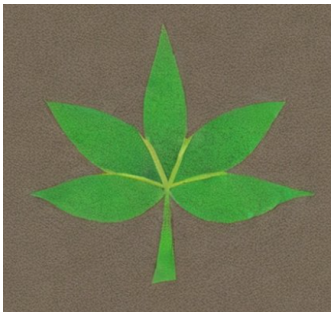

ClassiPlant Final Report

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Introduction

Our group name is called the ClassiPlant because our goal with our application is to classify plants in Pierce County, Washington through user input. At first, we used "Northwest Native Plant List Pierce County". We started off wanting to do all of the Pacific Northwest, but we quickly realized that would be hundreds of plants. We chose to narrow the scope of the project to our local Pierce County so that locals can also learn more about the native plants in the area.

When we go outside, we hardly focus on our surroundings, much less nature. The grass on the sidewalk, the trees around buildings, the flowers blooming in the spring these are all things we see but not truly perceive. When you look at a flower, do you notice all the petals, the different shapes of leaves and unique colors? When you are going outside exploring nature and touching the grass, how do you know if these plants are dangerous are not? What if you found a plant to eat, it looks like a blueberry, so you decide to eat it and it was not a blueberry? It might not be a safe plant to eat, maybe you'd like to quickly search up what kind of plant it can be, that is where our project can come in handy.

Users can identify a plant, and find out characteristics of the plant as well as the safety of the plant*. Users can also quickly see a comprehensive list of all the native plants in Pierce County, or search up information about a specific plant. Our product aims to encourage users to carefully observe nature around them by asking specific questions that require a discerning eye.

Scope of Project

Some of the scope for our project was dependent on the data we could find for the demographic we chose. We used an existing database for our plant list called, "Northwest-Native Plant List" , which was located on Pierce County's official website. This website was able to give us some good information, but we had to do quite a bit of extra research for our project to find specific characteristics for each plant. We had to find which plants produced fruits and/or flowers, edibility, leaf shape, and a few other specific attributes.

We split the work amongst our group, so each of us would be assigned around 28 plants each which was about 84 plants in total. There were the big three types of plants which were

shrub, tree, and herbs/ground cover. The tree has the most amount of traits these traits were tree ID, flower, fruit, color, bark type, lower height, and max height. Shrub and Herbs ground cover has the same amount which was only ID, flower, fruit, minimum height, and maximum height. These are the mains of the group, which has its own subgroups. The main subgroup's primary keys were ID numbers, and each had its own Foreign key. Flowers and fruit have their own traits. The fruit's traits were fruit name, season, color, shape, and size. While the flowers were flower name, blooming_season, petal_num, shape, color. While ID number is used for safety and plant_name.

We used the TreeHugger website to help find the characteristics of how the leaf is shaped and the name of it. This website helped us a lot because we didn't know that there were names for different types of leaves, and we did a bunch of research to figure out what traits plants have and make a database around them.

After we found our data, we added it all into our MySql schema which we used to hold the data and tie it all together with keys and constraints. We split the work up evenly to help save some time. We then used this schema to design and implement into our application. We decided to use a GUI for our project because of our prior knowledge of learning GUI.

Relation to other existing work

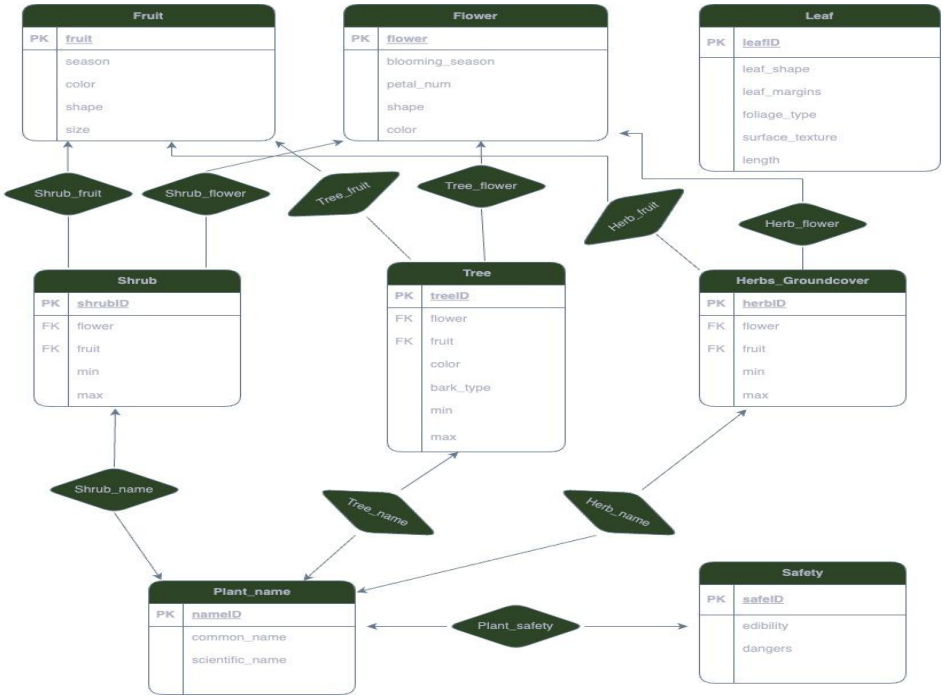
There is not a lot of specific information regarding plant databases within Pierce County, let alone the entire state. We used a plant list from the Pierce County website but even that didn't have all of the information we wanted.

The database we found did not provide enough information for our application, so we decided to put more time into research and find more characteristics for each plant.
Most databases we found were simple and they didn't talk about what flowers or fruits that grow on the plants. Others were very advanced, using photo recognition and AI to identify plants from pictures, but didn't provide us with the data we needed.

Overview of Architecture and Design Diagrams

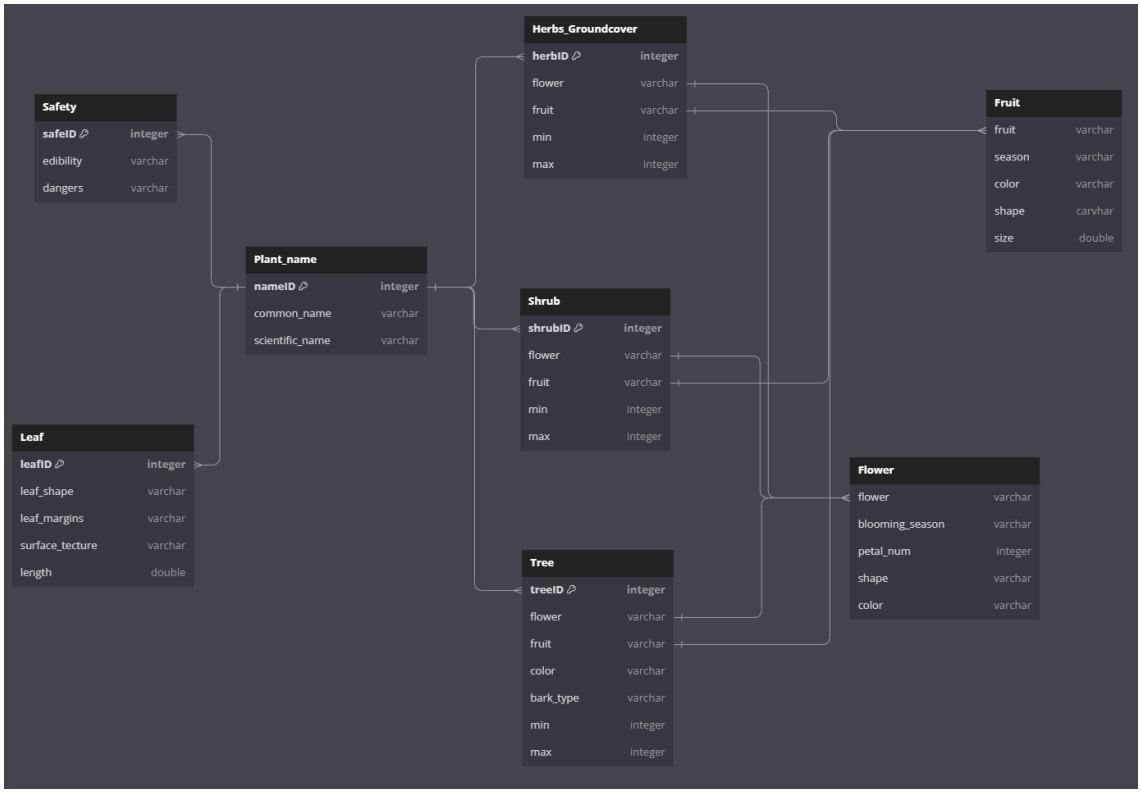
For the entity-relational model, we used our tables for each of the entities. This included fruit, flower, leaf, shrub, tree, herbs, safety, and plant names. Most of the entities had a one-to-many relationship as most of the plants could grow anywhere from one to many fruits or flowers. Safety and plant name both had a one-to-one relationship with each plant entity as they could only be used one time.

Entity Diagram



Schema diagram

Our schema diagram where nameID, treeID, shrubID, herbID, safeID, leafID are candidates keys and foreign keys. Flower and fruit are also foreign keys connecting the Tree, Shrub, and Herbs_Groundcover tables to the Flower and Fruit tables



Normalization proof

The tables show that it has functional dependence wherein the determinant is a candidate key, this means each of the tables is in BCNF. We can see these unique identifiers and can be used to find other attributes.

Tree Table:

FD1: treeID → flower, fruit, color, bark_type, min, max

Candidate Key for Tree: treeID as it is the candidate key and needed to identify flower, fruit, color, bark_type, min, and max

Proof: Since FD1 has a determinant as a candidate key (treeID), this relation is BCNF.

Plant_name Table:

FD1: nameID → common_name, scientific_name

Candidate Key for Plant_name: nameID as it is the candidate key and is needed to identify common_name and scientific_name

Proof: Since FD1 has a determinant as a candidate key (nameID), this relation is BCNF.

Shrub Table:

FD1: shrubID → flower, fruit, min, max

Candidate Key for Shrub: shrubID as it is the candidate key and needed to identify flower, fruit, min, and max

Proof: Since FD1 has a determinant as a candidate key (shrubID), this relation is BCNF.

Herbs_Groundcover Table:

FD1: herbID → flower, fruit, min, max

Candidate Key for Herbs_Groundcover: herbID as it is the candidate key and needed to identify flower, fruit, min, and max

Proof: Since FD1 has a determinant as a candidate key (herbID), this relation is BCNF.

Flower Table:

FD1:flowerID→blooming_season,petal_num,shape,colorflower→blooming_season,petal_num,shape,color

FlowerID is a candidate Key for Flower as it needed to identity blooming_season, petal_num, shape, color

Proof: Since FD1 has a determinant as a candidate key, this relation is BCNF

Fruit Table:

Candidate Key for Fruit: fruit (as it is the candidate key and needed to identify season, color, shape, size)

Proof: Since FD1 has a determinant as a candidate key (fruit), this relation is BCNF.

Leaf Table:

FD1: leafID → leaf_shape, leaf_margins, foliage_type, surface_texture, length

Candidate Key for Leaf: leafID as it is the candidate key and is needed to identify leaf_shape, leaf_margins, foliage_type, surface_texture, length

Proof: Since FD1 has a determinant as a candidate key (leafID), this relation is BCNF.

Safety Table:

FD1: safeID → edibility, dangers

Candidate Key for Safety: safeID as it is the candidate key and is needed to identify edibility and dangers

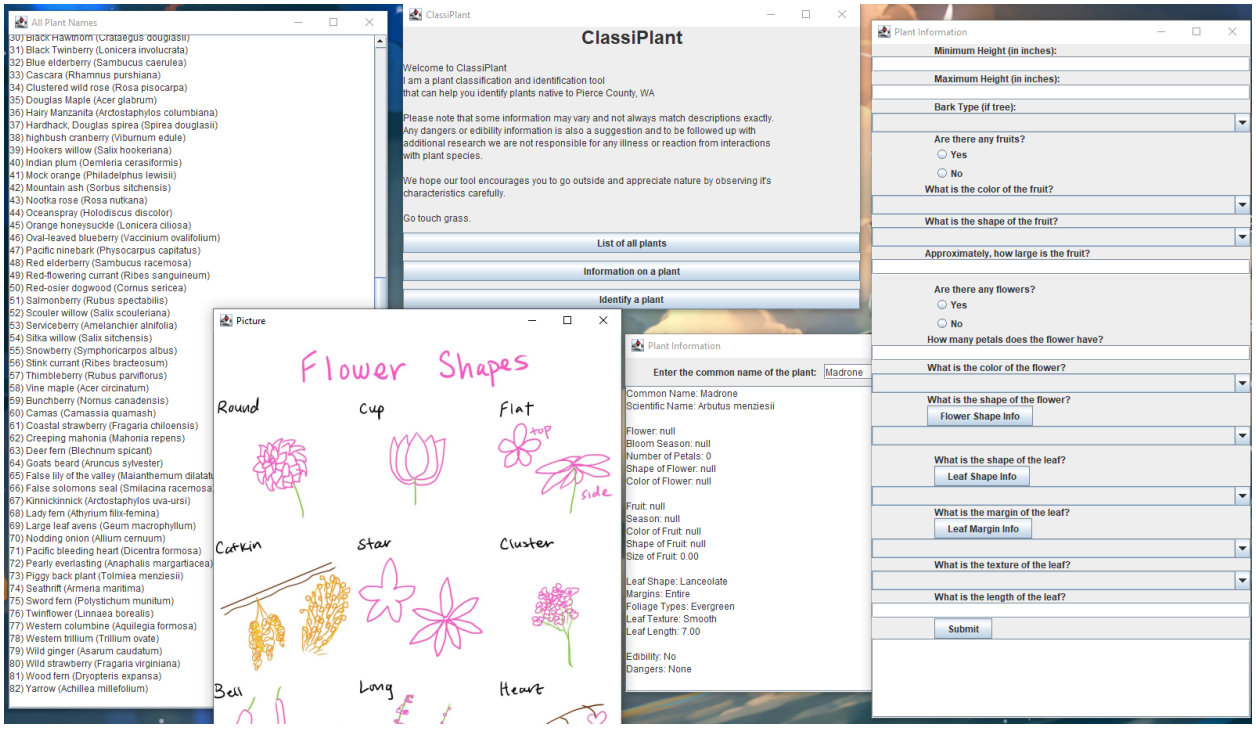
Proof: Since FD1 has a determinant as a candidate key (safeID), this relation is BCNF.

Design and Implementation

We have two different interfaces, one GUI using Java Swing and another text based. The GUI version offers 3 buttons, each will open up a new window. One option is to see a list of all native plant. Another option is to search up a specific plant and get information. The last option is to identify a plant by inputting information. The user can input information by text box or a drop down menu with choices. If the user selects ‘yes’ for fruit or flower then more questions will appear to ask more specific details.

The text based is our first iteration of a front end and may have some functionality compromised while the GUI was being implemented. It features some ASCII art for aesthetics and a menu where the user can choose an option similar to the options in the GUI. From there, prompts will print out where the user can input information.

Both version were coded in Java, the GUI using Java Swing. Our database used mySQL and




```
Welcome to ClassiPlant
I am a plant classification and identification tool
that can help you identify plants native to Pierce County, WA

Please note that some information may vary and not always match descriptions exactly.
Any dangers or edibility information is also a suggestion and to be followed up with
additional research we are not responsible for any illness or reaction from interactions
with plant species.

We hope our tool encourages you to go outside and appreciate nature by observing it's
characteristics carefully.

Go touch grass.
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Select a search method:
(1) See a list of names of all plants native to Pierce County
(2) Get information about a specific plant
(3) Identify a plant by providing information
(4) Quit
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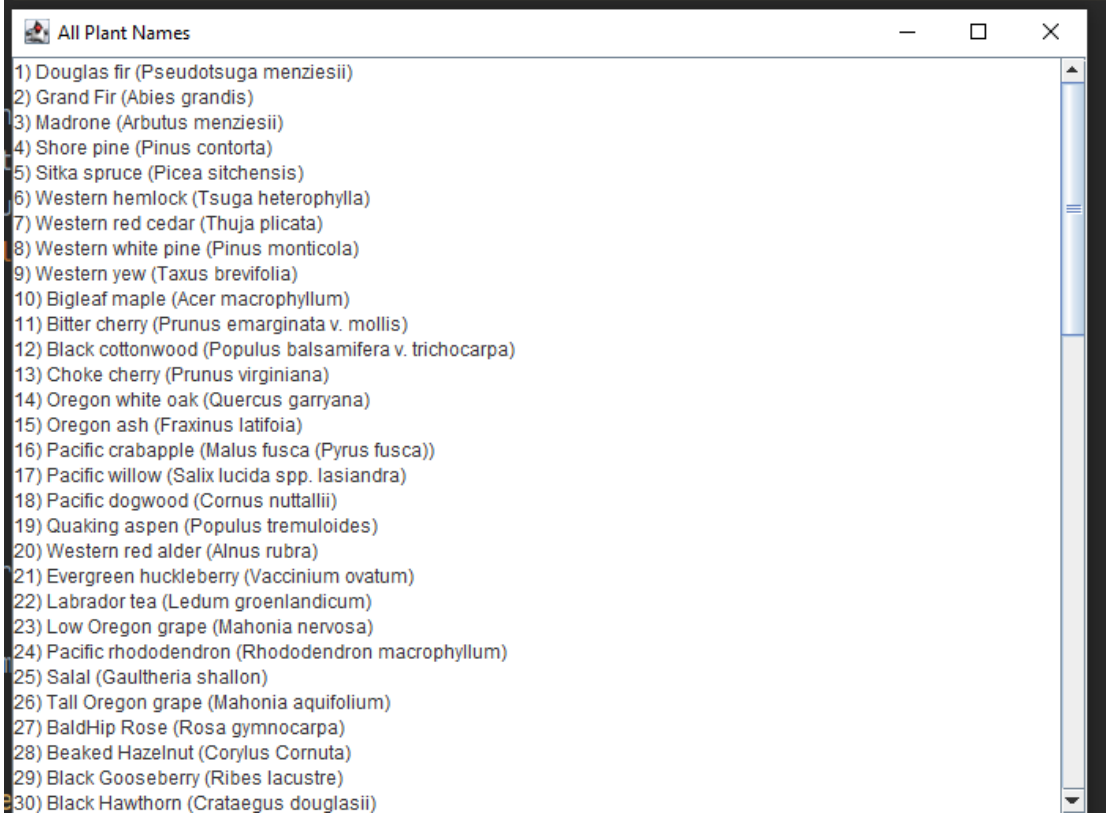
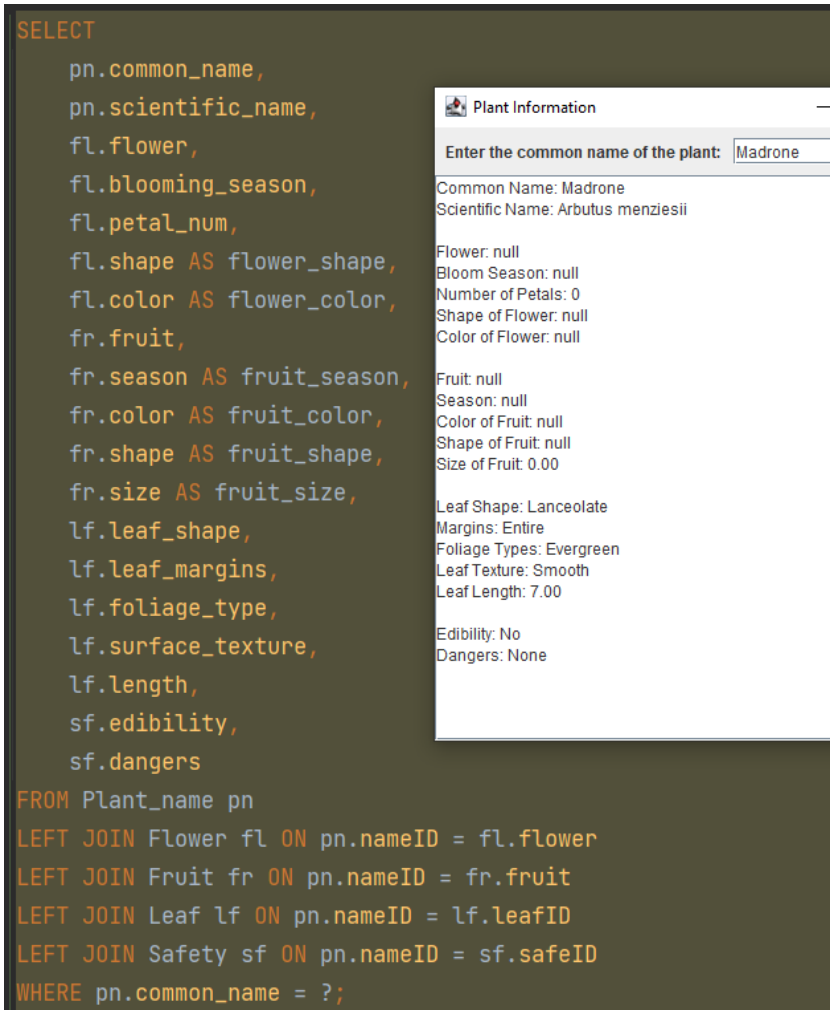
SQL queries

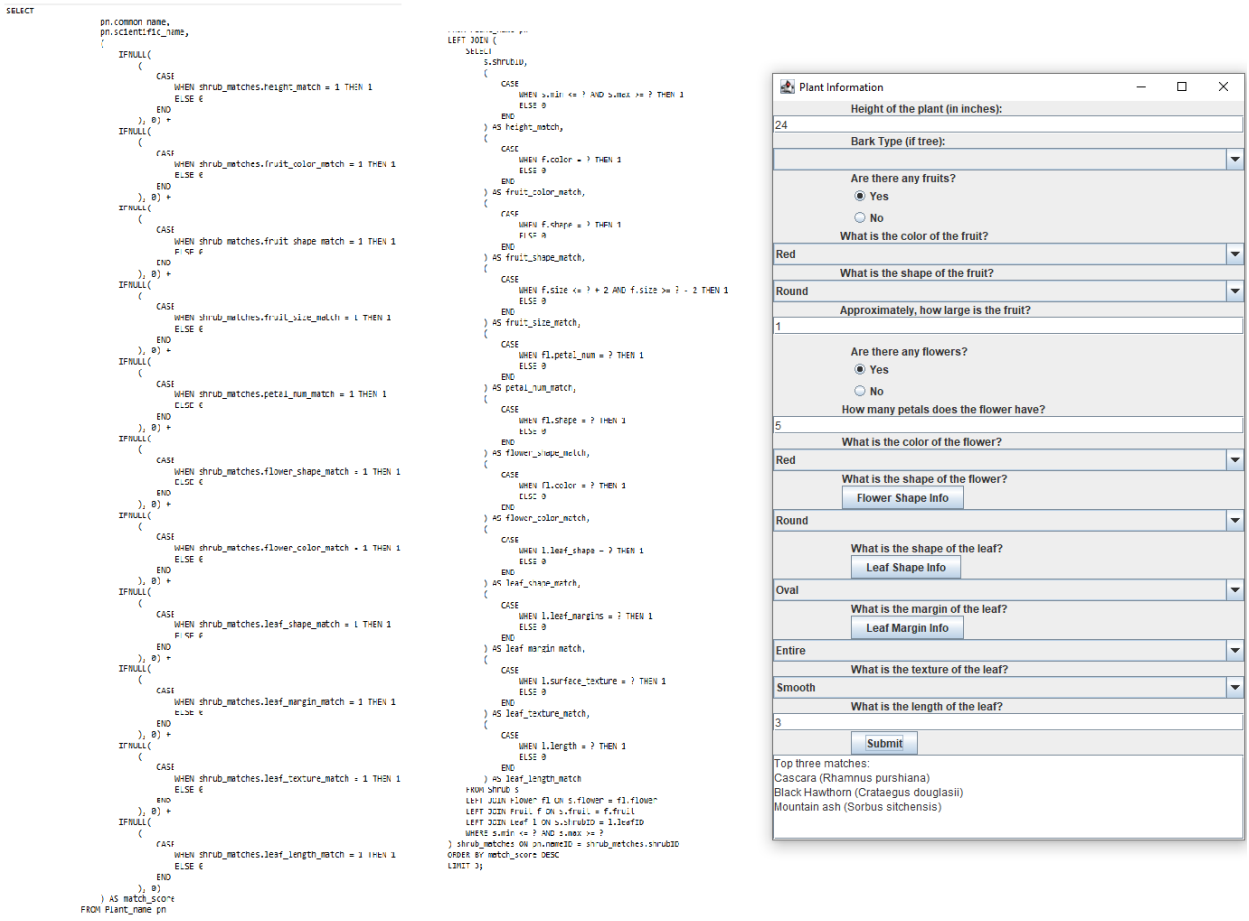
```
SELECT common_name, scientific_name
FROM Plant_name
```



Query to show all the plant names in a big list



Query to show the information on a specific plant



Query for identifying plants (was really long so had to take two screenshots and paste it side by side) Tries to find matches and calculates a best match score and returns the top three best ones

Conclusion with contribution

We distributed the work evenly throughout each phase of building this project. We all shared ideas and met weekly to stay on the same page about what we wanted to accomplish. Some of the challenges we ran into were with the designs, as well as some of the research for finding specific qualities of some of the plants.

For future work, it is possible to branch out to a larger region, to provide more information to the user on where you could find each plant, and create a more interactive front end application that provides detailed images of each plant. For references, we referred to the Pierce County official website, " Northwest-Native Plant List", which we used the same plant list for our project. We can also allow users to enter in their own plant as there are many non native and invasive species in the area, this could also serve as a sort of plant journal.

References

Mukherjee, Santanu. “Different Types of Leaves with Names and Pictures.” *Science Facts*, 2 Feb. 2023, www.sciencefacts.net/types-of-leaves.html.

Nix, Steve. “How to Identify a Tree Using Leaf Shape, Margin, and Venation.” *Treehugger*, Treehugger, 24 Mar. 2022, www.treehugger.com/id-trees-using-leaf-shape-venation-1343511.

Northwest Native Plant List - Pierce County, WA, www.piercecountywa.gov/DocumentCenter/View/4363/Northwest-Native-Plant-List. Accessed 19 Aug. 2023.

*Disclaimer, we are not responsible for any reactions or illnesses towards plants. Despite a plant being labeled ‘not dangerous’ please check with a third party source and don’t eat anything you just find outside.