Team #8 - Food Access Visualization

ITSC 3155 Final Project Report

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1 Introduction

Food is an important part of human life; it is a source of joy, culture, and nourishment. Having access to food whether it be from a restaurant or a grocery store sounds like a standard for American living, but this is not always the case. Whether it be due to distance, cost, or availability, there are communities across the country that have poor food access and thus the inability to take care of their bodies. Through this project, we want to understand what areas are affected by poor food access and which populations are most affected by food insecurity across different areas in the country.

1.1 Product Vision

Web application that uses a heatmap to identify the level of food access in different areas. The heatmap would display the data for different population types, allowing users to see which areas better serve different population types in terms of food access. The user will also be able to search specific counties across the country and compare accessibility data for different categories within that county.

1.2 Customer Description

The ideal customer for the web application would be local government officials to assist in addressing areas with low food access. Going above the state level, a national analysis of the factors that heavily affect food access such as poverty and race could assist in efforts to tackle the issue for marginalized populations. If not government related, then individual food retailers could use the information to locate areas where they could develop their businesses since it would be easy to locate areas where competition is low. Volunteers working with soup kitchens or food banks can use the application to find areas where they can do the most good and have the most impact.

1.3 Project Scope and Objectives

The web application would use a heat map to show the areas with poor access to healthy food options. The option to search for specific counties to find and compare data will allow users to see how a specific county is addressing food accessibility. This data can then be used to understand the effects of food retailers on the areas that they move into or leave from.

1.4 Ethical concerns

No ethical concerns present.

2 Project Resources

2.1 Group Members

1. Eli Mills
2. Eric Phann
3. Evan Hemming
4. William Chen

2.2 Data

https://www.ers.usda.gov/data-products/food-access-research-atlas/

Data about the availability of food choices depending on location and proximity to "healthy" food choices. The major factor is proximity to a supermarket or grocery store, coupled with census data such as income and race. Factors such as access to a vehicle and number of children/eldery in the household are accounted for as well.

2.3 Hardware and Software Resources

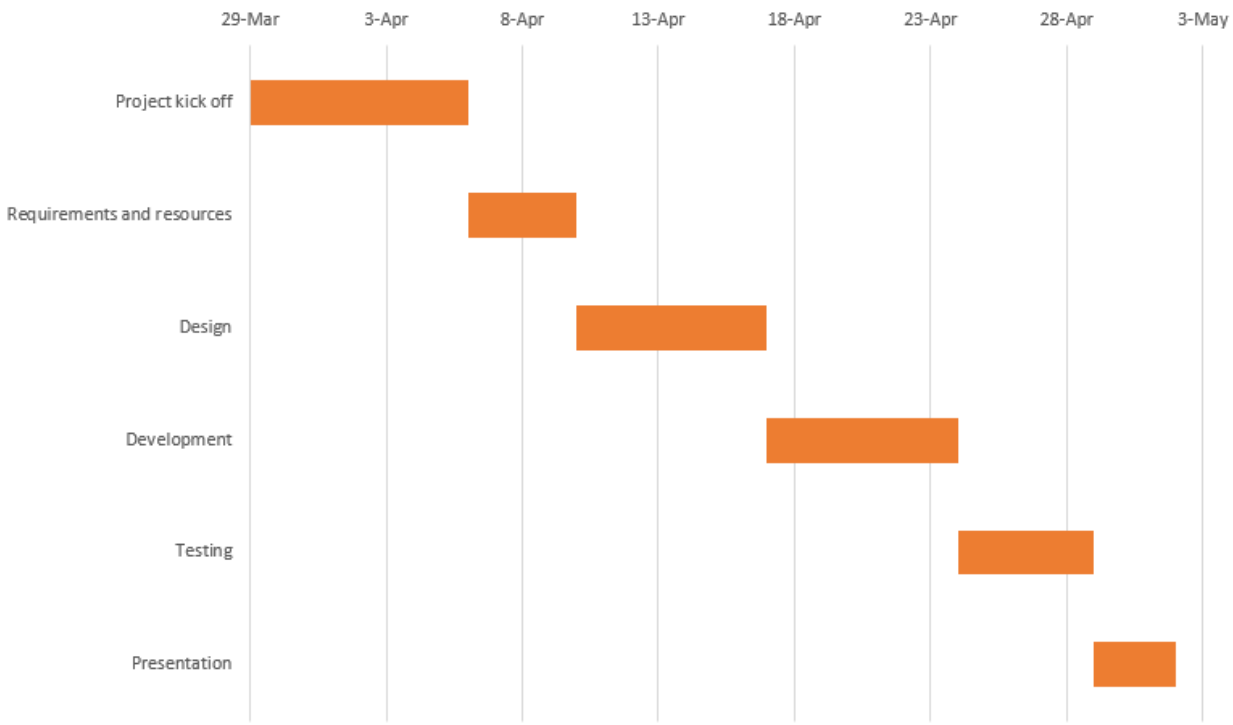
We anticipate that we will only need to use Python with additional libraries (Dash, Plotly, Pandas) to complete this project. Hardware requirements are simply a PC that can handle Python crunching our data.

2.4 Special Resources

The only special resource used was an additional set of data that matched county/state names with their FIPS (Federal Information Processing Standards) codes. We combined these codes with our initial data so we could visualize the data as a plotly.express chloropyth (heat map), which requires FIPS codes for U.S. national maps.

3 Plan

3.1 Timeline Chart



Consider the following milestones:

- Milestone 1: Project kick off 3/29-4/6
- Milestone 2: Requirements and Resources 4/6-4/10
- Milestone 3: Design 4/10-4/17
- Milestone 4: Development 4/17-4/24
- Milestone 5: Testing 4/24-4/29
- Milestone 6: Presentation 4/29-5/2

3.2 Task/Milestone Descriptions

Milestone 1 - Project kick off: Start brainstorming project ideas and collaborate with the group on expectations and communication standards. Submit final project proposal and product pitch.

Milestone 2 - Requirements and Resources: With scope of the final project in mind, come to a group understanding of product requirements and assignment requirements. From there, collect and assess any necessary resources to complete tasks and objectives for the final project.

Milestone 3 - Design: Spend the next week designing the product. This includes any diagrams, user stories, feature lists, and storyboards. The design process will serve as a blueprint for the development phase of the final project.

Milestone 4 - Development: Start working on the code using the previous milestones i.e., requirements and any design documents created.

Milestone 5 - Testing: Exchange files with Group 9 so that we can test each other's product using our respective user stories. Provide detailed feedback and implement any necessary changes and recommendations based on partner group's feedback.

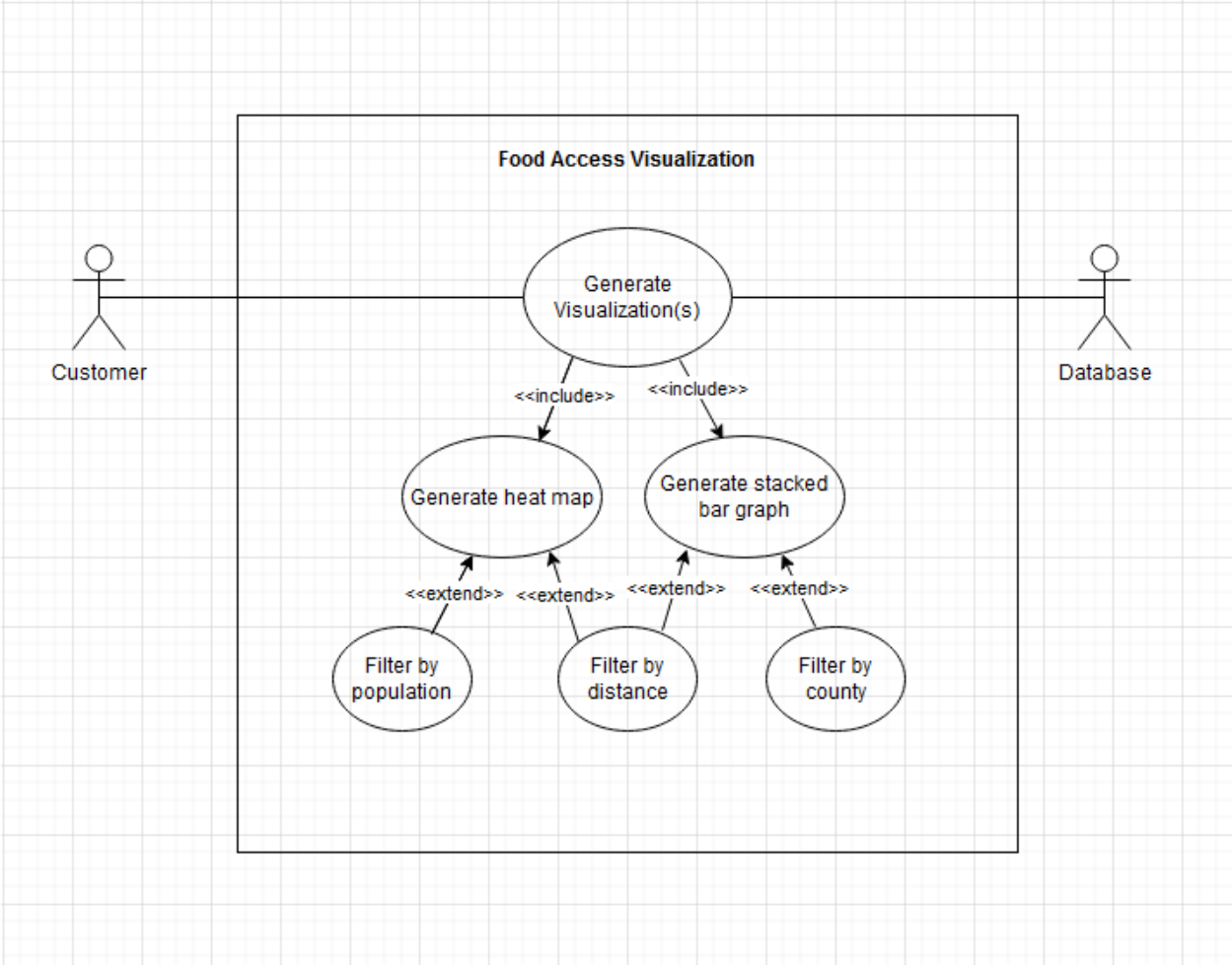
Milestone 6 - Presentation: Polish and clean up code for final submission. Work on demo, final report, presentation, and any video recordings.

3.3 Resource Table

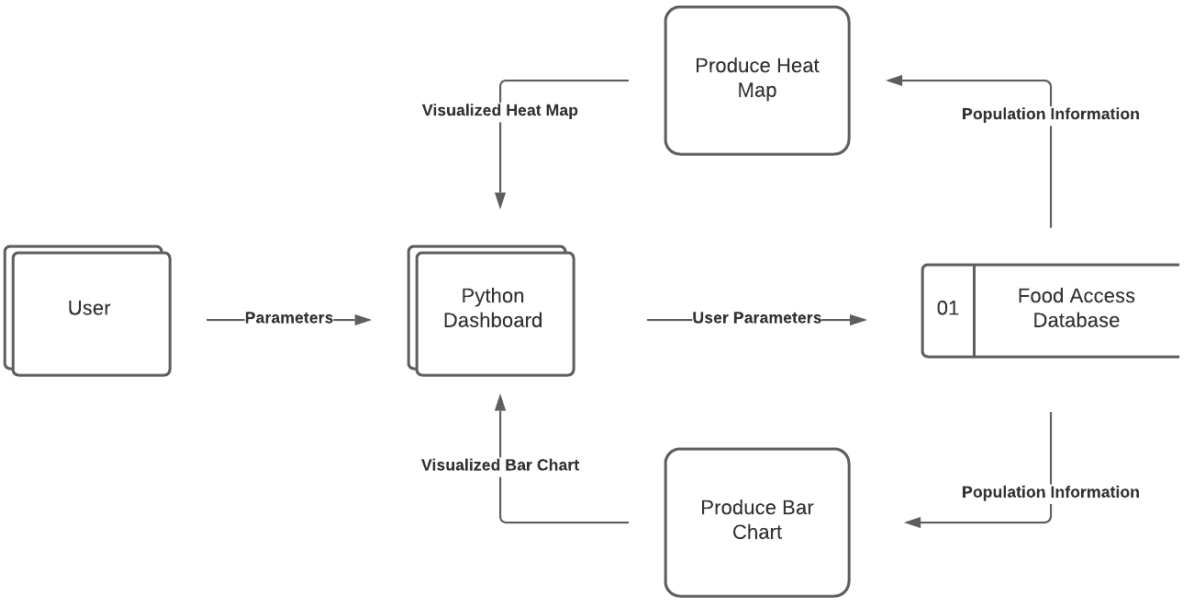
Task	**People**
Team Charter	All
Project Ideas	All
Proposal and Pitch Submission	Will
System Design (diagrams, features, etc.)	Eric, Will
Code Functionality	Eli, Evan
User Testing	Group 9
Final Report	All
Presentation and Demo	All

4 System Design

4.1 Use Case Diagram



4.2 DFD diagram



4.3 User Stories

As a government official, I need to be able to compare different areas and their food access levels.

As a government official, I need to compare food access levels based on various populations.

As a grocery store owner, I want to know which areas would be the best for my business.

As a government official, I want to be able to see the percentage of low income people in each county who are living beyond 20 miles from the nearest supermarket.

As an NC state official, I need to be able to see which counties in my state fall behind the state-wide average level of food access with varying distance ranges.

As a government official, I want to be able to visualize the relationship between low-income populations and low-food access areas.

4.4 Feature List

Heat Map featuring

- The percent of people in the given population type that live beyond the given distance from the nearest supermarket
- Data shown by a range of colors representing the maximum of the data to the minimum of the data
- Ability to swap between different population types (low-income, kids, seniors, white, black, asian, hispanic)

- Ability to swap between different distances to nearest supermarket (.5 miles, 1 mile, 10 miles, 20 miles)

Bar chart featuring

- Shows the difference in food accessibility across many population types for the given county and given distance to nearest supermarket
- Ability to search specific counties
- Ability to swap between different distances to nearest supermarket (.5 miles, 1 mile, 10 miles, 20 miles)
- Comparison to state average for each variable shown

4.5 Storyboard

5 User Tests

5.1 Test procedure

We met with our partner team (Group 9) through Discord to screen share our apps with each other, assign respective drivers, and swap user stories. Then, we had each group direct the other app's driver and take notes as they went through user stories. Afterwards, we debriefed and finished the testing session with key suggestions and conclusions for further improvements in our apps.

5.2 User Test and Results

#	User Story	Test Results
1	As a government official, I need to be able to compare different areas and their food access levels.	I am able to view the various counties across the U.S. and see the percentage of people that have access to food (from supermarkets) based on different distances. I can also compare the different counties with their respective state.
2	As a government official, I need to compare food access levels based on various populations.	I can choose to view the percent of people in various populations that live beyond a specified distance from the nearest supermarket. In the second graph I am able to view and compare all the different population types (all, low-income, kids, seniors, white, black, asian, hispanic) to see which populations have a higher or lower percentage of people who live beyond a given distance from a supermarket. At the same time, on the second graph, I can view the state average and the county average to compare the two for each population type that lives beyond the given distance from the nearest supermarket. In the same graph (and in the first graph), I can change the given distance (.5 miles, 1 miles, 10 miles, and 20 miles) to view the percentage of people for each population that live beyond the selected/ given distance.
3	As a grocery store owner, I want to know which areas would be the best for my business.	I can use the heat map and zoom in to the locations that I wish to build a grocery store and see which areas have a higher percentage of people that do not live near a supermarket at the given distances. Using this information I can build in areas that have fewer supermarkets access for the given distances. So, I can build in an area that has a large potential customer base but with less access to supermarkets. If my grocery store is targeting a specific specific population I can view the percentage of people in that specific population that live beyond the given/ chosen distance from the nearest supermarket to see where I should build a grocery store. (I should build in an area that has a large population of my targeted population type but where a high percentage of that population lives beyond the given/ chosen

		distance from the nearest supermarket (especially if those supermarkets are a direct competitor to me).
4	As a government official, I want to be able to see the percentage of low income people in each county who are living beyond 20 miles from the nearest supermarket.	Using the first graph (heat map), I can choose the population filter to be low-income and the distance from the nearest supermarket to be beyond 20 miles. I can then view the percentage of low-income people in each county that live beyond 20 miles from the nearest supermarket by hovering the mouse of each county. I can also zoom in on the heat map to get a better view of specific counties.
5	As an NC state official, I need to be able to see which counties in my state fall behind the state-wide average level of food access with varying distance ranges.	Using the second graph (county search) I can search for North Carolina, or scroll down in the drop down menu to view the various counties in North Carolina. Once I select a county the graph displays both the county and state averages for each population type that live beyond the given/ chosen distance from the nearest supermarket (I can choose different distances from the nearest supermarket to compare food access averages at different distances away from the nearest supermarket).
6	As a government official, I want to be able to visualize the relationship between low-income populations and low-food access areas.	Using the heat map, I am able to choose the low-income population and choose a distance from the nearest supermarket, and view the areas with the lowest food access (the highest percentage of people in the low-income population that live beyond the given/ chosen distance away from the nearest supermarket).

5.3 Conclusion

As the various users I was able to complete the given scenarios using this product. To better understand the product and its goal, it needs/ needed some tweaking and clarifications. For example, what the numbers on the y axis for the second graph (County Search) mean. Another tweak that could help the product be more intuitive would be to add labels (for x and y axes) and a title for each graph. Also, adding an explanation of the goal and purpose of the product could help the user understand the product better. These changes add clarity and usability which make the product easier to use and understand.

6 Lessons Learned

From a programming standpoint, there were definitely some key takeaways from this project. Firstly, it is very important to ensure that your dataset can be efficiently utilized with your visualization tools of choice before you decide on the dataset to use. In this project, we had to manipulate the format of the data a lot to work with our tools, which was unnecessary work if we had chosen a more streamlined dataset from the start. Secondly, it's important to iron out the complete details of how you want the app to look and work before coding. There were a couple features that we decided to add on relatively late, but to do so we had to make some fairly major changes to the code architecture, which was an avoidable amount of backtracking.

This project also allowed us to gain experience with key industry technologies/techniques such as version control, scrum, and flow diagrams. Although they could be challenging to learn how to use at first, it became easy to see how these tools are useful when developing a larger software project. Additionally, working with our partner group gave us the opportunity to learn how to communicate in a

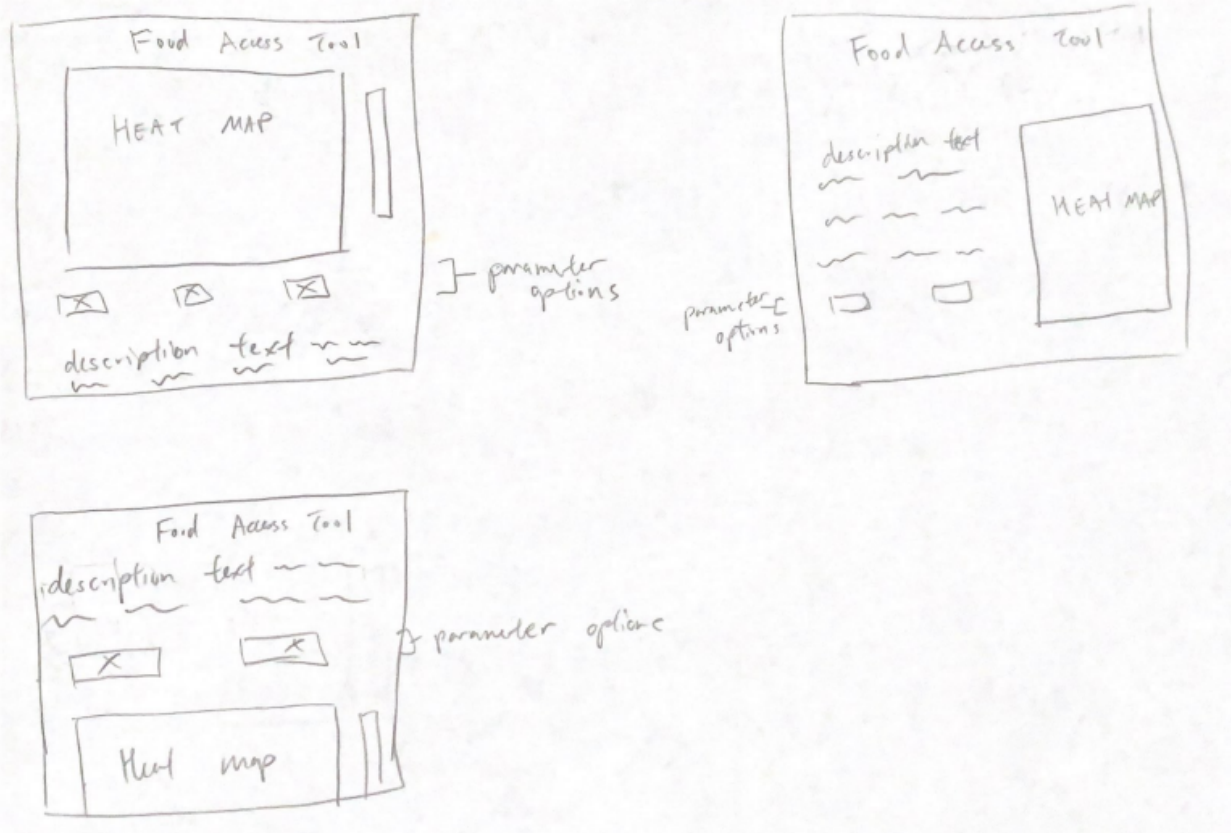
Creating a timeline and plan of action early on would decrease issues with deadlines and the stress related with them. Especially due to the difficulties related to online class work and Covid-19, scheduling has been difficult for such a team intensive project. We ran into issues with the data set and visualizations because of our uncertainty in the final product and lack of time management. Our group lacked a clearly defined project lead as we had decided early on to tackle problems as a group, but having a strict leader would have helped in the development process. Thankfully our team members were able to work well and complete the product in time.

7 Future work

- Comparison to data from other time periods
    - There is data available for 2010
    - There may be updated data from the USDA in the coming years we would want to add to the app too
- Support for other countries
    - Could use this app framework to provide visualizations of food accessibility in other countries if they have the relevant data
- Even more minute data visualization
    - The data given by the USDA provides data by "tract" of land (a tract is a more minute representation of land than a county, there can be dozens of tracts in a given county)
        - We could have a "state search" feature that provides the food accessibility heatmap for the given state geographically divided by tract

8 Appendices

8.1 Sketches



8.2 Software Repository

https://github.com/emills11/ITSC3155-group8-final-project.git

8.3 WBS tool

We primarily used Discord to communicate with each other and plan the tasks for the project. A Trello board was created later to reflect how we tackled the different parts of the project but it was not a major part of our development process.
https://trello.com/b/oesQLz2A/itsc-3155-group-8-final-project