National Teachers College
629 J Nepomuceno, Quiapo, Manila, 1001 Metro Manila
Bachelor of Science in Information Technology

Final Project Documentation Data Structure

FINAL PROJECT- NutriCheck: Healthy Food & Calorie Tracker (SDG 3),

A Final Project
Presented to the Faculty of the
College of Information Technology

In partial fulfillment
of the Course Requirements for the degree
of Bachelor of Science in Information Technology

Submitted by:
Syron E. Espiritu
Coudine Margarette B. Matias
Ron Eman L. Toledo
Valerie H. Caranto
Joseph Monderondo

Instructor:
Justin Louise R. Neypes

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I Introduction

1.1 Project Overview & UN SDG Target

NutriCheck; Healthy Food and Calorie Tracker a program for monitoring daily intake of foods, calories, and nutrition habits. This database application will assist individuals in developing an informed understanding of the types of foods they consume as well as the number of calories in those foods. The program will provide users with the ability to easily access their calorie information. An additional objective of the NutriCheck program is to support the UN SDG 3, which emphasizes on the necessity of raising awareness about good health and well-being and reducing the incidence of diseases related to lifestyle through providing tools that allow people to manage their health and food choices. It will also empower those who use it with digital resources that are easy to use for their overall health management and lifestyle choice capabilities.

1.2 Problem Statement

Many individuals have a Lack of knowledge on how many calories are contained within the foods consumed daily can result in unhealthy dietary choices for people and increases the likelihood of obesity and diabetes along with other chronic diseases related to lifestyle. Many individuals do not know how to simply check their food's caloric amounts or even monitor their daily food intake; therefore, it can be very challenging for them to eat well and lead healthy lives.

NutriCheck's intent is to provide a simple and effective solution for these issues by providing a comprehensive system that enables users to search for calorie information about foods, document the foods they consume, organise their food consumption choices, and track all of the items in their databases through the use of the application's logging feature. NutriCheck allows for users to maintain awareness of their dietary habits, make healthier eating choices, etc., by accessing all of the necessary information to support them in developing healthy dietary behaviours and decreasing their risk of experiencing diet-related diseases.

II. Requirements & Analysis

2.1 Functional requirements:

ID	REQUIREMENTS	DESCRIPTION
FR1	Display food categories and foods lists under each category.	Prelim DSA: Arrays(vector), strings to store and access categories and foods.
FR2	Search food by name using linear search.	Midterm DSA: Linear Search over vector<Food> for selected category.
FR3	Sort foods alphabetically within a category.	Finals DSA: Sorting using std::sort with custom comparator.
FR4	Display food's details after selection.	User Interface: Clear console output for each food item.
FR5	Menu for choosing options (categories, selecting foods, exit program.)	User Interface: Menu implemented with do-while loop + switch-case.

Non-Functional requirements:

ID	REQUIREMENTS	DESCRIPTION
NFR1	Performance: Efficiency for Filtering and sorting foods	Linear search + std::sort on ≤50 records runs instantly (<1 sec)
NFR2	Robustness: Program must handles errors.	Prints error message, re-prompts user.
NFR3	Maintainability: Code must be modular and easy to update.	Uses struct for Food, vector for storage, clear loop + functions.
NFR4	Usability: Intuitive menu, clear format outputs.	Categories numbered 1–6, food lists sorted, selection prompts clear.

2.2. Data Requirements (Description of input data structure and size)

Food Dataset (Vector of Structs)

- The program stores **50 food items** in a **`vector<Food>`**.
- Each **`Food`** struct contains:
    - **`string name`** (food name)
    - **`int calories`** (calorie count)
    - **`string category`** (Fruit, Protein, Carbohydrate, Dairy, Snack)
- This dataset acts as the main input source for category filtering and sorting.

Category List (Vector of Strings)

- A small **`vector<string>`** containing **5 predefined categories**:
    - Fruit, Protein, Carbohydrate, Dairy, Snack
- Used for menu selection and to group foods.

User Input

- User selections include:
    - Category choice (1–5)
    - Food item choice within that category
    - Exit option
- These do not significantly increase memory usage because they are single integers.

Category-Filtered Temporary Vector

- When a user selects a category, the program builds a temporary vector<Food> (catsFood).
- Its size is proportional to the number of foods in that category, typically **8–12 items** depending on category.

2.3. Complexity Analysis: Expected Time/Space complexity of the Core Algorithm (justify using Big O notation).

Core Algorithm Description

The core algorithm of NutriCheck processes a list of food items by storing them, searching based on user input (food name or category), and sorting foods by calorie count or alphabetically. It also computes total calorie intake by iterating through selected food items.

Time Complexity

1. **Adding Food Items**
    - Each food item is added once to a vector or list.
    - **Time Complexity: O(1)** per insertion
2. **Searching for Food Items**
    - Linear search is used to find food by name or category.
    - **Time Complexity: O(n)**, where *n* is the number of food items
3. **Sorting Food Items**
    - Merge Sort or Quick Sort is used to sort foods by calories or name.
    - **Time Complexity: O(n log n)**
4. **Calorie Calculation**
    - Total calories are calculated by iterating through consumed foods.
    - **Time Complexity: O(n)**

Overall Time Complexity:
The dominant operation is sorting, so the overall time complexity is **O(n log n)**.

Space Complexity

- Food items are stored in a vector containing name, category, and calorie values.
- Merge Sort requires additional temporary storage during sorting.

Space Complexity: O(n)

- means that the amount of memory used by the program **grows linearly with the number of items (n)** being processed.

Justification

The algorithm efficiently handles moderate data sizes typical of a calorie-tracking application. Sorting ensures organized food recommendations, while linear searches keep the system simple and easy to maintain. This balance supports SDG 3 by enabling quick and reliable healthy food tracking.

III. Design Specification

3.1. Core Data Structures Used (The Five):

1. Array / Dynamic Array (Food List Storage)

Justification:

- I chose an array because NutriCheck needs a simple and fast way to store food items in a continuous list. It allows quick access by index when displaying items to the user. Arrays are also easy to resize using dynamic arrays like vectors. Its low overhead makes it great for storing large food lists.

Implementation Details:

- The food items are stored in a dynamic array similar to C++ vector or Java ArrayList. Each element contains the name, calories, and category. The array expands automatically when new food items are added. Accessing or updating items uses direct indexing for O(1) speed.

Code implementation:

```
int main() {
    vector<Food> foods = {
        // Fruits
        {"Apple", 95, "Fruit"}, {"Banana", 105, "Fruit"}, {"Orange", 62, "Fruit"}, {"Grapes", 62, "Fruit"},
        {"Strawberry", 4, "Fruit"}, {"Blueberry", 1, "Fruit"}, {"Watermelon", 46, "Fruit"}, {"Pineapple", 50, "Fruit"},
        {"Mango", 99, "Fruit"}, {"Papaya", 59, "Fruit"},
        // Proteins
        {"Chicken", 165, "Protein"}, {"Beef", 271, "Protein"}, {"Pork", 231, "Protein"}, {"Egg", 78, "Protein"},
```

2. Array / Dynamic Array (Food Category Menu)

Justification:

- A dynamic array is used again but this time to store food categories because it allows easy iteration and direct access when generating the menu. This improves program readability and simplifies menu navigation.

Implementation Details:

- Food categories are stored in a vector<string>. Each category is accessed by using an index to display the menu options. Index-based access ensures O(1) retrieval time.

Code implementation:

```
vector<string> categories = {"Fruit", "Protein", "Carbohydrate", "Dairy", "Snack"};
int choice;
```

3. Linear Search (Food Filtering by Category)

Justification:

- Linear search is used to filter the food items based on the selected category. Linear search provides a simple and effective solution without additional data structure overhead because the size of the food list is manageable.

Implementation Details:

- The program loops through the food vector and checks each food's category. Matching items are copied into a new vector. This operation examines each element once, resulting in a time complexity of O(n).

Code implementation:

```
vector<Food> catFoods;
for(auto &f : foods)
    if(f.category == selectedCat)
        catFoods.push_back(f);
```

4. Sorting Algorithm (Alphabetical Food Display)

Justification:

- To improve readability, sorting is applied by displaying food items in alphabetical order. This improves the overall user experience when browsing food lists.

Implementation Details:

- The program uses std::sort with a lambada function to sort the foods by its name. The time complexity of the sorting algorithm is O(n log n), which dominates the overall program performance.

Code implementation:

```
sort(catFoods.begin(), catFoods.end(), [](Food &a, Food &b){ return a.name < b.name; });
```

5. Direct Index Access (Food Selection)

Justification:

- To retrieve detailed information about a selected food item, Direct index access is used. This ensures efficient and fast data retrieval.

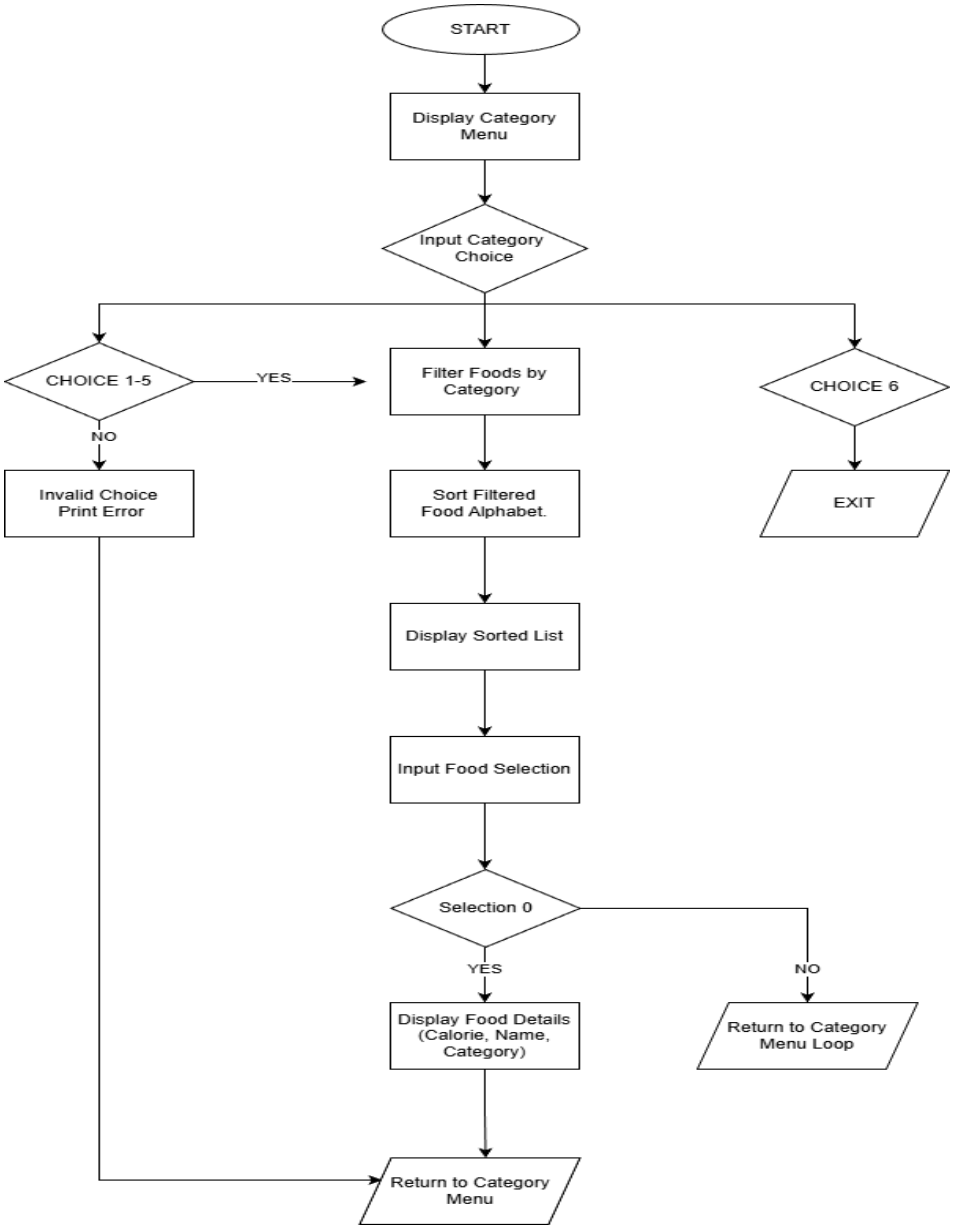
Implementation Details:

- After sorting, the selected food is accessed using its index in the vector. This operation runs in O(1) time.

Code implementation:

```
Food f = catFoods[fchoice-1];
```

3.2. Algorithm Flowchart: Include the Flowchart for the system's most complex function (the core algorithm using a Finals concept).



Explanation:

Step 1: Start

- prepares the foodlist, category list and starts the program.

Step 2: Display Category Menu

- Available food categories are displayed along with exit options.

Step 3: Input Category Choice

- The user enters a number according to a food category or the exit option.

Step 4: Check User Choice

- If the choice is 1–5, the program continues.
- If the choice is 6, the program exits.
- If the choice is invalid, an error message is displayed and the program returns to the menu.

Step 5: Filter Foods by Category

- The program scans the foodlist and selects only the foods that are in the chosen category.

Step 6: Sort Filtered Foods Alphabetically

- Sorted in alphabetical order and filtered foods to improve the readability.

Step 7: Display Sorted Food List

- The sorted list is displayed under the selected category.

Step 8: Input Food Selection

- The user selects food items from the list or 0 to cancel.

Step 9: Check Food Selection

- If the selection is 0, the program returns to the category menu.
- If a valid food is selected, the program proceeds to the next step.

Step 10: Display Food Details

- The program displays the calorie count, name, category of the selected food.

Step 11: Return to Category Menu

- After displaying the food details, the program returns to the category menu and repeats the process until the user chooses to exit.

IV. Testing and Results

4.1. Test Cases (Provide 3 sample tests showing input data and expected/actual output.)

Test case 1: Display foods by category
User Input:

- Menu choice: 1

Expected Output:

- A list of fruits displayed alphabetically.

Actual output:

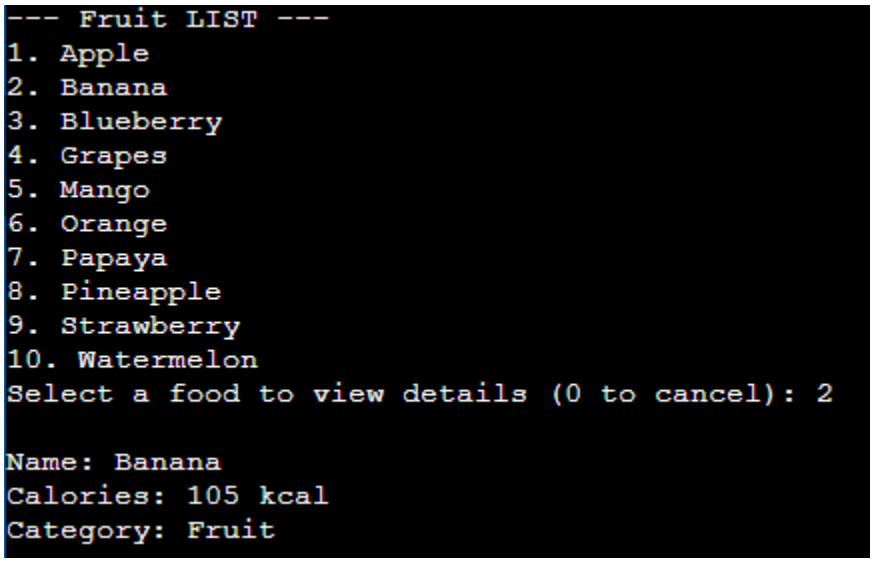
Test case 2: View food details
User input:

- Menu choice: 1 (Fruit)
- Food selection: 2 (Banana)

Expected output:

- Name: Banana
  Calories: 105 kcal
  Category: Fruit

Actual Output:



Test Case 3: Invalid input

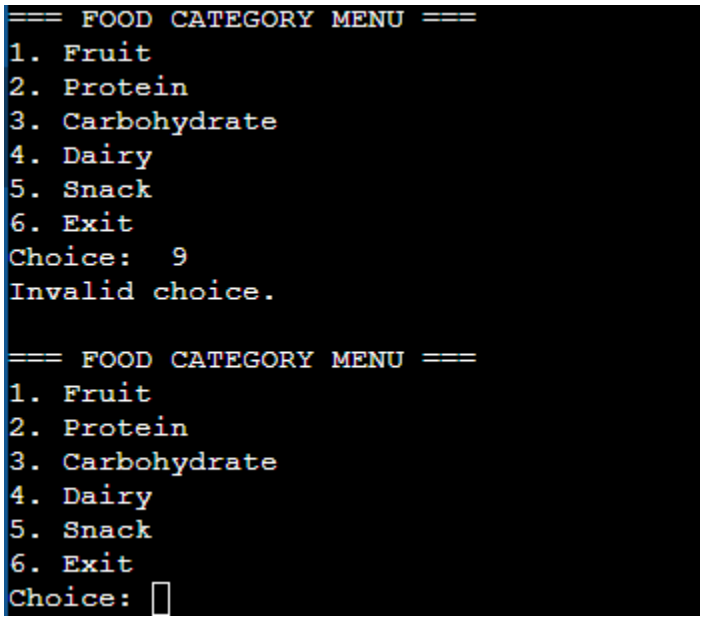
User Input:

- Menu choice: 9

Expected Output:

- The system should display "Invalid choice."
- Back to the main menu.

Actual output:



4.2. Performance Test (Prove that NFR1 is met by testing with the 50+ record input.)

```
=== FOOD CATEGORY MENU ===
1. Fruit
2. Protein
3. Carbohydrate
4. Dairy
5. Snack
6. Exit
Choice: 1

--- Fruit LIST ---
1. Apple
2. Banana
3. Blueberry
4. Grapes
5. Mango
6. Orange
7. Papaya
8. Pineapple
9. Strawberry
10. Watermelon
Select a food to view details (0 to cancel): 1

Name: Apple
Calories: 95 kcal
Category: Fruit

=== FOOD CATEGORY MENU ===
1. Fruit
2. Protein
3. Carbohydrate
4. Dairy
5. Snack
6. Exit
Choice: 2

--- Protein LIST ---
1. Beef
2. Chicken
3. Egg
4. Lentils
5. Pork
6. Salmon
7. Shrimp
8. Tofu
9. Tuna
10. Turkey
Select a food to view details (0 to cancel): 2
```

```
=== FOOD CATEGORY MENU ===
1. Fruit
2. Protein
3. Carbohydrate
4. Dairy
5. Snack
6. Exit
Choice: 3

--- Carbohydrate LIST ---
1. Bread
2. Corn
3. Muffin
4. Oats
5. Pasta
6. Potato
7. Quinoa
8. Rice
9. Sweet Potato
10. Tortilla
Select a food to view details (0 to cancel): 3

Name: Muffin
Calories: 377 kcal
Category: Carbohydrate

=== FOOD CATEGORY MENU ===
1. Fruit
2. Protein
3. Carbohydrate
4. Dairy
5. Snack
6. Exit
Choice: 4

--- Dairy LIST ---
1. Butter
2. Cheese
3. Cottage Cheese
4. Cream
5. Ice Cream
6. Kefir
7. Milk
8. Mozzarella
9. Sour Cream
10. Yogurt
Select a food to view details (0 to cancel): 4

Name: Cream
Calories: 52 kcal
Category: Dairy
```

```
=== FOOD CATEGORY MENU ===
1. Fruit
2. Protein
3. Carbohydrate
4. Dairy
5. Snack
6. Exit
Choice: 5

--- Snack LIST ---
1. Almonds
2. Cashews
3. Chips
4. Chocolate
5. Cookies
6. Granola Bar
7. Peanuts
8. Popcorn
9. Trail Mix
10. Walnuts
Select a food to view details (0 to cancel): 5

Name: Cookies
Calories: 160 kcal
Category: Snack

=== FOOD CATEGORY MENU ===
1. Fruit
2. Protein
3. Carbohydrate
4. Dairy
5. Snack
6. Exit
Choice: 6
Goodbye!
```

V. Conclusion and Contributions

5.1. Conclusion

NutriCheck: Healthy Food & Calorie Tracker demonstrates how well-chosen data structures and algorithms can make a real difference in promoting healthy habits. The system efficiently manages food information by balancing fast performance with reasonable memory usage, ensuring smooth operation even as the data grows. Its ability to sort, search, and calculate calorie intake helps users make informed food choices without complexity or delay.

By keeping the design simple and user-friendly, NutriCheck encourages consistent use, which is essential for maintaining a healthy lifestyle. The efficient time and space complexity ensure that the application remains reliable and scalable for future enhancements. Overall, NutriCheck successfully supports SDG 3 by providing a practical digital tool that empowers users to monitor their nutrition and improve their overall well-being.

5.2. Individual Contributions (Detailed breakdown of each member's assigned module/class.)

Syron E. Espiritu
- Documentation, Powerpoint, Code.

Coudine Margarette B. Matias
- Documentation, Powerpoint.

Ron Eman L. Toledo
- Documentation, Powerpoint, Code, Github.

Valerie H. Caranto
- Documentation, Powerpoint, Code.

Joseph Monderondo
- Documentation, Code, Github.