipping' the file and then investigating the resulting XML files that are found in the zip file. The XML files can be easily parsed to retrieve the needed data from them. XML formatting has an advantage as the system can 'read' the tags to determine the data, and as such if the formatting changes the parsing program is still able to handle the modification without programmer or user input.

The last technique involves the parsing of PDF files. As shown in Table 1, the PDF file format is the selected format of single home sales. The parsing of PDF files is more complex than that of the other two techniques due to its being created and protected by a third party to prevent access to the contents of the file. The developed solution for a PDF file involved the PDF file to be converted to an xml using Adobe Acrobat program for conversion. After an xml file was obtained the xml parsing techniques were used to extract the necessary data from the xml file.

With all three types of file parsing, each individual type of data point required a separate parser due to the complexities of extracting data from differently formatted files. The negative aspect of this technique is that as new economic items are desired to be collected that are not currently in the data warehouse, a new parsing routine will need to be added. For different data types, the xml parsing algorithm may need to be adjusted due to modifications of the source file.

C. Enhancements

Increased presentation methods for public interaction

The development of a touch screen kiosk interface in the SCBES office was researched as part of the project. The touch screen kiosk interface involves the implementation of an interactive North Carolina map of counties. The SCBES office, which is located in the Computer Information Systems building, desires to have a kiosk located in its lobby so that guests may interface directly with the data. In addition, the kiosk would be used for potential donors to the center as well as by students for economic studies.

The interactive map was added as a separate component of the website. This map allows a user to select a county, port or airport; to retrieve the data for that item; and then drill down for specific data by year or month. Progress Energy, who has been supporting the development of both the database and website, are willing to enable a "showplace" for visiting professionals. The addition of this kiosk to the "showplace" would bring a great deal of visibility to both the website and the work being done by SCBES.

Subscription Service

A subscription service is being considered by SCBES to be offered to businesses, industries and economic development agencies interested in economic data for southeast North Carolina. The subscription service would involve the development of advanced features of the website currently not available to the public. As part of this project, legal issues pertaining to a paid subscription, which

services and data to charge for and possible designs of incorporating a paid subscription into the current web site design were researched. A potential service of the subscription service could entail selected projections and forecasts from the SCBES associates.

Data Expansion

The university has also expressed the desire to become a hub of economic data for more than southeast North Carolina. Part of the objective of this capstone project was to investigate the expansion of the data warehouse from four counties to all North Carolina counties east of I-95. This is now achievable by simply adding the counties into the database as possible locations and using advanced automated data entry techniques. The expansion of data collection from all North Carolina counties has been made possible.

James Leutze, the Chancellor of UNCW from 1990-2003, has expressed a desire for the warehouse to be used to gather more than economic data. He has asked for the consideration of warehousing crime and population statistics. This project did not include those data items in its scope; however, consideration in the design of input items to permit ease of entry for new data collection items has been given.

Admin Data Category Creation

Previously, to add a new data category (i.e. tourist dollars) to the current collection of data sets, required manual database manipulation and the involvement of a systems person. In an effort to alleviate the burden of creating new data categories, a solution for providing the ability for the website administrator to add a data category as easily and effectively as needed was created and implemented as part of this project. This ability allows for quicker and more efficient growth of the data collection, which in return will create an opportunity for more complex and sophisticated data analysis and forecasts.

CSB Homepage Feature Block

Increasing site visibility is of great importance to SCBES and UNCW. As part of this project, the creation of a feature block prototype for the home page of the Cameron School of Business's website was developed. The block contains images of specific graphs that are automatically generated as users of the site view data via the graph section of the site. The generated images are stored in a specific folder on the server with a table in the database containing the tracking id and image location of the corresponding graph. The feature block presents a slideshow of the generated pictures with a caption describing the data being presented while also containing a link to the NC Economic Data website.

SAS Analysis Assistance

Increasing the efficiency of Dr. Hall's analysis and forecasts was a large part of this project. To aid in this, the project insures that administrators can download the data by data pod into an excel spreadsheet format. This provides Dr. Hall with the ability to load the downloaded Excel files into SAS for analysis. After the data has been analyzed and adjusted, a solution to auto update the seasonally adjusted data for administrators was created and implemented. This solution enables administrators to update seasonally adjusted data through the uploading of a file via the administrative section of the website. After the file is uploaded, the same automated data entry techniques were used to enter the data as were the ones used to enter the collected economic data discussed earlier in this paper.

Enhanced Reporting

To assist in the tracking and reporting of the data viewed on the website, this project enhanced such reporting through the addition of the tracking of data. This enhanced tracking consists of enabling each individual datapod to be tracked and the proper reports generated so that administrators can determine which data items are actually being viewed. The tracking data is gathered from the table display and graph display pages as they are viewed on the site. The tracking data is then stored in a table in the database that references the data category, datapod, location,

start year, end year, type of graph viewed and date accessed. This can then be viewed through the tracking page of the admin section of the site.

Figure 1. Tracking Table Database Diagram

Customer Suggestions

Dr. Hall has expressed the desire for a simplest manner for customers to contact SCBES, other than email, to express wants and suggestions for the site such as a question or comment box. This ability was investigated through a form that can be completed via the webpage and submitted directly to SCBES. The actual content collected such as contact info and questions/comments will be determined by Dr. Hall.

Training Manuals

Training documents for using the website as a customer and administrator were created through this project. This will help to lower the learning curve and enable the website to be efficiently passed from one administrator to the next. It will also serve as a good reference document for current administrators to ensure correct procedures are followed.

Advanced Administrative Data Display Control

In the past, data items can be displayed as a rolling year total via the table view on the website. Certain data items need to be displayed as a rolling monthly or

quarterly average. Through this project, administrative abilities were created to review all data item displays to determine if they need to be rolling year, monthly or quarterly average. This was accomplished through the creation of a review screen in the admin section of the website.

D. Importance

One of the main objectives of SCBES is the collection and analysis of local, state and national economic data that affects the growth of the region. Dr. Hall and SCBES receive many requests for current economic data from local businesses and public officials in order to make business and budget planning and expansion decisions.

This project helps UNCW and CSB make progress in achieving their strategic goals. Specifically this projects aligns with strategic goal number five: "Strengthen the university's regional engagement and outreach activities", and number seven, "Ensure adequate resources to achieve university goals by increasing public financial support and private giving" of the UNCW Mission (UNCW Mission). It also fits into number seven, "pursue increased public financial support and private giving", of the eight learning goals of the Cameron School of Business (CSB Mission).

III. System Analysis and Design Methodology

This section details the various system analysis and design methodologies that were considered for this project. It also discusses the advantages and disadvantages of each system methodology. In addition the selected the methodology is discussed in greater detail.

A. Extreme Programming

Agile Software Development (XP)

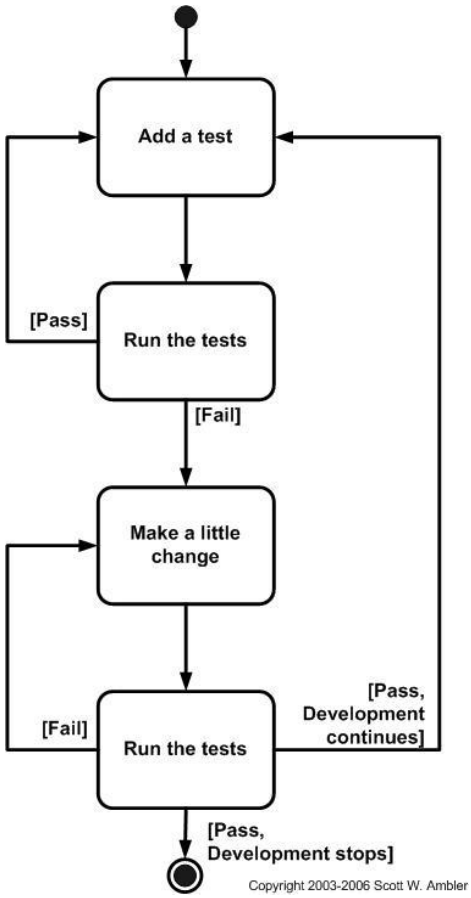
Agile software development methodology is based on iterative development that follows the agile manifesto. The methodology stresses collaborative and integrated teams, quick and frequent releases, and the quick adaptation to changes in business needs. It is not an *ad hoc* sloppy do whatever feels good process. It requires great discipline to enable a project to adapt quickly to business needs (Hendrickson, 2008). The testing side of agile development does not require there to be designated testers. Therefore everyone in the team tests the functionality of their code. The tests are created at the beginning of each iteration before programming begins. With agile development, quality assurance (QA) does not act like the quality police. The business stakeholder classifies what is acceptable and what is not. The agile team should work closely with the business stakeholder because of this relationship (Hendrickson, 2008). In addition, with agile testing every iteration must pass specified tests before moving onto the next iteration of the development process.

Figure 2. XP Iteration Cycle

Agile software development has six concrete practices: 1) Automated unit test, 2) Automated integration tests, 3) Test Driven Design, 4) Automated regression tests, 5) Acceptance Test Driven Design (ATDD), 6) Exploratory testing and collaborative testing.

Automated unit and integration tests help to convey the expectations of the internal behavior of the code and to allow for the tests to execute quickly and run after every change.

Automated regression tests allow for the continuous integration process to flow quicker and more efficiently while verifying the external behavior of the program.



ATDD is a concept derived from test driven development (TDD) where you discuss the needs of the project with the business holder, distill those needs into acceptance tests, implement the code to satisfy the developed acceptance tests and demonstrate the functionality of the code to the stakeholder.

Figure 3. Test Driven Development Cycle (Beck, 1999)

Exploratory testing is the process of simultaneously learning, test design and test execution to help inform future tests. Collaborative testing is the involvement of the business stakeholder(s) in the testing and development activities. (Hendrickson, 2008)

Extreme programming (XP) is an agile methodology. The goal of XP is to reduce the cost of changing software by performing activities a little at a time throughout the entire development cycle. (Beck, 1999) A few characteristics of XP are that it focuses on running production code and automated testing. Automated testing is used to ensure quality at every stage of development and development is achieved in very small iterations with continuous integration and refactoring of code to improve the code structurally. (Rumpe, 2006)

Extreme Programming's basic practice is short software releases and iterations. (Talby, 2006) Other practices of XP are test-first programming, pair programming, short refactoring, user stories, acceptance testing, continuous integration, collective ownership and planning game. Testing is the most time consuming part of XP. Some common XP tester activities are

- Negotiate quality with the customer
- Clarify stories and reveal hidden assumptions
- Develop accurate estimations of programming and testing tasks
- Verify acceptance tests match quality specified by the customer
- Automate Tests
- Produce testable code (Rumpe, 2006):

Test Driven Design (TDD) is used in extreme programming and is big a part of what differentiates XP and the Agile methodology from traditional forms of software

testing and development. TDD is the practice of "developing code by writing a failing, executable unit test that demonstrates that the existing code base does not currently possess some capability." (Ambler, 2003) In other words, TDD aims to demonstrate that a piece of code cannot perform a specific operation through a unit test. Also, once this failing unit test has been written, code is then developed to make the test pass. TDD, However, is not a testing technique but more of a programming practice. The fully automated unit tests are merely a side effect of TDD, not the goal of TDD.

This project used an agile software testing methodology, more specifically, Extreme Programming, for its development methodology. This type of methodology will better fit the development needs of the project due to the easy separation of existing challenges and additional enhancements into iterations. The creation of iterations inside each iteration is based on user stories. Test-first programming will allow for greater and more enhanced testing. Agile software development also allows for quicker development. With the timeline of the project being fairly fast paced, any amount of extra efficiency in the development process will increase the output of the research areas of the project. XP is also an area of personal research interest and this will allow for greater depth of research into the methodology.

B. Alternatives

Waterfall Model

The waterfall model of software development uses a sequential approach of the software development life cycle. Where each step sequentially follows the next and the activities of each step are based on the previous step's activities. For instance, design logically follows requirements and implementation logically follows design. The first part of this approach is to determine the requirements of the project then to design a system based on those requirements. From there, an implementation of the design is created. The implementation is then verified against the requirements of the project and then the software is maintained for the life of the software. (Leffingwell, 2003)

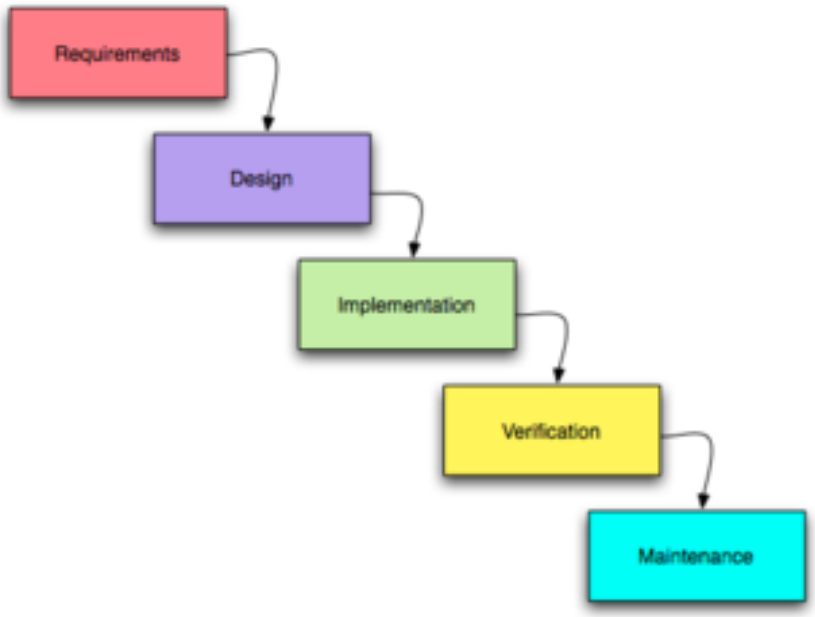


Figure 4. Waterfall Model (Leffingwell, 2003)

Spiral Model

The spiral model of software development is a combination of the prototyping model and waterfall model. This model combines the elements of design and prototyping in stages. The prototyping model involves the creation of a sample of the final system or product. The sample or prototype is then tested and modified until it is an acceptable product. The prototypes are used to drive a structured waterfall-like model to produce the final system. A typical cycle of the spiral begins with the determination of the objective to be completed by the current spiral. The risks are then identified and resolved. Then the objective is then developed and tested based on the risk assessment. The objective of the next spiral is then determined. (Selby, 2007)

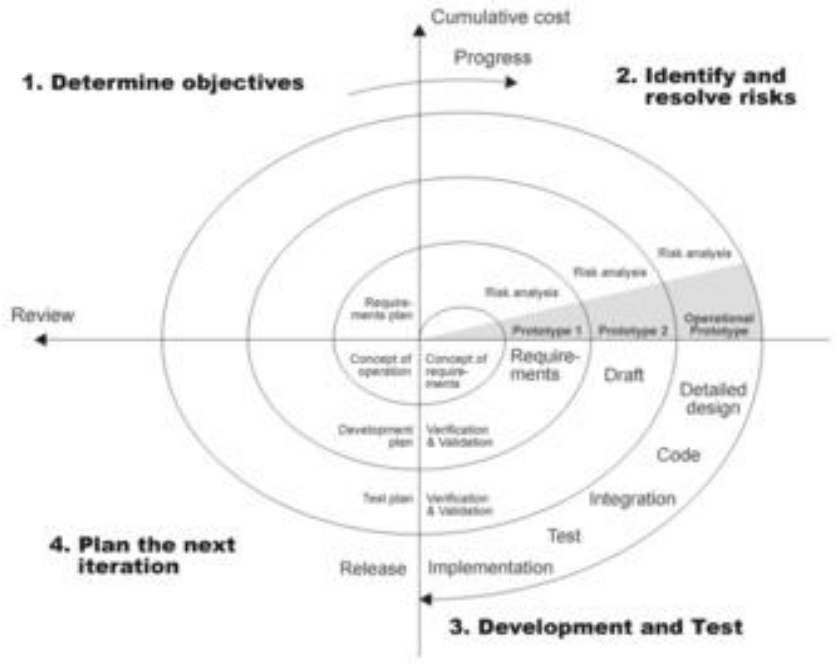


Figure 5. Spiral Model (Leffingwell, 2003)

Object Oriented Design

Object oriented software analysis and design is one of the most popular software development methodologies. This approach models a system as a collection of interacting components or objects. Each object/component of the collection represents an entity of interest of the system. The system can be modeled using many different modeling languages with the most popular being the Unified Modeling Language (UML). Object oriented analysis and design is commonly used in conjunction with the Unified Process (UP). UP is an iterative and incremental development methodology that consists of phase and disciplines to establish a framework for project definition and execution. The UP development lifecycle consists of four phases split into iterations: inception, elaboration, construction and transition. Deliverables are due at the end of each iteration to allow for quicker user feedback throughout the development of the project. (Satzinger, 2005)

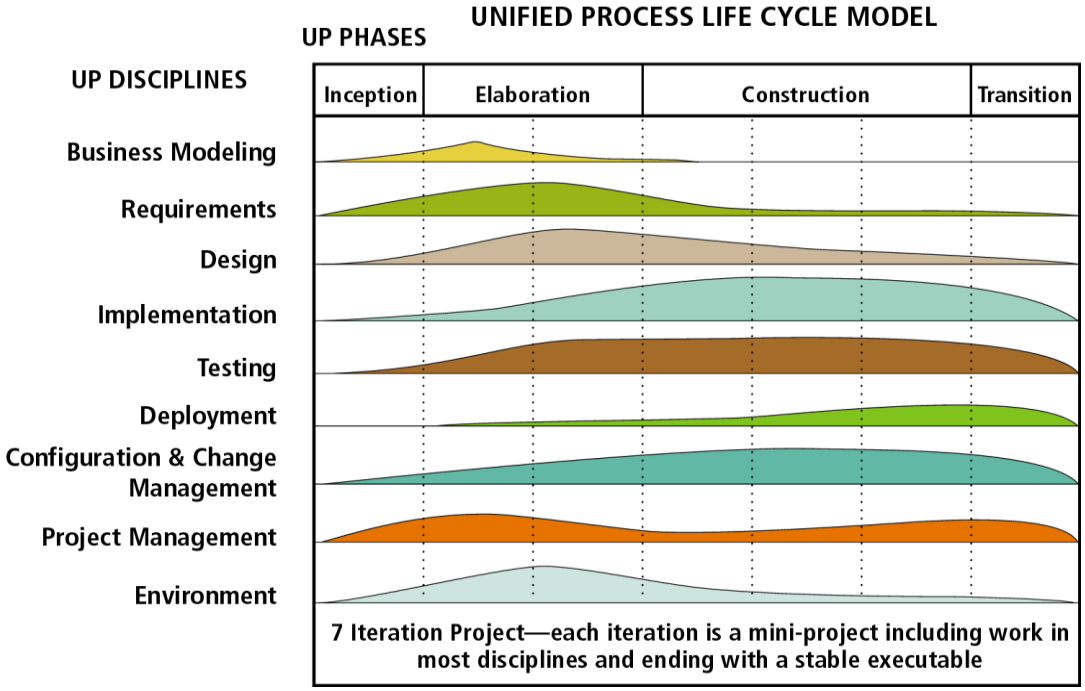


Figure 6. Unified Process (Satzinger, 2005)

IV. Work Plan

A. User Stories

User stories are the extreme programming version of use cases. For the initial user stories, started with creating stories for automated data entry and proceeded from there, creating more user stories for every release as the project developed. The initial user story of the project was the uploading of a CSV file containing employment data for a specific year for all counties. This lead to the user wanting the data parsed from the uploaded employment file. The user now wants to insert the parsed data into the database. From this sequence, the following user stories were created:

- User wants to upload a file containing employment data
- User wants to have employment data parsed from uploaded file
- User wants to insert parsed employment data into the database

Over sixty user stories were developed for this project, a full list of the user stories may be found in Appendix B.

B. Release/Iteration Plans

With agile development, after the user stories have been created a release plan is developed. The release plan specifies the user stories that will be include in each systems release and the dates of each release. The beginning of a release plan for this project can be seen in Table 2.

Iteration	Estimated Completion Date
I. Automated Data Entry	End of October 2009
II. County Map Development	Middle of November 2009
III. Administrative Additional Features	Beginning of December 2009

Table 2. Project Release Plan

After a release plan has been developed then an iteration plan is created. The iteration plan is created through an iteration-planning meeting where the customer chooses user stories from the release plan to have implemented in that iteration. After each iteration is completed, an iteration-planning meeting with the customer occurs to determine the next set of user stories to be implemented. If a new user story has been created then the release will be modified to account for the new user story, as seen in Figure 7. Please refer to Appendix C for a complete layout of the iterations and iteration plans (selected user stories) used for this project.

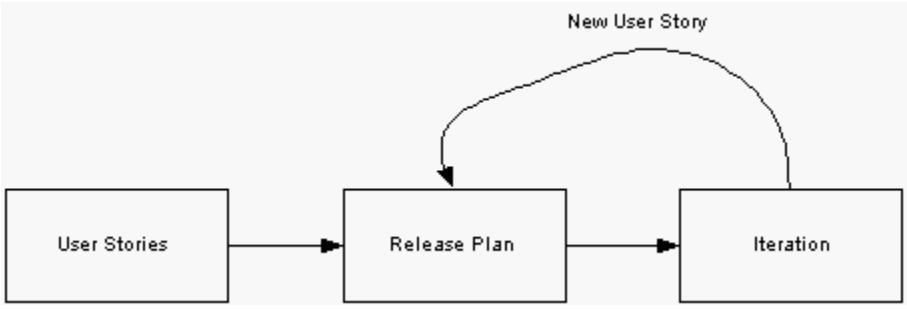


Figure 7. XP Simple Flow Diagram

The following sections will detail three specific iteration cycles or releases. Iterations I1 to I12 refer to the development of the automated data entry portion of the project. Iterations II1 to 6 refer to the development of the county map kiosk

portion of the project. Iterations III1 to 3 discuss the development of the additional administrative privileges added for this project.

Release I - Automated Data Entry
Iterations I1 – I6.

Iterations one through six involved the analysis and development of the automated data entry section of the site. The categories to be entered were determined through meetings with Dr. Hall and various faculty members. The sources for the data were then analyzed and determined to be applicable for this project. For airport and port data, the sources supplied such minimal data each period so the effort to automate the entry of this data would not be beneficial to the project or SCBES. For automobile sales, unemployment, retail sales, and home sales data the automation of the data entry seemed feasible and beneficial to the project and SCBES. The difference being the quantity of data supplied by individual counties.

The user interface for the automated data entry was incorporated into the manual data entry by adding an new web forms to permit the automated data entry of the uploaded file. A month selection drop down list was made available for the automated data entry of data. An example file was made available for data types that automated entry was developed for. In addition, a sanity check was added in the software to verify the source file format and data.

The XML and CSV parsers were built for each data category. Each data category involved a different set of time ranges and county coverage. For example, the unemployment data source file covered one county over many years with collected figures for each individual month of that year. The parser, in this case a CSV parser, would parse out the needed data for that county. A stored procedure was created to store that parsed data into the database. This process was completed for each data source of the iteration. Figure 8 demonstrates the ease of uploading a new series of data. Notice that a year may be entered all at one time for each county.

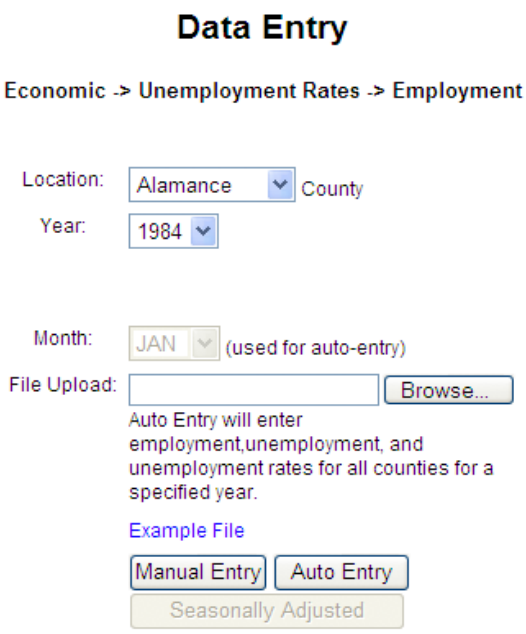


Figure 8. Automated Data Entry Screen for Unemployment Data

Iterations I7 – I12.

In iterations seven though twelve the addition of automating the entry of seasonally adjusted numbers was explored and a solution implemented. The parser for this file was simply a text parser since the data came in the form a dat file. The dat file contained the seasonally adjusted data for an individual data category and was created by Dr. Hall using SAS and an original source file. The original source file for calculating the seasonally adjusted data is provided in the excel format and is downloaded directly from the website. The automated data entry for seasonally adjusted data also proved to be beneficial for every data category explored by the project.

The user interface to have seasonally adjusted data auto entered into the database was added as an additional feature of the already developed automated data entry section of the site, this can be seen in Figure 9. This development took advantage of the already existing uploading feature and added a supplementary button to the interface specifically for seasonally adjusted data entry, which allowed the user to insert parse seasonally adjusted data. A stored procedure was created in this set of iterations to insert the parsed seasonally adjusted data into the database.

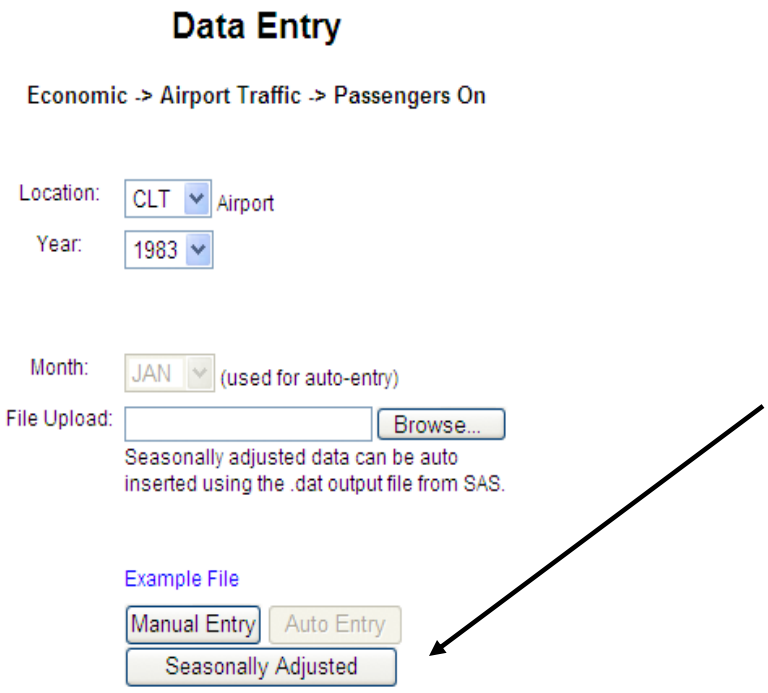


Figure 9. Automated Data Entry for Airport Seasonally Adjusted Data

Release II - County Map Development

Iteration II1.

The first iteration for the county map development release involved the creation of a paging system for the touch screen portion of the site. This iteration focused on the development of image maps of the state, counties, ports and airports. The state map was divided into two sections: the coastal/Piedmont section and the mountain/Piedmont section, as seen in Figure 10. Once a section of the state has been selected, a more zoomed in image of that is section is loaded. The state section image is then broken down into selectable counties.

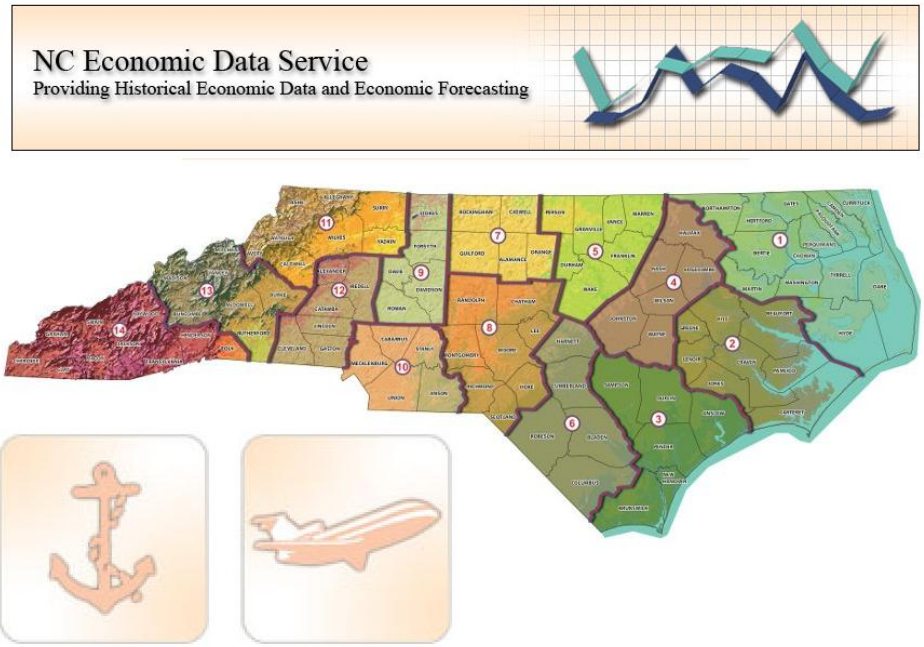


Figure 10. State Selection Image Map (The anchor represents port data and the airplane represents airport data)

Iterations II2-5.

This set of iterations focused on the development of the selection screens after a county, port or airport has been selected. These iterations reused the data driven concepts originally developed by Tobey to create selection screens for start-year and end-year. In addition, selection screens for data category and data pod were created as well.

Iteration II6.

Iteration six involved the re-structuring of the already developed graph display into the county map section of the site. The graph display was enhanced and adapted from previously accomplished work done by Tobey.

Release III - Administrative Additional Features

Iteration III1.

The first iteration of the additional administrative features investigated the development of an advanced graph display through the admin section of the site. This development included the ability to adjust the way data is displayed by each individual data category.

Iteration III2.

The second iteration of this release centered on the development of the user viewed data tracking system. The system involved the development of a table in the database to store the data category, data pod, location, start year, end year, graph type, and date accessed viewed by a user. The development also included the modification of the graph display, including the touch-screen display, and table display to insert the specified data into the table in the database.

This system incorporated a reports page for the admin section of the site. The reports page allows for viewing the collected tracking data in the database. The reports page limits the data shown via a selected date range based on the date accessed stored in the database. The date range can be adjusted dynamically using the reports page. The data can then be viewed by hits per data category, data pod and location. The data can also be viewed by a specific data category, data pod, location (as seen in figure 11) and raw unfiltered data for the selected date range.

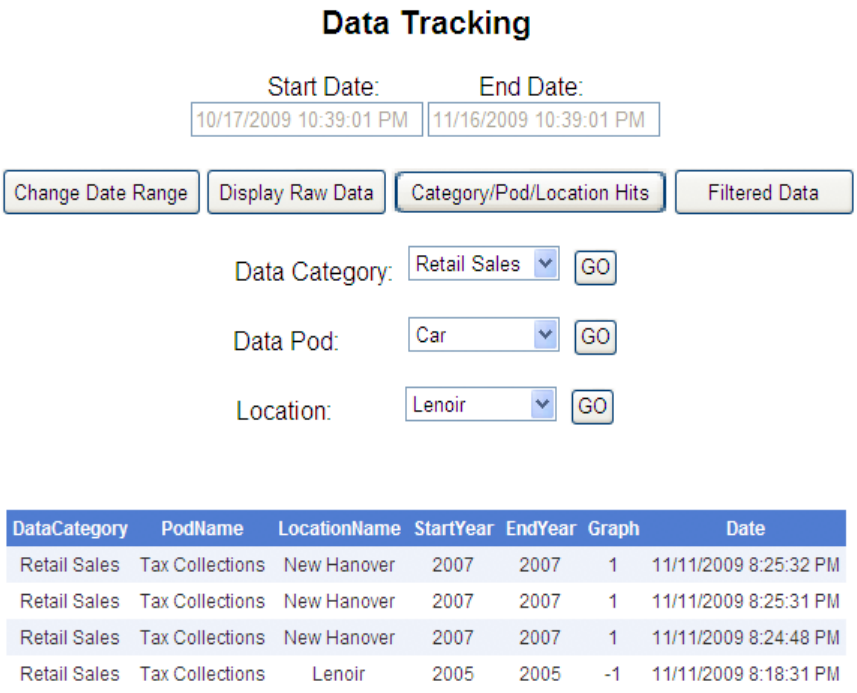


Figure 11. Filtered Data Tracking Screen

Iteration III3.

The third iteration of this release was the development of the administrative data category and data pod creation page of the admin section of the site. The creation page allows for administrators of the site to add data pods to existing data categories and allows for the creation of a new data category and data pods for that data category. This development involved the creation of the page and a few stored procedures to create a new data category and to add a data pod to a data category.

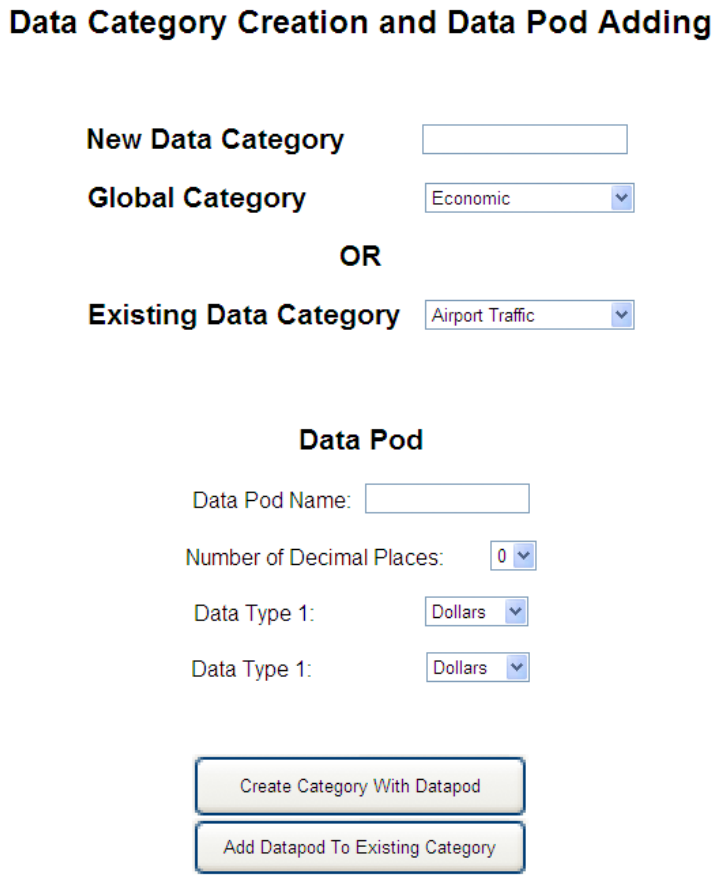


Figure 12. Data Category Creation and Data Pod Addition Screen

V. Timeline

November 09

- Develop a way to contact SCBES based on the needed information by Dr. Hall
- Create administrative privileges to adjust data display to rolling year, quarter or month average

- Investigate subscription service
- Write and distribute final capstone document

December 09

- Implement touch-screen kiosk
- Complete Training Manual
- Complete user training
- Complete capstone

VI. Lessons Learned

This project provided the author with many educational opportunities through research and implementation. It covered a variety of research topics in computer science and information systems: parsing techniques for different file types, web scraping techniques, economic analysis, human computer interaction, online subscription services and web technologies. It also involved the development of algorithms to parse files, human touch screen interfaces, web interfaces and automation of data entry.

References

Ambler, S. (2003) “Introduction to Test Driven Design.” <http://www.agiledata.org/essays/tdd.html>.

Beck, K. (1999) “Embracing Change with Extreme Programming.” *IEEE 1999*.

Cameron School of Business Mission (http://www.csb.uncw.edu/about/mission.htm).

Swain Center of Business and Economic Services Mission (http://www.csb.uncw.edu/SCBES/about.htm).

Hendrickson, E. (2008) “Agile Testing Nine Principles and Six Concrete Practices for Testing on agile teams.” Quality Tree.

Leffingwell, D & Widrig, D (2003) *Managing Software Requirements*. Addison-Wesley Professional, Boston.

Rumpe. (2006) Agile Test-based Modeling. In International Conference on Software Engineering Research & Practice. CSREA Press, June 2006.

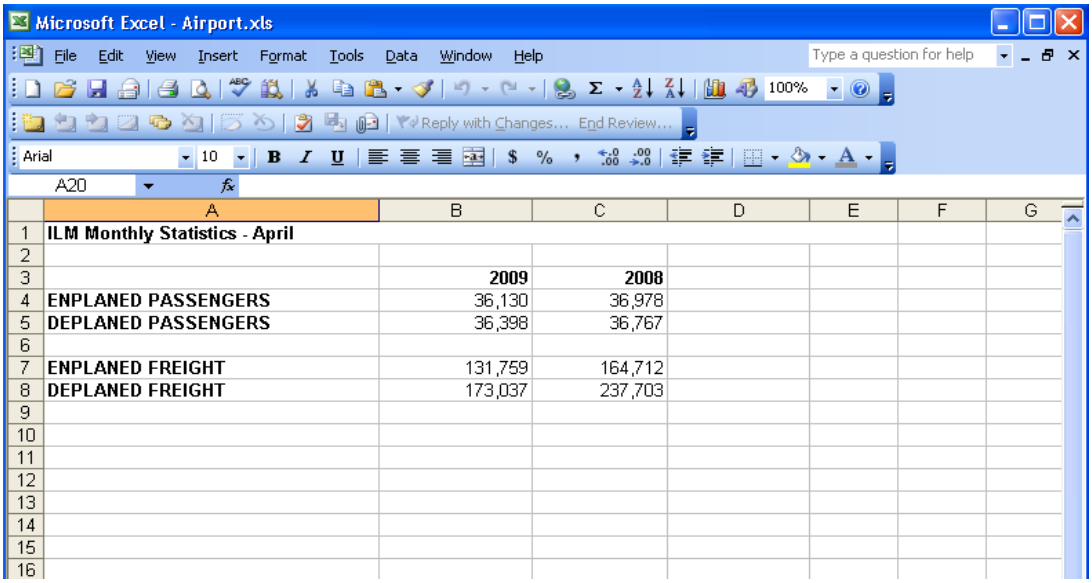
Selby, Richard W. (2007) “Software engineering: Barry W. Boehm's lifetime contributions to software development, management, and research.” *IEEE. 2007.*

Satzinger, John W., Robert B. Jackson, & Stephen D. Burd (2005). *Object-Oriented Analysis and Design with the Unified Process*. Thomson Learning, Inc.

Talby, D and Keren, A (2006) “Agile Software Testing in a Large-Scale project.” *IEEE. 2006*.

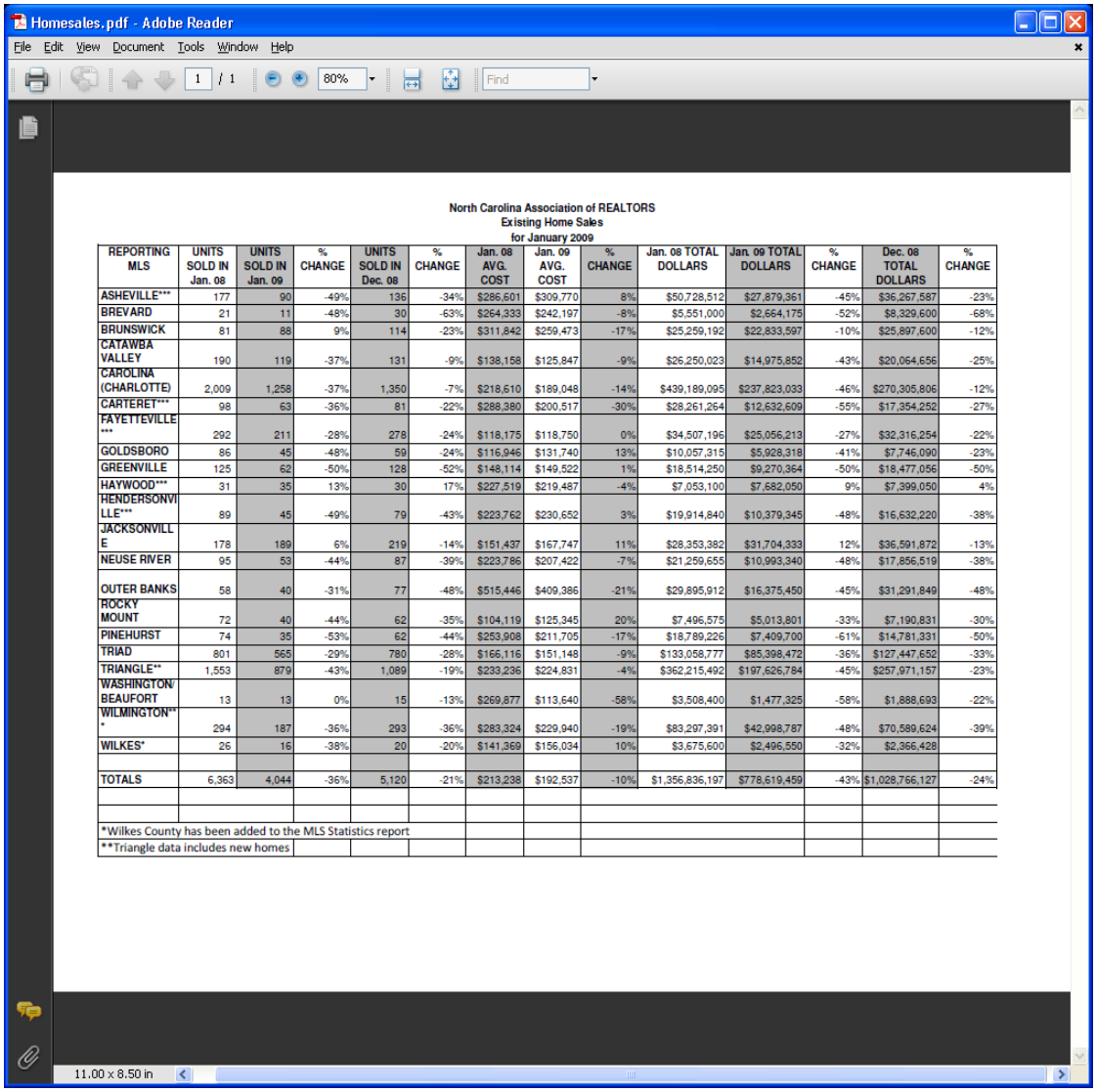
Tobey, Josh (2007) “Utilizing Web Technologies to Provide Historical Data Relative to the Economic Health of Southeastern North Carolina”, Capstone Project for MSCSIS from UNCW. 2007.

Appendix A: Data Sources



	A	B	C	D	E	F	G
1	**ILM Monthly Statistics - April**						
2							
3		**2009**	**2008**				
4	**ENPLANED PASSENGERS**	36,130	36,978				
5	**DEPLANED PASSENGERS**	36,398	36,767				
6							
7	**ENPLANED FREIGHT**	131,759	164,712				
8	**DEPLANED FREIGHT**	173,037	237,703				
9							
10							
11							
12							
13							
14							
15							
16							

A-1: Airport Data Source – Excel File

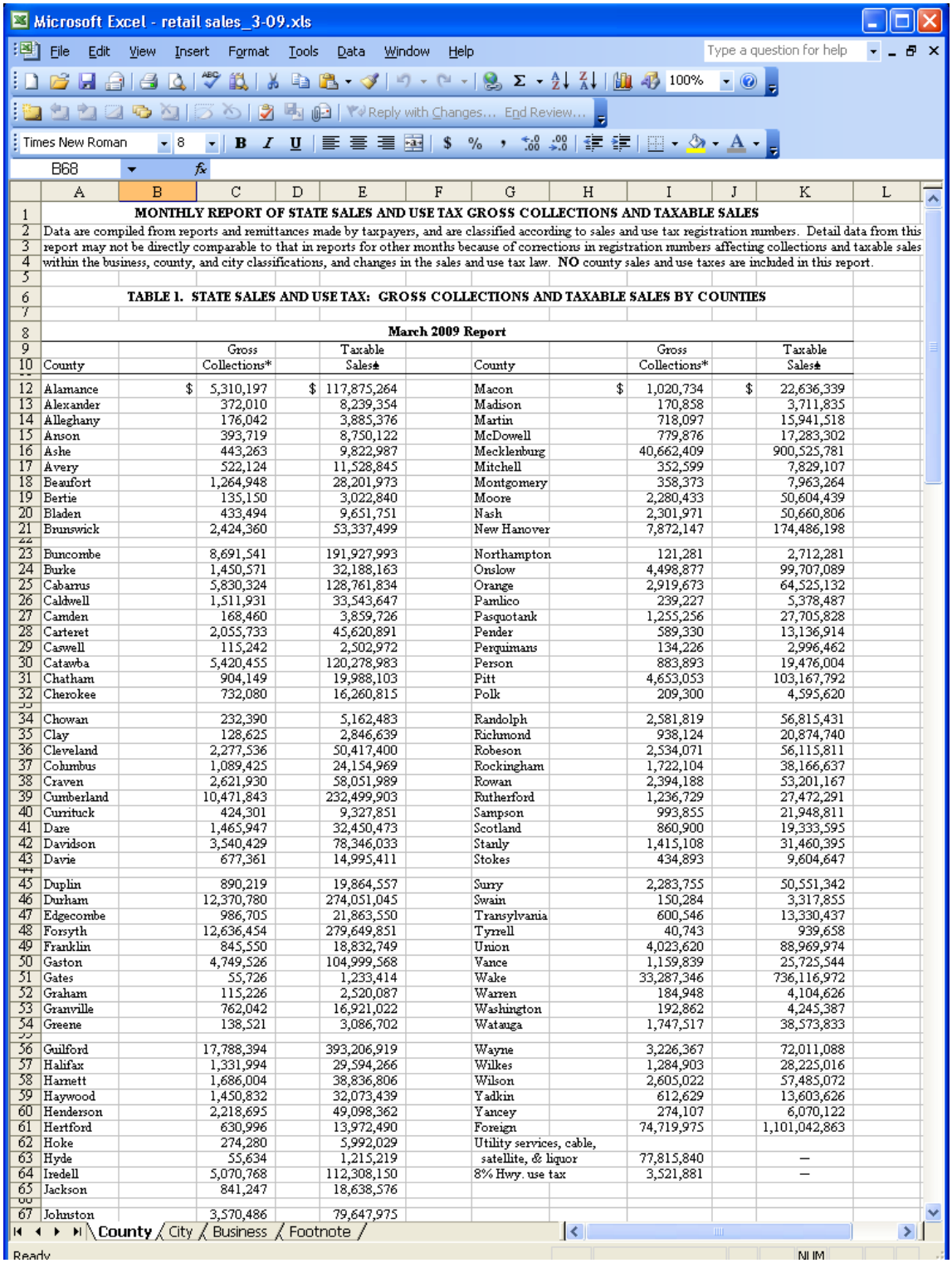


North Carolina Association of REALTORS
Existing Home Sales
for January 2009

REPORTING MLS	UNITS SOLD IN Jan. 08	UNITS SOLD IN Jan. 09	% CHANGE	UNITS SOLD IN Dec. 08	% CHANGE	Jan. 08 AVG. COST	Jan. 09 AVG. COST	% CHANGE	Jan. 08 TOTAL DOLLARS	Jan. 09 TOTAL DOLLARS	% CHANGE	Dec. 08 TOTAL DOLLARS	% CHANGE
ASHEVILLE***	177	90	-49%	136	-34%	$286,501	$309,770	8%	$50,728,512	$27,879,361	-45%	$36,267,587	-23%
BREVARD	21	11	-48%	30	-63%	$264,333	$242,197	-8%	$5,551,000	$2,664,175	-52%	$8,329,600	-68%
BRUNSWICK	81	88	9%	114	-23%	$311,842	$259,473	-17%	$25,259,192	$22,833,597	-10%	$25,897,600	-12%
CATAWBA VALLEY	190	119	-37%	131	-9%	$138,158	$125,847	-9%	$26,250,023	$14,975,852	-43%	$20,064,656	-25%
CAROLINA (CHARLOTTE)	2,009	1,258	-37%	1,350	-7%	$218,610	$189,048	-14%	$439,189,095	$237,823,033	-46%	$270,305,806	-12%
CARTERET***	98	63	-36%	81	-22%	$288,380	$200,517	-30%	$28,261,264	$12,632,609	-55%	$17,354,252	-27%
FAYETTEVILLE ***	292	211	-28%	278	-24%	$118,175	$118,750	0%	$34,507,196	$25,056,213	-27%	$32,316,254	-22%
GOLDSBORO	86	45	-48%	59	-24%	$116,946	$131,740	13%	$10,057,315	$5,928,318	-41%	$7,746,090	-23%
GREENVILLE	125	62	-50%	128	-52%	$148,114	$149,522	1%	$18,514,250	$9,270,364	-50%	$18,477,056	-50%
HAYWOOD***	31	35	13%	30	17%	$227,519	$219,487	-4%	$7,053,100	$7,682,050	9%	$7,399,050	4%
HENDERSONVILLE***	89	45	-49%	79	-43%	$223,762	$230,652	3%	$19,914,840	$10,379,345	-48%	$16,632,220	-38%
JACKSONVILLE	178	189	6%	219	-14%	$151,437	$167,747	11%	$28,353,382	$31,704,333	12%	$36,591,872	-13%
NEUSE RIVER	95	53	-44%	87	-39%	$223,786	$207,422	-7%	$21,259,655	$10,993,340	-48%	$17,856,519	-38%
OUTER BANKS	58	40	-31%	77	-48%	$515,446	$409,386	-21%	$29,895,912	$16,375,450	-45%	$31,291,849	-48%
ROCKY MOUNT	72	40	-44%	62	-35%	$104,119	$125,345	20%	$7,496,575	$5,013,801	-33%	$7,190,831	-30%
PINEHURST	74	35	-53%	62	-44%	$253,908	$211,705	-17%	$18,789,226	$7,409,700	-61%	$14,781,331	-50%
TRIAD	801	565	-29%	780	-28%	$166,116	$151,148	-9%	$133,058,777	$85,398,472	-36%	$127,447,652	-33%
TRIANGLE**	1,553	879	-43%	1,089	-19%	$233,236	$224,831	-4%	$362,215,492	$197,626,784	-45%	$257,971,157	-23%
WASHINGTON/ BEAUFORT	13	13	0%	15	-13%	$269,877	$113,640	-58%	$3,508,400	$1,477,325	-58%	$1,888,693	-22%
WILMINGTON***	294	187	-36%	293	-36%	$283,324	$229,940	-19%	$83,297,391	$42,998,787	-48%	$70,589,624	-39%
WILKES*	26	16	-38%	20	-20%	$141,369	$156,034	10%	$3,675,600	$2,496,550	-32%	$2,366,428	
TOTALS	6,363	4,044	-36%	5,120	-21%	$213,238	$192,537	-10%	$1,356,836,197	$778,619,459	-43%	$1,028,766,127	-24%

*Wilkes County has been added to the MLS Statistics report
**Triangle data includes new homes

A-2: Home Sales Data Source – PDF File



Microsoft Excel - retail sales_3-09.xls

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B68

MONTHLY REPORT OF STATE SALES AND USE TAX GROSS COLLECTIONS AND TAXABLE SALES

Data are compiled from reports and remittances made by taxpayers, and are classified according to sales and use tax registration numbers. Detail data from this report may not be directly comparable to that in reports for other months because of corrections in registration numbers affecting collections and taxable sales within the business, county, and city classifications, and changes in the sales and use tax law. **NO** county sales and use taxes are included in this report.

TABLE 1. STATE SALES AND USE TAX: GROSS COLLECTIONS AND TAXABLE SALES BY COUNTIES

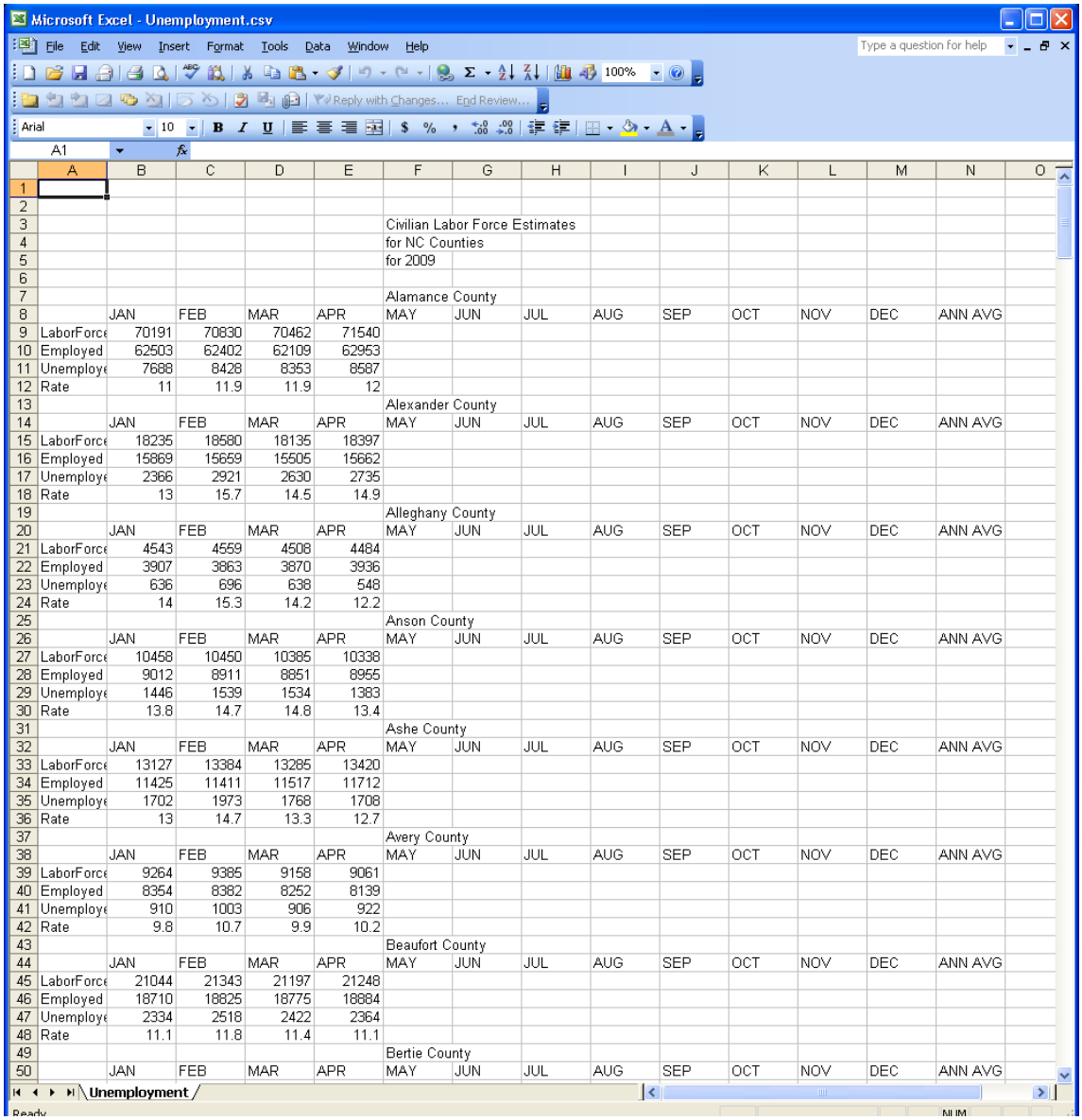
March 2009 Report

County	Gross Collections*	Taxable Sales♣	County	Gross Collections*	Taxable Sales♣
Alamance	$ 5,310,197	$ 117,875,264	Macon	$ 1,020,734	$ 22,636,339
Alexander	372,010	8,239,354	Madison	170,858	3,711,835
Alleghany	176,042	3,885,376	Martin	718,097	15,941,518
Anson	393,719	8,750,122	McDowell	779,876	17,283,302
Ashe	443,263	9,822,987	Mecklenburg	40,662,409	900,525,781
Avery	522,124	11,528,845	Mitchell	352,599	7,829,107
Beaufort	1,264,948	28,201,973	Montgomery	358,373	7,963,264
Bertie	135,150	3,022,840	Moore	2,280,433	50,604,439
Bladen	433,494	9,651,751	Nash	2,301,971	50,660,806
Brunswick	2,424,360	53,337,499	New Hanover	7,872,147	174,486,198
Buncombe	8,691,541	191,927,993	Northampton	121,281	2,712,281
Burke	1,450,571	32,188,163	Onslow	4,498,877	99,707,089
Cabarrus	5,830,324	128,761,834	Orange	2,919,673	64,525,132
Caldwell	1,511,931	33,543,647	Pamlico	239,227	5,378,487
Camden	168,460	3,859,726	Pasquotank	1,255,256	27,705,828
Carteret	2,055,733	45,620,891	Pender	589,330	13,136,914
Caswell	115,242	2,502,972	Perquimans	134,226	2,996,462
Catawba	5,420,455	120,278,983	Person	883,893	19,476,004
Chatham	904,149	19,988,103	Pitt	4,653,053	103,167,792
Cherokee	732,080	16,260,815	Polk	209,300	4,595,620
Chowan	232,390	5,162,483	Randolph	2,581,819	56,815,431
Clay	128,625	2,846,639	Richmond	938,124	20,874,740
Cleveland	2,277,536	50,417,400	Robeson	2,534,071	56,115,811
Columbus	1,089,425	24,154,969	Rockingham	1,722,104	38,166,637
Craven	2,621,930	58,051,989	Rowan	2,394,188	53,201,167
Cumberland	10,471,843	232,499,903	Rutherford	1,236,729	27,472,291
Currituck	424,301	9,327,851	Sampson	993,855	21,948,811
Dare	1,465,947	32,450,473	Scotland	860,900	19,333,595
Davidson	3,540,429	78,346,033	Stanly	1,415,108	31,460,395
Davie	677,361	14,995,411	Stokes	434,893	9,604,647
Duplin	890,219	19,864,557	Surry	2,283,755	50,551,342
Durham	12,370,780	274,051,045	Swain	150,284	3,317,855
Edgecombe	986,705	21,863,550	Transylvania	600,546	13,330,437
Forsyth	12,636,454	279,649,851	Tyrrell	40,743	939,658
Franklin	845,550	18,832,749	Union	4,023,620	88,969,974
Gaston	4,749,526	104,999,568	Vance	1,159,839	25,725,544
Gates	55,726	1,233,414	Wake	33,287,346	736,116,972
Graham	115,226	2,520,087	Warren	184,948	4,104,626
Granville	762,042	16,921,022	Washington	192,862	4,245,387
Greene	138,521	3,086,702	Watauga	1,747,517	38,573,833
Guilford	17,788,394	393,206,919	Wayne	3,226,367	72,011,088
Halifax	1,331,994	29,594,266	Wilkes	1,284,903	28,225,016
Harnett	1,686,004	38,836,806	Wilson	2,605,022	57,485,072
Haywood	1,450,832	32,073,439	Yadkin	612,629	13,603,626
Henderson	2,218,695	49,098,362	Yancey	274,107	6,070,122
Hertford	630,996	13,972,490	Foreign	74,719,975	1,101,042,863
Hoke	274,280	5,992,029	Utility services, cable, satellite, & liquor	77,815,840	–
Hyde	55,634	1,215,219	8% Hwy. use tax	3,521,881	–
Iredell	5,070,768	112,308,150			
Jackson	841,247	18,638,576			
Johnston	3,570,486	79,647,975			

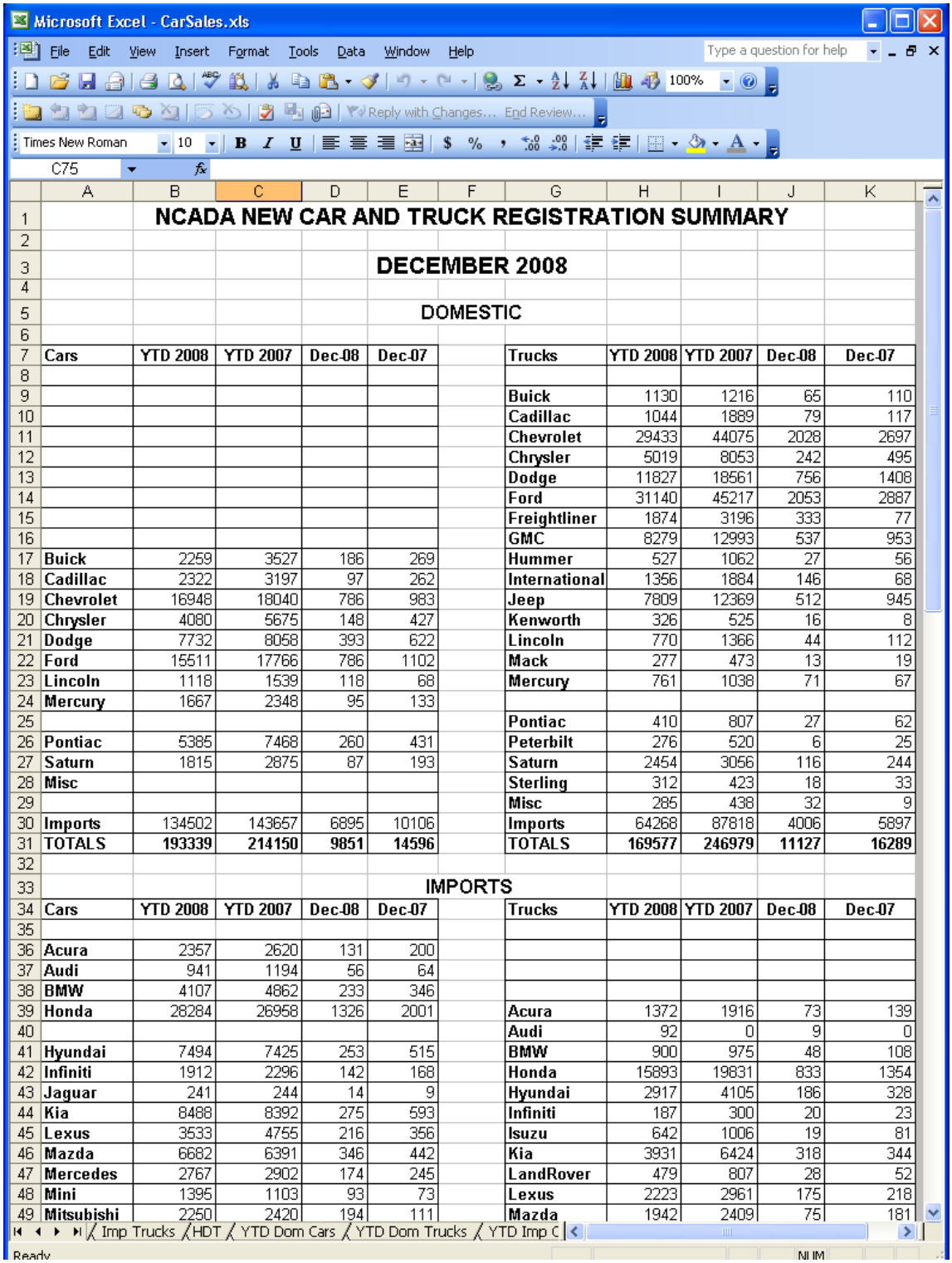
County / City / Business / Footnote /

Ready

A-3: Tax Collections Data Source – Excel File



A-4: Employment Data Source – CSV File



Microsoft Excel - CarSales.xls

File Edit View Insert Format Tools Data Window Help

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C75

NCADA NEW CAR AND TRUCK REGISTRATION SUMMARY

DECEMBER 2008

DOMESTIC

Cars	YTD 2008	YTD 2007	Dec-08	Dec-07
Buick	2259	3527	186	269
Cadillac	2322	3197	97	262
Chevrolet	16948	18040	786	983
Chrysler	4080	5675	148	427
Dodge	7732	8058	393	622
Ford	15511	17766	786	1102
Lincoln	1118	1539	118	68
Mercury	1667	2348	95	133
Pontiac	5385	7468	260	431
Saturn	1815	2875	87	193
Misc				
Imports	134502	143657	6895	10106
TOTALS	**193339**	**214150**	**9851**	**14596**

Trucks	YTD 2008	YTD 2007	Dec-08	Dec-07
Buick	1130	1216	65	110
Cadillac	1044	1889	79	117
Chevrolet	29433	44075	2028	2697
Chrysler	5019	8053	242	495
Dodge	11827	18561	756	1408
Ford	31140	45217	2053	2887
Freightliner	1874	3196	333	77
GMC	8279	12993	537	953
Hummer	527	1062	27	56
International	1356	1884	146	68
Jeep	7809	12369	512	945
Kenworth	326	525	16	8
Lincoln	770	1366	44	112
Mack	277	473	13	19
Mercury	761	1038	71	67
Pontiac	410	807	27	62
Peterbilt	276	520	6	25
Saturn	2454	3056	116	244
Sterling	312	423	18	33
Misc	285	438	32	9
Imports	64268	87818	4006	5897
TOTALS	**169577**	**246979**	**11127**	**16289**

IMPORTS

Cars	YTD 2008	YTD 2007	Dec-08	Dec-07
Acura	2357	2620	131	200
Audi	941	1194	56	64
BMW	4107	4862	233	346
Honda	28284	26958	1326	2001
Hyundai	7494	7425	253	515
Infiniti	1912	2296	142	168
Jaguar	241	244	14	9
Kia	8488	8392	275	593
Lexus	3533	4755	216	356
Mazda	6682	6391	346	442
Mercedes	2767	2902	174	245
Mini	1395	1103	93	73
Mitsubishi	2250	2420	194	111

Trucks	YTD 2008	YTD 2007	Dec-08	Dec-07
Acura	1372	1916	73	139
Audi	92	0	9	0
BMW	900	975	48	108
Honda	15893	19831	833	1354
Hyundai	2917	4105	186	328
Infiniti	187	300	20	23
Isuzu	642	1006	19	81
Kia	3931	6424	318	344
LandRover	479	807	28	52
Lexus	2223	2961	175	218
Mazda	1942	2409	75	181

Imp Trucks / HDT / YTD Dom Cars / YTD Dom Trucks / YTD Imp C

Ready NUM

A-5: Vehicle Sales Data Source - Excel

Appendix B: User Stories

B-1 - Automated Data Entry

1) User wants to upload a file containing retail sales Data
2) User wants to upload a file containing employment Data
3) User wants to upload a file containing home sales Data
4) User wants to upload a file containing vehicle sales Data
5) User wants to upload a file containing airport Data
6) User wants to upload a file containing port Data
7) User wants to have retail sales data parsed from uploaded file
8) User wants to have employment data parsed from uploaded file
9) User wants to have home sales data parsed from uploaded file
10) User wants to have vehicle sales data parsed from uploaded file
11) User wants to have airport data parsed from uploaded file
12) User wants to have port data parsed from uploaded file
13) User wants to insert parsed retail sales data into the database
14) User wants to insert parsed employment data into the database
15) User wants to insert parsed home sales data into the database
16) User wants to insert parsed vehicle sales data into the database
17) User wants to insert parsed airport data into the database
18) User wants to insert parsed port data into the database
19) User wants to upload a file containing retail sales seasonally adjusted data
20) User wants to upload a file containing employment seasonally adjusted data
21) User wants to upload a file containing home sales seasonally adjusted data
22) User wants to upload a file containing vehicle sales seasonally adjusted data
23) User wants to upload a file containing airport seasonally adjusted data
24) User wants to upload a file containing port seasonally adjusted data
25) User wants to have retail sales seasonally adjusted data parsed from uploaded file
26) User wants to have employment seasonally adjusted data parsed from uploaded file
27) User wants to have home sales seasonally adjusted data parsed from uploaded file
28) User wants to have vehicle sales seasonally adjusted data parsed from uploaded file
29) User wants to have airport seasonally adjusted data parsed from uploaded file
30) User wants to have port seasonally adjusted data parsed from uploaded file
31) User wants to have insert parsed retail sales seasonally adjusted data into the database
32) User wants to have insert parsed employment seasonally adjusted data into the database
33) User wants to have insert parsed home sales seasonally adjusted data into the database
34) User wants to have insert parsed vehicle sales seasonally adjusted data into the database

35) User wants to have insert parsed airport seasonally adjusted data into the database
36) User wants to have insert parsed port seasonally adjusted data into the database

B-2 County Map Development

1) User wants to see port data
2) User wants to see airport data
3) User wants to see county data
4) User wants to select a piedmont/coastal county
5) User wants to select a mountains/piedmont county
6) User want to select airport data for a specific airport
7) User wants to select port data for a specific port
8) User wants to select passengers on for a specific airport
9) User wants to select passengers off for a specific airport
10) User wants to select cargo off for a specific airport
11) User wants to select cargo on for a specific airport
12) User wants to select port tonnage for a specific port
13) User want to select a year range for port data
14) User want to select a year range for airport data
15) User want to select a year range for county data
16) User wants to see a graph of selected data
17) User wants to start over
18) User wants to select construction permit data for a specific county
19) User wants to select retail sales data for a specific county
20) User wants to select unemployment data for a specific county
21) User wants to select vehicle sales data for a specific county

B-3 Administrative Additional Features

1) Admin wants to adjust the data display to rolling year
2) Admin wants to adjust the data display to quarter average
3) Admin wants to adjust the data display to month average
4) Admin wants to track viewing of specific data items
5) Admin wants to create a report of tracked data items
6) Admin wants to add data category to county data
7) Admin wants to add data category to airport data
8) Admin wants to add data category to port data

Appendix C - Iteration Plans

C-1 Automated Data Entry

I. Parse and Insert Employment Data
    a. User Stories: 2,8,14
II. Parse and Insert Retail Sales Data
    a. User Stories: 1,7,13
III. Parse and Insert Vehicle Sales Data
    a. User Stories: 4,10,16
IV. Parse and Insert Home Sales Data
    a. User Stories: 3,9,15
V. Parse and Insert Airport Data
    a. User Stories: 5,11,17
VI. Parse and Insert Port Data
    a. User Stories: 6,12,18
VII. Parse and Insert Employment Seasonally Adjusted Data
    a. User Stories: 20,26,32
VIII. Parse and Insert Retail Sales Seasonally Adjusted Data
    a. User Stories: 19,25,31
IX. Parse and Insert Vehicle Sales Seasonally Adjusted Data
    a. User Stories: 22,28,34
X. Parse and Insert Home Sales Seasonally Adjusted Data
    a. User Stories: 21,27,33
XI. Parse and Insert Airport Seasonally Adjusted Data
    a. User Stories: 23,29,35
XII. Parse and Insert Port Seasonally Adjusted Data
    a. User Stories: 24,30,36

C-2 County Map Development

I. Develop Paging Select System
    a. User Stories: 4,5,6,7
II. Year Selection
    a. User Stories: 13,14,15
III. Airport Data Selection
    a. User Stories: 2,8,9,10,11
IV. Port Data Selection
    a. User Stories: 1,12
V. County Data Selection
    a. User Stories: 3,18,19,20,21
VI. Graph Display of Data
    a. User Stories: 16,17

C-3 Administrative Additional Features

I. Advanced Graph Display Adjustments
    a. User Stories: 1,2,3
II. Tracking and Reporting
    a. User Stories: 4,5
III. Advanced Data Category Creation
    a. User Stories: 6,7,8

Appendix D – Automated Data Entry Screenshots

Data Entry

Economic -> Unemployment Rates -> Employment -> 2009

Employment Data

County	Month	LaborForce	Employed	Unemployed	Rate
Alamance	JAN	70191	62503	7688	11
Alamance	FEB	70830	62402	8428	11.9
Alamance	MAR	70462	62109	8353	11.9
Alamance	APR	71540	62953	8587	12
Alamance	MAY	0	0	0	0
Alamance	JUN	0	0	0	0
Alamance	JUL	0	0	0	0
Alamance	AUG	0	0	0	0
Alamance	SEP	0	0	0	0
Alamance	OCT	0	0	0	0
Alamance	NOV	0	0	0	0
Alamance	DEC	0	0	0	0
Alamance	ANN AVG	0	0	0	0
Alexander	JAN	18235	15869	2366	13
Alexander	FEB	18580	15659	2921	15.7
Alexander	MAR	18135	15505	2630	14.5

D-1: Parsed unemployment data display after file has been uploaded and parsed.

Data Entry

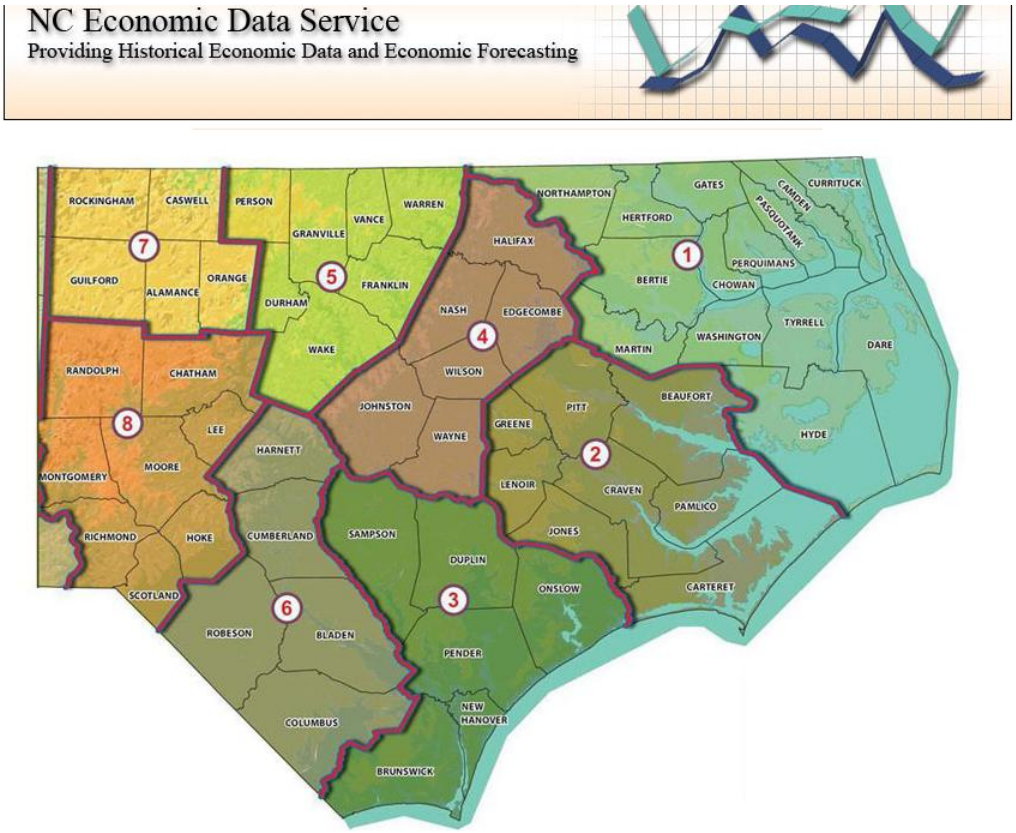
Economic -> Airport Traffic -> Passengers On-> Seasonally Adjusted Data

Seasonally Adjusted Airport Traffic Data

Year	Month	BOARD	DEBOARD	CL	CUL
1999	JAN	16119	15934	174645	216147
1999	FEB	16296	16031	183866	232778
1999	MAR	20697	20807	188976	250961
1999	APR	22489	22787	197026	254965
1999	MAY	22484	22036	189323	240961
1999	JUN	24065	23573	157892	231465
1999	JUL	26618	26449	133991	237832
1999	AUG	25254	24098	116545	221622
1999	SEP	19503	19071	138432	284756
1999	OCT	24256	24046	156359	240905
1999	NOV	22771	22946	130032	217258
1999	DEC	21386	21354	143271	256469
2000	JAN	16479	16355	146121	196815
2000	FEB	17894	17262	186762	247121
2000	MAR	21546	22010	191555	274920
2000	APR	23801	23544	166076	225400

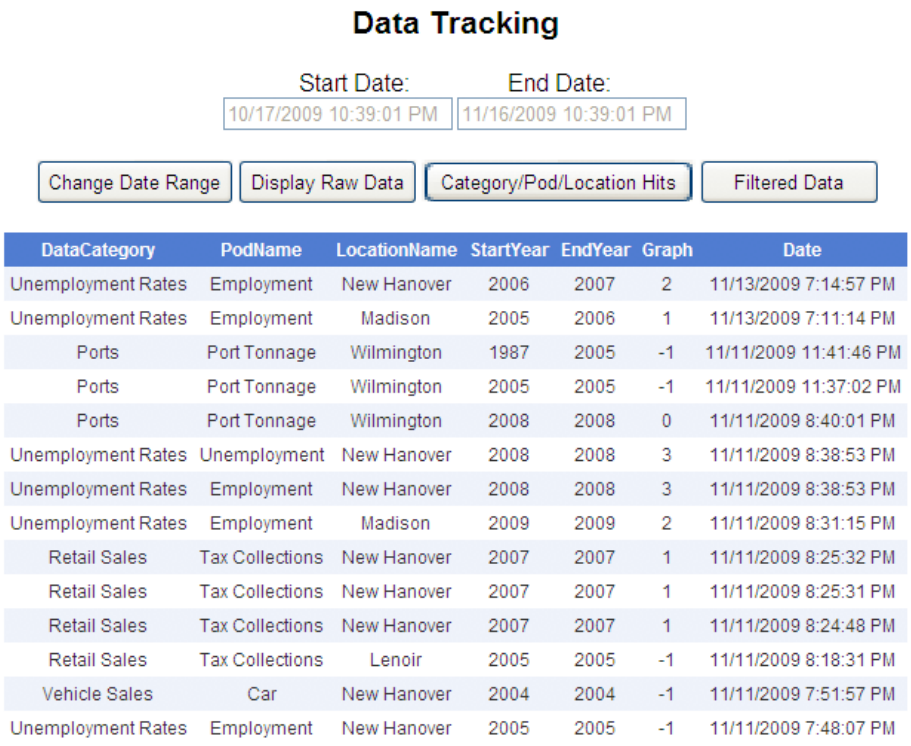
D-2: Parsed seasonally adjusted airport data display after file has been uploaded and parsed.

Appendix E– County Map Development Screenshots



E-1: Coastal county image map breakdown.

Appendix F – Data Tracking Screenshots



Data Tracking

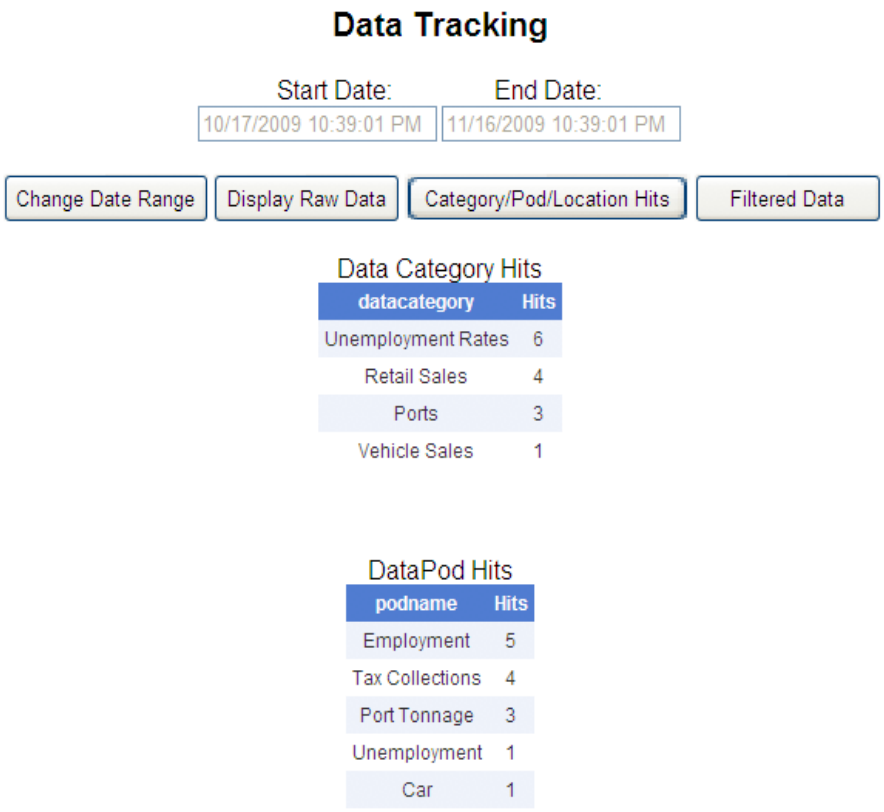
Start Date: 10/17/2009 10:39:01 PM

End Date: 11/16/2009 10:39:01 PM

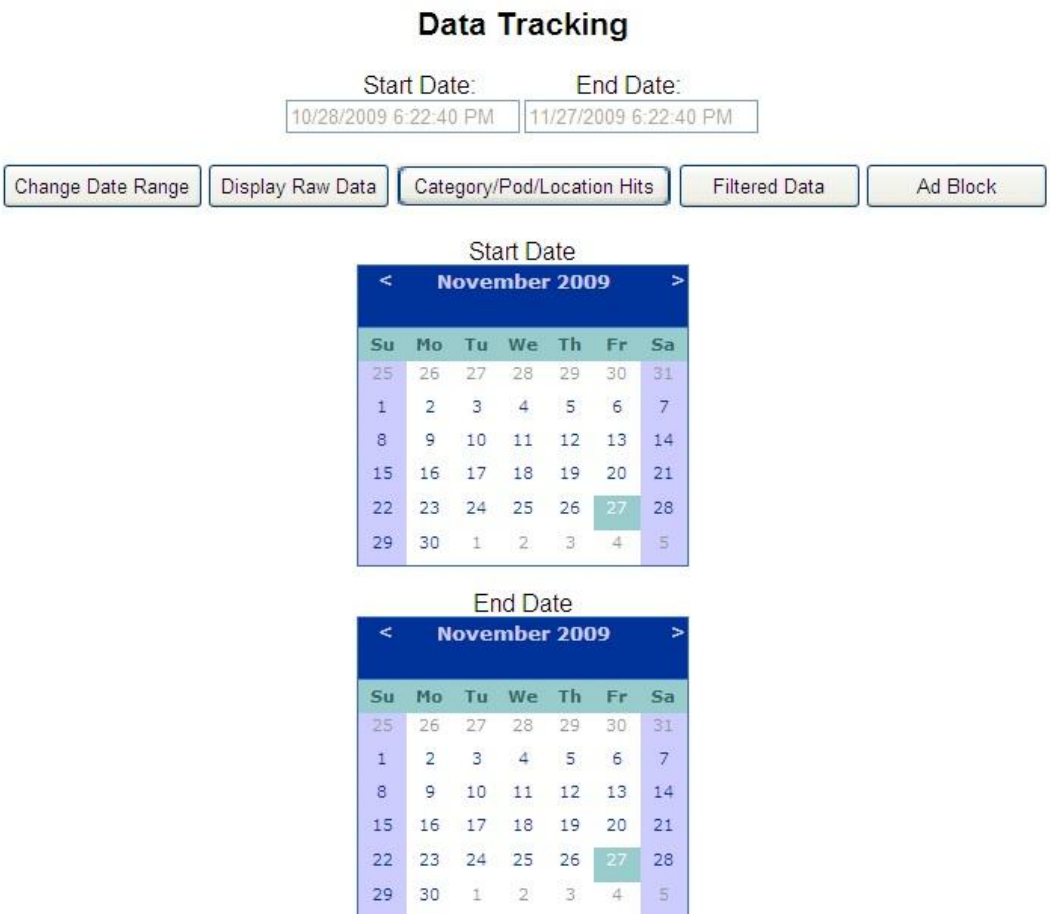
Change Date Range | Display Raw Data | Category/Pod/Location Hits | Filtered Data

DataCategory	PodName	LocationName	StartYear	EndYear	Graph	Date
Unemployment Rates	Employment	New Hanover	2006	2007	2	11/13/2009 7:14:57 PM
Unemployment Rates	Employment	Madison	2005	2006	1	11/13/2009 7:11:14 PM
Ports	Port Tonnage	Wilmington	1987	2005	-1	11/11/2009 11:41:46 PM
Ports	Port Tonnage	Wilmington	2005	2005	-1	11/11/2009 11:37:02 PM
Ports	Port Tonnage	Wilmington	2008	2008	0	11/11/2009 8:40:01 PM
Unemployment Rates	Unemployment	New Hanover	2008	2008	3	11/11/2009 8:38:53 PM
Unemployment Rates	Employment	New Hanover	2008	2008	3	11/11/2009 8:38:53 PM
Unemployment Rates	Employment	Madison	2009	2009	2	11/11/2009 8:31:15 PM
Retail Sales	Tax Collections	New Hanover	2007	2007	1	11/11/2009 8:25:32 PM
Retail Sales	Tax Collections	New Hanover	2007	2007	1	11/11/2009 8:25:31 PM
Retail Sales	Tax Collections	New Hanover	2007	2007	1	11/11/2009 8:24:48 PM
Retail Sales	Tax Collections	Lenoir	2005	2005	-1	11/11/2009 8:18:31 PM
Vehicle Sales	Car	New Hanover	2004	2004	-1	11/11/2009 7:51:57 PM
Unemployment Rates	Employment	New Hanover	2005	2005	-1	11/11/2009 7:48:07 PM

F-1: Tracked Raw Data Display.



F-2: Tracked Hits Data Display.



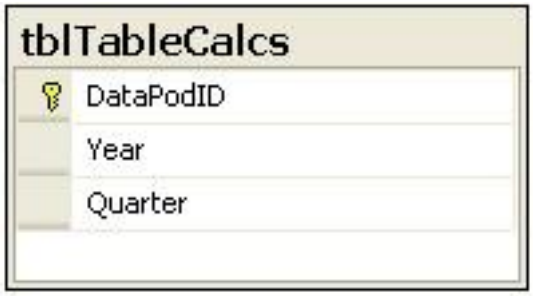
F-3: Tracked Data Date Range Selection Screen

Appendix G – Customer Suggestions

G-1: Customer Suggestion/Comment Page.

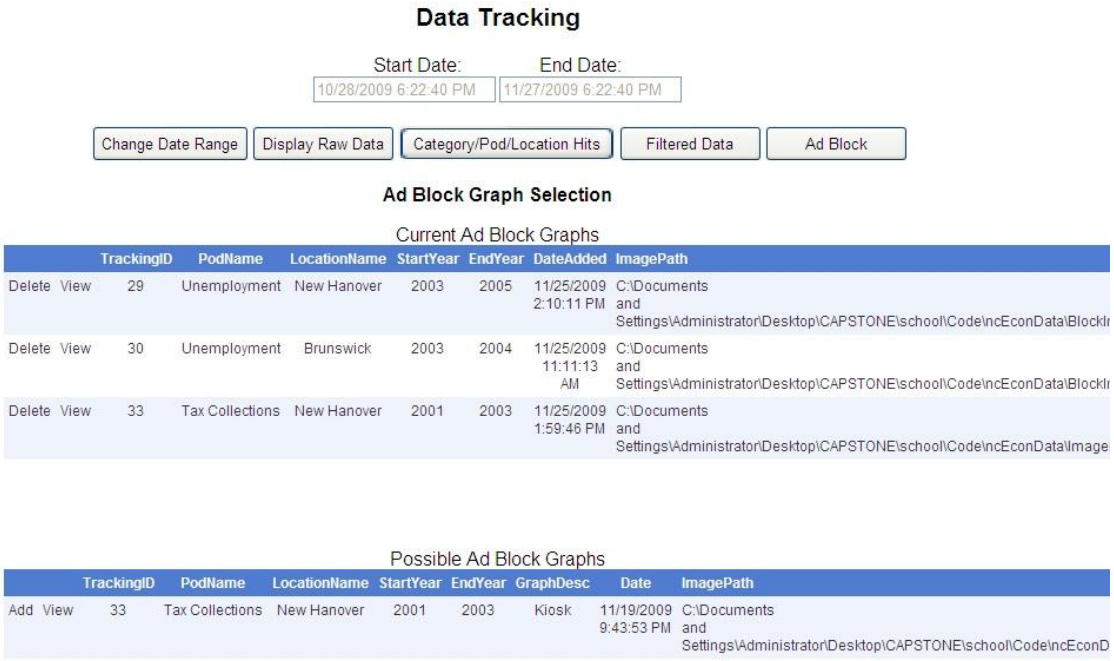
Appendix H – Additional Database Tables

H-1: Ad Block Database Table.



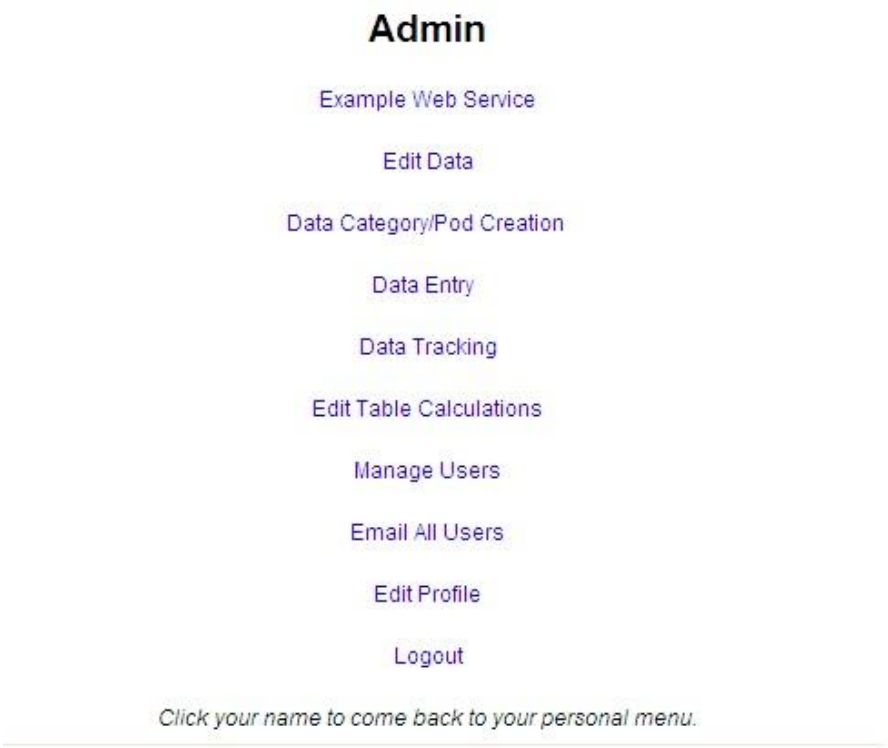
H-2: Table Calculations Database Table.

Appendix I – Ad Block Settings Screen



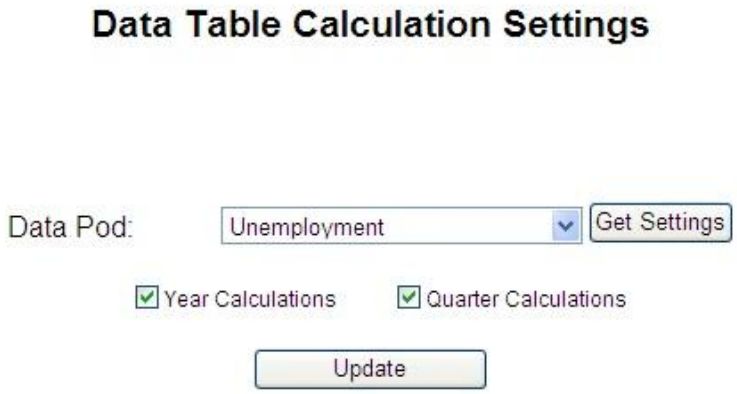
I-1: Ad Block Settings Screen.

Appendix J – New Admin Menu



J-1: New Admin Menu.

Appendix K – Table Calculation Settings



K-1: Table Calculation Settings