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Iteration III - Elaboration: Requirements Modeling and Analysis

**Innovation Class Part:**
- A lively, engaging description of the project, and how and why it will add value
  - This census database web application will provide users with a new perspective of the data collected. This web application will present the data in a comprehensible fashion to avoid confusion among the users. Much of the data presented to the public today is very crowded and confusing. We will create a way to easily view and understand the data through this web application. If the census database web application is simple and comprehensible then it is likely that municipalities will be able to make more appropriate and effective decisions based on the data collected.
- A discussion of social, economic and real-world issues that must be addressed for the project to deliver value, and how the team will do this
  - In order for this census database web application to produce value, it must be easier to understand than the census data available currently.
  - A social issue that may arise is despite the data being presented appropriately and clearly in the census database web application, municipalities may not want to change information sources. While we may have clear data, municipalities may question the effectiveness of the capability of the data visualization as we are delivering a new web application and do not have an existing consumer base. The team will address this potential social issue by ensuring the difference between our data visualization and the current method of data visualization is significant and has the potential to increase the appropriateness of legislative decisions.
  - An economic challenge that may arise could include the cost of server hosting. As of right now it is free because we are using TCNJ server hosting but if the web app exceeded the TCNJ server hosting capabilities then the cost of server hosting could potentially be more than municipalities have budgeted for. The issue arises if municipalities have to pay for the server hosting of this web app that has the potential to help them better understand which decisions will be most effective and the web app costs exceeds the value it has to municipalities. However, if the value the web app delivers exceeds the opportunity cost of the municipality then

the web app will thrive. The team will address this potential issue by testing the visualization web app with smaller groups of random people. The test will include a conceptual problem that could present itself in daily life and each person must use different quantitative factors presented in the web app to make a decision. A different group of random people will be presented the same problem but instead of using the web app we created, they will use the current method of decision making utilized by municipalities. This will determine if the web app is effective in altering decision making or if the difference is rendered insignificant.

- A description of the feedback you have received from project stakeholders, and an explanation of why you have chosen not to follow some requests or suggestions, if applicable
    - While we are not directly planning an impact to raise the count of the Census, we will provide a data visualization that can make municipalities more effectively and efficiently address issues that were complicated before by complex data. Mr. Solomon suggested that we choose one path: data visualization or increasing the count and as a team we decided to go with the data visualization as there were many complications with raising the count directly through a web based application. For example, creating an application that encourages people to contribute time and personal information to a government that they already have compromised trust in is no small feat. Additionally, much of the work that would need to be done to encourage people to use the application and introduce it to them would have to involve direct contact with people. Human to human contact is the best channel for trust which is ultimately what we believe will increase the count. This method is not exactly simple at this time due to the coronavirus pandemic.
- Analysis of any ethical or legal concerns posed by the implementation or use of the system
    - Ethical concerns that have been given much thought include the possibility of this data visualization app to be used in a discriminatory manner. There is always an ethical concern when any demographic information is considered in legislative decision making. For example, if anything more specific than sheer numbers are used to redistrict it poses a legal and ethical problem. Not only is gerrymandering illegal, but it also presents an ethical dilemma to provide the information that makes manipulation of the data possible. The team has put privacy measures in place to make sure users cannot manipulate the data directly so to avoid any illegal and ethical dilemma for the user or the creators/designers.

Software Engineering Class Part:
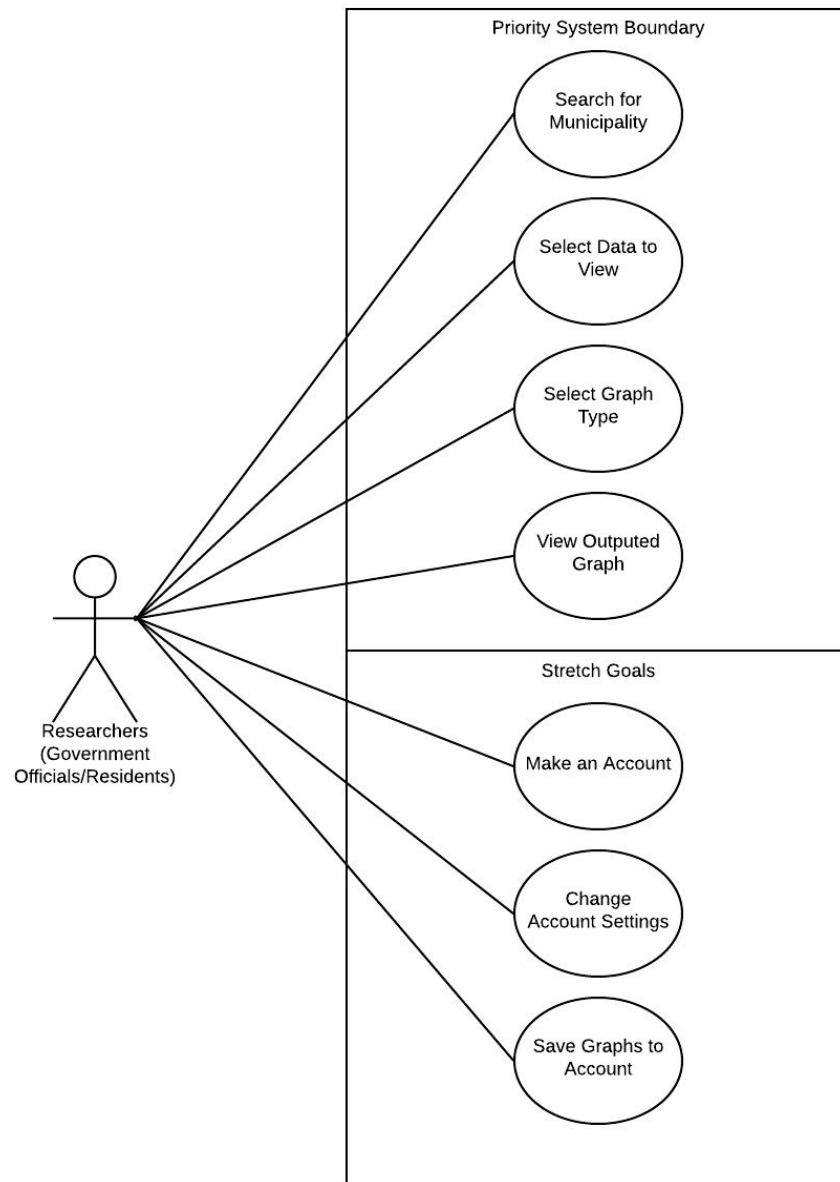
Figure 1. Use Case Diagram
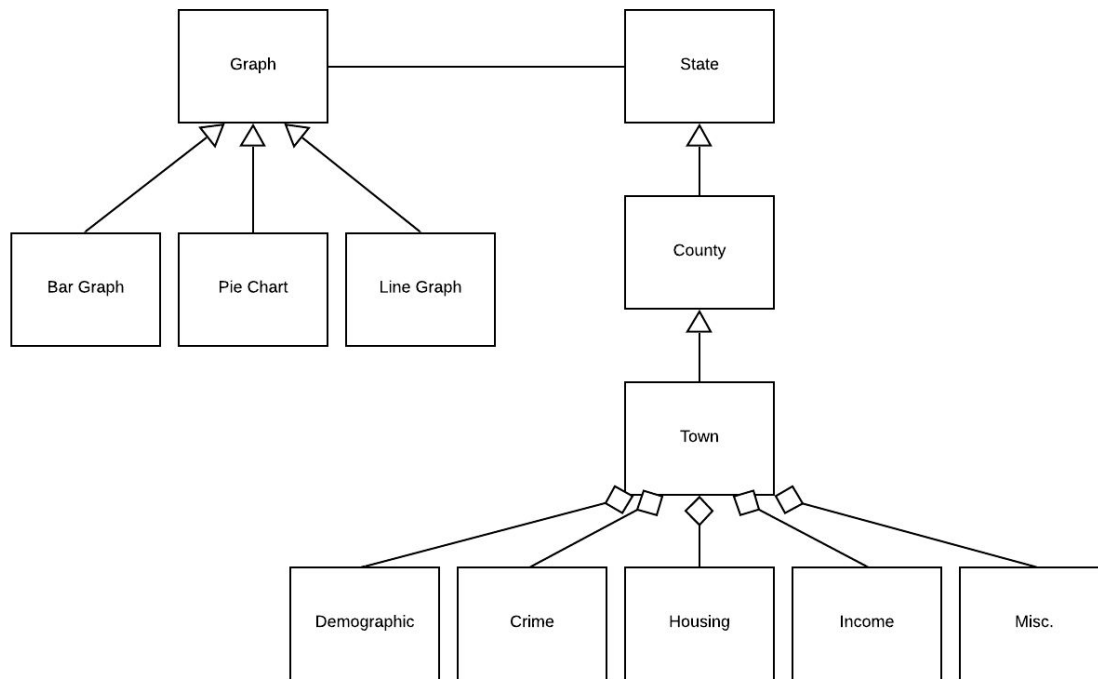
Figure 2. Class Analysis Diagram

Security and Privacy Concerns:
All users must be authenticated when trying to access the website. In addition, users will not be able to manipulate the census data itself. The only thing users will be able to manipulate is how the data is viewed in terms of data visualization. In addition, when developing this system, we will be utilizing information hiding in order to prevent others from manipulating or changing the code. In terms of privacy, there will be sets of data that will be saved onto each user profile. These datasets will only be visible to each individual profile. Since the Census data is available for anyone on the internet, the data stored in Postgresql Database does not need to be encrypted.

Data Backup and Recovery:
In our project, we will have two kinds of data banks. The first data bank will be the census data bank and the other data bank with being the user's data bank. We will also need to backup our code too.

For the census data bank:
- We will have the census data be written to a backup location before every time the census data updates with the most up-to-date data. Upon an update, the data will be verified to ensure it has not corrupted. If it is found to have corrupted it will use the backup version

of the data instead and send a message to the console to let the developers know something went wrong so they can further look into the system with minimal downtime.

For the user data:
-   The system will create a backup of the user database every hour of operation. If at any point data is corrupted or lost, the system will make a copy of the backup version and use that as the main database instead.
-   The downside of this method is that the users may lose some of their data, but they will not lose all of their data.

Implementation of this:
-   For both of these, we can use PostgreSQL to automate these backups through a Cron Task. The Cron Task can be edited to change the frequency and time a backup can occur as well.
-   Implementation Reference: https://www.linode.com/docs/databases/postgresql/how-to-back-up-your-postgresql-database/

Code Backup:
-   We will be using github to backup our code and push all our commits on github. That way our code will be saved online digitally through a cloud.

Use Case Descriptions:

Table 1. Detailed Use Case Descriptions

Use Case: Search For Municipalities
Primary Actor: Researchers
The goal in Context: The researchers will be able to search through a list of municipalities and select the town they wish to view the data on.
Preconditions: The researcher knows what town they want to look up data on.
Trigger: The researcher is curious about a certain town's census data and wants to find out more about the town.
Scenario:
1. Users will immediately see a search bar upon visiting the web application.
2. Users will type in the name of the municipality of the desired town they want to look up.
3. As users types in the name of the municipality, suggested town names will be populated below the search bar, similar to a google search.
4. Users will complete the search and immediately be viewed with the dashboard of the municipality's data.

Exceptions:
1. The user could have misspelled the name of the municipality they are searching for. If misspelled, the user will be brought to a window that has a list of suggested municipalities based on search result.
2. The user could not find the municipality they were looking for. The user will be brought to a page stating that their search does not exist.

Open Issues:
1. Creating a list of suggested municipalities based on misspelled municipalities could be difficult to implement.
2. Creating a list of suggested municipalities as the user is typing into the search bar could also be tough to implement.

Use Case: Select Data to View
Primary Actor: Researchers
The goal in Context: The researcher will be able to select the type of data from a particular municipality they want to view.
Preconditions: The researcher has successfully been brought to the dashboard of the municipality they want to conduct analyses on and knows what kind of data they want to learn about.

Trigger: The researcher is brought to the municipality dashboard and is ready to select the dataset they want.

Scenario:
1. Users will be brought to the dashboard to select what dataset they want to learn about.
2. Users will select the dataset they want to analyze.

Exceptions:
1. Users cannot find the dataset they want to analyze for the particular municipality they are looking up. This could happen simply due to the fact that the information may not have been collected by the census. Maybe prompt the user a request form that will allow the user to request the type of data they are searching for the next census. This request form will be sent directly to the census.

Open Issues:
1. What kind of data should be populated in the database?
2. What data is most meaningful to government officials and what data is meaningful to residents of municipalities?

Use Case: Select Graph Type

Primary Actor: Researchers

The goal in Context: The researcher will be able to customize a graph that will use the census data points that they want to view.

Preconditions: The researcher has selected data from the Census Database and what range of years they want to look at.

Trigger: The researcher has finished selecting what data he wants to view and is ready to select the graph they want.

Scenario:
1. User will be brought to a page to select which kind of graph they want to use
2. User will select either a line graph, bar graph, or pie chart
3. One of the follow cases happen based on their selection:
    a. If line graph is selected, it will create a graph that shows the trend of the selected census data type over time with multiple municipalities on the plot. This will create a group of graphs where each graph corresponds with a selected data type that the user wants to view.
    b. If bar graph is selected, it will create a graph that shows the values of the selected census data type over time with multiple municipalities on the plot. Each municipality's bar will be side-by-side one another and located at their respective year. This will create a group of graphs where each graph corresponds with a selected data type that the user wants to view.
    c. If a circle graph is selected, it will create a graph that shows the percentage of the selected data type compared to other municipalities. This will create a group

of graphs where each graph corresponds with a selected data type that the user wants to view. The user will have to select a specific year they would want to view as well.

4. The user will then submit their selections

Exceptions:

1. The user made a mistake in their data selection. The user will be able to go back to the select data page and pick which data types and data range they would prefer to use instead.
2. The user made the graphs, but they want to edit their graphs. The user will have their current settings saved from their current session to the website and be able to adjust the data points they want to use and what kind of graph they want to see.

Open Issues:

1. We should review all other kinds of ways these graphs could be formatted and see if there is a feasible way to implement them that allows the application to stay simple and easy to use. For example, the pie chart can be made to only view one municipality but show a comparison of multiple kinds of census data versing each other. But if something like this was implemented, could it take away from the simplicity of the application if too many features/options were to be added.

Use Case: View Output Graph

Primary Actor: Researchers

The goal in Context: The researchers will be able to visual the census data based on the graph and data parameters they set

Preconditions: The researcher has selected the data and selected their graph type

Trigger: The researcher has clicked the submit button on the graph selection page

Scenario:

1. The view sends a request to the controller and gives all the data and graph parameters the user has given
2. The controller will request all the data it needs from the model
3. The controller will use the data and make the graphs based on the configurations
4. The controller will send the graphs to the view
5. The view will open a page that displays all the graphs that were requested

Exceptions:

1. The data from the model is missing or corrupted. The controller will request the model to use a copy of the backup file and proceed as normal with the data extraction

Open Issues:

1. Giving the users a way to save their graphs and format it onto their dashboard
2. Figure out a method of displaying the graphs for any kind of graph request that the user makes while maintaining a pleasurable UI design

Use Case: Make An Account
Primary Actor: Researchers
The goal in Context: The researcher can make an account where they can save customized data.
Preconditions: The researcher is interested in saving data they have searched for and want an account to store it on.
Trigger: The researcher has selected a button on the homepage to create a new account.
Scenario:
1. User is on main page of website and is interested in making an account
2. Clicks on "Make a new account" button on the webpage
3. Fills out all correct information
4. Submits information and gets notification that an account was made successfully

Exceptions:
1. User enters in username already being used: Message will come up that prompts them the username is already in use and they need to choose a new one

Open Issues:
1. Should there be a certain length or certain types of characters that a user can use for their password?

Use Case: Change Account Settings
Primary Actor: Researchers
The goal in Context: The researcher can change their account settings to include customized features, such as what municipalities they would like to see data on.
Preconditions: The researcher is logged into their account and interested in changing any settings they currently have their account set to.
Trigger: The researcher clicks on the button on the homepage that will take them to the customizable account settings.
Scenario:
1. User is logged in and wants to make changes to their account
2. Clicks on the "Account Settings" button on the main page of the website
3. Makes any changes they would like to occur
4. Clicks "Save" button to ensure all new account information will be saved
5. Will bring them back to the main page and have a pop-up message that states "Account changes made successfully"

Exceptions:
1. User is not able to change what they want about the account: Not every single feature they have access to will be customizable, so only the features they are able to change will be included in the account settings

Open Issues:

1. How many things about their account should a user be able to change?

Use Case: Save Graphs to Account

Primary Actor: Researchers

The goal in Context: The researcher can search for certain graphs and save them to their account so they can access them at any time.

Preconditions: The researcher is logged into their account, searched for graphs on certain municipalities, and is interested in saving some of the graphs for future use.

Trigger: The researcher clicks the button underneath the graph of their choice that will allow the graph to be saved to their account.

Scenario:

1. User is logged in and has searched for graphs they are interested in saving to be able to access at another time
2. Clicks on "Save Graph" button underneath the specific graph they would like to save
3. Pop-up message will state "Graph saved successfully"

Exceptions:

1. Incorrect graph is saved by the user: They will be able to go into their saved graphs and delete them from the list

Open Issues:

1. Where on the account should saved graphs be stored to ensure users can easily find them?
2. How can it be ensured that any saved graph can also be deleted by the user?