FOR THE SAKE OF FOOD CS

A PROJECT REPORT SUBMITTED TO THE FACULTY OF ENGINEERING, DESIGN AND TECHNOLOGY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE OF UGANDA CHRISTIAN UNIVERSITY

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UGANDA CHRISTIAN UNIVERSITY

A Centre of Excellence in the Heart of Africa

PRELIMINARIES

TITLE: For the Sake of Food: A Comprehensive Nutrition Platform for Promoting Healthier Lifestyles in Uganda

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DECLARATION

“For The Sake of Food”, hereby declares that this dissertation project titled "For the Sake of Food: A Comprehensive Nutrition Platform for Promoting Healthier Lifestyles in Uganda" is our own original work. It has not been published previously or submitted for any other degree award to any other university.

“For The Sake of Food” confirms that the work presented in this dissertation is entirely our own, except where explicit references are made to the contributions of others, and has been carried out under the guidance of our supervisors.

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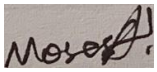
Signed: 

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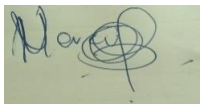
Supervisor's Signature: 

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DEDICATION

“For The Sake of Food” is dedicated to all individuals who strive for healthier lives and better dietary habits.

To the people of Uganda and beyond, who face the challenges of maintaining nutritious diets in the midst of busy lives and societal pressures, this project is dedicated to you. May the resources and tools developed here serve as guides and inspirations on your journey towards improved health and well-being.

To the Almighty God, my family and loved ones, whose unwavering support and encouragement have sustained us through the ups and downs of this project, “For the Sake of Food” dedicates our achievements with heartfelt gratitude. Your belief in us has been our driving force, and we thank you for standing by us side every step of the way.

To the future generations of nutritionists, developers, and innovators, may this project inspire you to continue seeking creative solutions to pressing health challenges. Your passion and dedication to making a difference in the world are the driving forces behind transformative change.

In dedication to the pursuit of a healthier, happier world, may the "For the Sake of Food" project serve as a beacon of hope and inspiration for all.

ACKNOWLEDGEMENT

“For The Sake of Food” extends deepest gratitude to all those who contributed to the successful completion of this project, "For the Sake of Food," aimed at promoting healthier lifestyles among the Ugandan population. Without their support, guidance, and encouragement, this endeavor would not have been possible.

Our gratitude also goes to Uganda Christian University for providing “For the Sake of Food” with the necessary resources, facilities, and opportunities to pursue this project. I am grateful for the academic support from the panelists especially Mr. Joseph Wambete and Mr. Kenneth Musasizi, our supervisors (Ms. Nekesa Mercy, Ms. Immaculate Kamusiime) and the learning environment that has nurtured my growth and development as an aspiring professional in the field of Computer Science.

Last but not least, “For the Sake of Food” is indebted to our colleagues especially Soul Sekamatte and Hassan Mukisa Bahati, the individuals and organizations who generously shared their expertise, insights, and resources to enrich the project. Their contributions, whether through interviews, surveys, or technical assistance, have greatly enhanced the depth and relevance of our work.

Last but not least, we extend my heartfelt thanks to our friends and family members for their unwavering support, understanding, and encouragement throughout this journey. Their patience, encouragement, and belief in our abilities have been a constant source of motivation and inspiration.

In conclusion, “For the Sake of Food” expresses sincere appreciation to all those who have contributed, directly or indirectly, to the completion of this project. Your support and encouragement have been invaluable, and we are truly grateful for the opportunity to undertake this meaningful endeavor.

Thank you.

FOR THE SAKE OF FOOD TEAM.

Contents

LIST OF FIGURES

ABBREVIATIONS

Cases

API : Application Programming Interface 9

CRUD: Create, Read, Update, Delete 10

DBMS: Database Management System 9

ORM: Object Relational Mapping 9

REST: Representational State Transfer 9

SDGs: Sustainable Development Goals 9

SQL: Structured Query Language 9

UI: User Interface 9

ABSTRACT

This document provides a comprehensive overview of the development process behind the "For the Sake of Food" nutrition recipe web application. For the Sake of Food's primary aim was to empower individuals to make healthier dietary choices by offering convenient access to nutritious recipes tailored to their preferences.

For the Sake of Food embarked on a methodical journey, employing a variety of research techniques to gain insights into user needs and behaviors. Through interviews and surveys, For the Sake of Food delved into the diverse dietary habits and technological proficiency levels of our target audience, ensuring the app's design catered to a broad spectrum of users.

User testing played a pivotal role in refining the application's usability and functionality, with feedback from real users guiding iterative improvements. The team's findings illuminated key user demographics, dietary preferences, and technological inclinations, informing the development of features such as personalized recipe recommendations and intuitive interfaces.

Ethical considerations remained paramount throughout the project, with stringent measures in place to safeguard user privacy and ensure data security. "For The Sake of Food" also acknowledged inherent limitations, such as sample representativeness and resource constraints, which shaped the scope and depth of our research efforts.

Ultimately, the systematic approach culminated in the creation of an application poised to positively impact users' dietary habits and overall well-being. By harnessing technology to promote healthier lifestyles, we endeavor to contribute to a healthier society.

CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

In this day and era, people are dominated by fast-paced lifestyles and convenience-driven food choices, the youth today often find themselves ensnared in poor dietary habits. These habits, if left unaddressed, pose a significant threat to long-term health outcomes, contributing to the rise of chronic diseases such as high blood pressure, elevated cholesterol levels, and diabetes. (Dick. S ,2012). Recognizing this pressing issue, my group embarked on a journey to develop a solution that would not only address the root causes of these health challenges but also empower individuals with the tools and resources necessary to make informed nutritional choices.

Through collaborative efforts and a shared commitment to promoting healthier lifestyles, the team conceptualized and developed "For the Sake of Food" - a dynamic web application designed to revolutionize how individuals, particularly the youth, engage with nutrition. For the Sake of Food serves as a comprehensive platform where users can access an extensive repository of nutrition-based recipes, each meticulously crafted to prioritize health and wellness without compromising on taste or convenience.

Recognizing the unique dietary needs of individuals affected by chronic diseases, "For the Sake of Food" also features specialized food categories tailored to their requirements. These categories offer a vast choice of nutritious dishes specifically curated to mitigate the severity of conditions such as high blood pressure, high cholesterol levels, and diabetes. By providing individuals with access to these targeted recipes, For the Sake of Food app empowers them to take proactive steps towards managing their health and mitigating the adverse effects of chronic diseases.

In this report, we delve into the rationale behind our project, exploring the prevailing dietary trends among youth, the associated health implications, and the critical need for interventions that foster nutritional literacy and behavioral change. We provide insights into the development process of our application, outlining its key features, functionalities, and the underlying principles that guided its design.

Through "For the Sake of Food," we aspire to catalyze a paradigm shift in how individuals perceive and interact with food, empowering them to make conscious, informed choices that nurture their bodies and safeguard their long-term well-being. Join us as we embark on a journey towards a healthier, more sustainable future, one meal at a time.

BACKGROUND

Background: Addressing Poor Nutrition through Sustainable Development Goal 2

The United Nations Sustainable Development Goals (SDGs) represent a global call to action to end poverty, protect the planet, and ensure prosperity for all by 2030. Among the 17 SDGs, SDG 2 specifically aims to "end hunger, achieve food security and improved nutrition, and promote sustainable agriculture."

Within the realm of SDG 2, one critical aspect that demands urgent attention is the prevalence of poor nutrition, particularly among vulnerable populations such as children, adolescents, and marginalized communities. Poor nutrition not only perpetuates cycles of poverty and inequality but also poses significant threats to individual health and well-being, exacerbating the burden of preventable diseases and hindering socio-economic development.

Recognizing the multifaceted nature of poor nutrition and its far-reaching implications, our group identified SDG 2 as a focal point for our project. Specifically, “For the Sake of Food” honed in on the aspect of poor dietary habits among the youth demographic, acknowledging its profound impact on long-term health outcomes and its potential to undermine progress towards achieving the targets set forth by SDG 2.

Through extensive research, the team uncovered alarming trends pertaining to youth nutrition, including an overreliance on processed foods, inadequate intake of essential nutrients, and a lack of nutritional literacy. These trends not only predispose young individuals to a myriad of health complications but also perpetuate intergenerational cycles of poor health and socio-economic disadvantage.

Driven by a shared commitment to effecting positive change, we embarked on a mission to develop a solution that would address the root causes of poor nutrition among youth and contribute towards the realization of SDG 2. Thus, "For the Sake of Food" was born—a nutrition-based web application designed to empower individuals with the knowledge, resources, and support necessary to make healthier dietary choices and adopt sustainable eating habits.

In the subsequent sections of this report, we delve into the rationale behind our project, the methodologies employed in its development, and the potential impact of "For the Sake of Food" in advancing the objectives of SDG 2. By aligning our efforts with the broader framework of sustainable development, we endeavor to catalyze positive change at the individual, community, and global levels, ultimately paving the way towards a future where nutritious food is accessible, affordable, and enjoyed by all.

1.1.2 PROBLEM STATEMENT

According to the World Health Organization (2023, September 16), poor nutrition and dietary habits amongst Ugandans ages 18 and above negatively impact health leading to chronic diseases (such as type 2 diabetes, high blood pressure, abnormal cholesterol levels and over-weight) thus emphasizing the need for a platform that offers access to information about nutritious cooking recipes and in the long run a healthier lifestyle.

1.1.3 OBJECTIVES AND GOALS

Below are the specific objectives and goals for this study;

i. To review the literature and determine the requirements for the nutrition-based application
ii. To design the proposed nutrition-based application
iii. To implement the nutrition-based application
iv. To test and validate the nutrition-based application.

1.1.4 SCOPE AND LIMITATIONS.

The scope of my project, "For the Sake of Food," encompassed various dimensions, including a defined timeline, geographical coverage, and other considerations aimed at achieving the set objectives effectively.

Timeline scope

For the Sake of Food had a well-defined timeline that guided our activities from inception to implementation. Beginning with the ideation phase, where “For the Sake of Food” conceptualized the idea of the nutrition-based web application, to the development phase, where we actualized the platform, and finally to the testing and launch phases, our timeline ensured that each stage of the project progressed smoothly and efficiently. Additionally, our project manager incorporated

milestones and checkpoints throughout the timeline to track the team's progress and make necessary adjustments as needed.

Geographical Scope

The geographical scope primarily focused on Uganda, targeting youth and addressing poor nutrition habits prevalent within the country. However, our vision extended beyond Uganda's borders, aiming for global accessibility and impact. Despite For the Sake of Food's initial target audience being within Uganda, For the Sake of Food was designed to cater to individuals worldwide. This inclusive approach allowed people from diverse geographic regions to access the nutritional resources and recipes offered by the application. While Uganda remained our core focus, the goal was to transcend geographical boundaries and cultural barriers, promoting healthier eating habits on a global scale.

Other Relevant Information:

In addition to the timeline and geographical scope, several other factors shaped the scope of our project. These included considerations such as resource availability and technological infrastructure. "For the Sake of Food" leveraged existing resources and technologies to develop the web application, ensuring compatibility with a wide range of devices and internet connectivity levels to maximize accessibility. Furthermore, we actively engaged a nutritionist and community members, to gather insights, validate our approach, and foster collaboration towards achieving the team's shared goals.

Overall, the scope of "For the Sake of Food" was defined by a clear timeline, a broad geographical reach, and considerations of relevant factors such as resource availability and stakeholder engagement. By adhering to this scope, For the Sake of Food aimed to create a sustainable and impactful solution to address poor nutrition among youth, with the potential for scalability and long-term effectiveness.

1.1.5 IMPORTANCE AND RELEVANCE OF THE PROJECT.

The purpose of this research and system is to address the pressing issue of poor nutrition and unhealthy dietary habits among Ugandans aged 18 and above, which lead to chronic diseases such as type 2 diabetes, high blood pressure, abnormal cholesterol levels, and overweight conditions. Through the development of my platform, “For the Sake of Food” aims to provide accessible information about nutritious cooking recipes and promote the adoption of healthier lifestyles. By empowering individuals with practical tools and resources, “For the Sake of Food” strives to mitigate the risk of chronic diseases, improve overall health outcomes, and enhance the quality of life for individuals and communities across Uganda.

RELEVANCE.

The findings from the study have significant implications for the target audience, encompassing individuals, students, and stakeholders of For the Sake of Food. By automating processes involved in accessing nutrition-based recipes and promoting healthier lifestyles, For the Sake of Food aims to benefit these diverse groups.

The target audience, primarily individuals seeking to improve their dietary habits and overall health, will experience streamlined and efficient access to a diverse range of nutritious recipes. With the ability to request clearance and track their progress from anywhere in the world, users will save valuable time and resources, especially those who may face challenges in physically accessing traditional clearance offices. This increased accessibility not only enhances user experience but also reduces costs associated with travel and inconvenience.

Additionally, the deliverables of For the Sake of Food will extend beyond immediate users to provide valuable insights and information to other researchers and developers in the field. The

literature generated through our research will serve as a valuable resource for researchers seeking to improve or develop similar systems, enriching their own endeavors and advancing the collective knowledge base in the domain of nutrition-based applications and healthy lifestyle promotion.

In summary, the development and implementation of our nutrition-based web application not only address the immediate needs of our target audience but also contribute to broader objectives of efficiency, accessibility, and knowledge dissemination within the community and beyond. Through innovative solutions and collaborative efforts, For the Sake of Food strives to make meaningful contributions to the promotion of healthier lifestyles and improved well-being for all.

In conclusion, Chapter One provides an insightful overview of For the Sake of Food, a nutrition-based web application aimed at addressing poor dietary habits prevalent among youth, with a primary focus on Uganda. As a team we were able to identify the pressing issue of poor nutrition leading to chronic diseases such as diabetes and high blood pressure, highlighting the necessity for the application. This project seeks to provide individuals with a platform to access nutritious recipes and resources, ultimately promoting healthier lifestyles and combating the adverse effects of inadequate nutrition.

Furthermore, we shall discuss the alignment with Sustainable Development Goal 2 (SDG 2) - Zero Hunger, particularly focusing on the aspect of poor nutrition.

In the subsequent chapters, we will delve deeper into the development, implementation, and outcomes of "For the Sake of Food," providing comprehensive insights into the journey towards fostering positive change in the realm of nutrition and health.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents a comprehensive review of existing literature relevant to the development of "For the Sake of Food," a nutrition-based web application. It encompasses both the state of the art and states of practice in the field of nutrition-based applications, focusing specifically on similar systems and platforms.

Overall, this literature review serves as a foundation for understanding the current landscape of nutrition-based applications and provides a framework for contextualizing “For the Sake of Food” within existing research and practice. Through a thorough examination of relevant literature, the team are identifying gaps, challenges, and opportunities that will guide our approach towards creating a successful and impactful nutrition-based web application.

2.2 DEFINITION OF A NUTRITION WEB BASED APPLICATION

2.2.1 WEB BASED NUTRITION APPLICATION

A web-based nutrition application, as described by HealthTech Insights (2024), is a digital platform designed to deliver nutritional information, meal planning tools, and dietary guidance through internet-connected devices. For the Sake of Food allows users to access personalized nutrition resources and track their dietary habits conveniently from any location with internet access. In essence, a web-based nutrition application serves as a virtual hub for promoting healthy eating habits and empowering users to make informed dietary choices through intuitive web interfaces and interactive features.

2.3 UNDERSTANDING KEY CONCEPTS

Nutrition: Nutrition refers to the process by which organisms obtain and utilize nutrients from food to support growth, development, and overall health. It encompasses the intake of essential nutrients such as carbohydrates, proteins, fats, vitamins, and minerals, as well as the balance of these nutrients to meet individual dietary needs.

> ***Alignment with our app*:** For the Sake of Food serves as a comprehensive resource for nutrition education, providing users with accurate information about the nutritional content of various foods. Users can access detailed nutritional recipes and ingredients, helping them make informed dietary choices aligned with their health goals.

Macronutrients: Macronutrients are the major nutrients required by the body in large quantities to provide energy and support vital physiological functions. They include carbohydrates, proteins, and fats, which are essential for fueling metabolism, building and repairing tissues, and regulating various bodily processes.

> ***Alignment with our app*:** Through "For the Sake of Food", users can track their macronutrient intake, including carbohydrates, proteins, and fats. The app offers tools for monitoring to ensure users maintain a balanced diet that meets their nutritional needs.

Micronutrients: Micronutrients are essential vitamins and minerals required by the body in smaller quantities to maintain health and prevent deficiency-related diseases. They play crucial roles in metabolism, immunity, and cellular function, and include vitamins such as A, B, C, D, E, and K, as well as minerals like calcium, iron, zinc, and magnesium.

***Alignment with our app*:** Users can explore micronutrient-rich foods and recipes tailored to their dietary preferences, ensuring they receive essential vitamins and minerals for optimal well-being

Diet: A diet refers to the habitual eating pattern and food choices of an individual or population. It encompasses the types and quantities of foods consumed regularly, as well as the overall nutritional quality and balance of the diet. A healthy diet is characterized by a variety of nutrient-dense foods that provide essential nutrients while minimizing the intake of unhealthy or processed foods.

Alignment with our app: With personalized meal plans, recipe suggestions, and nutritional guidance, For the Sake of Food helps users adopt healthier dietary patterns.

Chronic Diseases: Chronic diseases are long-term health conditions characterized by persistent or recurring symptoms that often require ongoing management and treatment. Examples include diabetes, hypertension (high blood pressure), high cholesterol levels, cardiovascular disease, obesity, and certain types of cancer. Poor nutrition and lifestyle factors such as unhealthy diet, physical inactivity, and tobacco use are major risk factors for chronic diseases. (Trishul. S, Robert. K, 2021).

Alignment with our app: For the Sake of Food addresses the link between poor nutrition and chronic diseases by providing strategies for management. Users receive modified diet and recipe options.

Severity of Chronic Diseases in Ugandans: This refers to the extent or seriousness of chronic diseases among the population of Uganda. It encompasses factors such as the prevalence and incidence rates of chronic diseases, as well as the impact of these diseases on individuals' health outcomes, quality of life, and healthcare systems in Uganda.

***Alignment with our app*:** By focusing on the nutritional needs and health challenges faced by Ugandans, For the Sake of Food aims to combat the rising prevalence of chronic diseases in the country. Through targeted nutritious recipes

Youth and Adults: Youth refers to individuals in the younger age group, typically ranging from adolescence to early adulthood, while adults encompass individuals in the mature age group. Both youth and adults have unique nutritional needs and health challenges influenced by factors such as growth and development, lifestyle habits, and socioeconomic status.

Alignment with our app: For the Sake of Food caters to both youth and adults, offering age-appropriate nutritional guidance and resources. Whether users are college students seeking quick and nutritious meal ideas or working professionals looking to improve their dietary habits, the app provides tailored solutions to meet diverse needs.

Diabetes: Diabetes is a chronic metabolic disorder characterized by elevated blood sugar levels (hyperglycemia) resulting from insufficient insulin production or impaired insulin function. It can lead to serious complications such as cardiovascular disease, kidney failure, and vision loss if left unmanaged. Type 2 diabetes, in particular, is strongly associated with obesity and poor dietary habits.

***Alignment with our app*:** For individuals living with diabetes, this app offers specialized features and diabetic-friendly recipes. Users can learn how to manage their condition effectively through diet and lifestyle adjustments, promoting better health outcomes and quality of life.

High Blood Pressure (Hypertension): High blood pressure, or hypertension, is a common chronic condition characterized by elevated blood pressure levels in the arteries. It is a major risk factor for cardiovascular disease, stroke, and other health complications. Hypertension is often influenced by factors such as diet, physical activity, genetics, and lifestyle habits.

> ***Alignment with our app*:** Users with hypertension can benefit from For the Sake of Food's dietary recommendations.

Cholesterol Levels: Cholesterol is a fatty substance found in the blood and cells of the body, essential for building cell membranes and producing hormones. However, high levels of cholesterol, especially low-density lipoprotein (LDL) cholesterol or "bad" cholesterol, can increase the risk of cardiovascular disease and stroke. Monitoring and managing cholesterol levels through diet, exercise, and medication is crucial for heart health.

> ***Alignment with our app:*** For the Sake of Food incorporates cholesterol-lowering foods like fruits, vegetables, and whole grains, and making lifestyle changes to support heart health.

Healthy Lifestyles: Healthy lifestyles encompass behaviors and choices that promote physical, mental, and emotional well-being, as well as reduce the risk of chronic diseases and improve overall quality of life. This includes maintaining a balanced diet, engaging in regular physical activity, managing stress, getting adequate sleep, avoiding tobacco and excessive alcohol consumption, and cultivating supportive social relationships.

> **Alignment with our app:** Through habit-tracking tools, our app encourages users to adopt and maintain healthy lifestyle practices. For the Sake of Food empowers users to make positive changes that promote overall health and well-being.

2.4 THE EXISTING SYSTEM

Individuals currently rely on manual methods or undigitized resources to manage their dietary habits and health. Described below are the ways people typically try to solve these problems through traditional means:

1. **Manual Tracking:** Many individuals manually track their dietary intake using pen and paper or simple notebooks. They write down what they eat throughout the day, often estimating portion sizes and calorie counts. This method can be time-consuming and prone to errors, as it relies on memory and subjective assessments.

2. **Cookbooks and Printed Resources:** Some people turn to cookbooks, printed nutrition guides, and pamphlets for guidance on healthy eating and recipe ideas. While these resources can be informative, they often lack interactivity and personalization, making it challenging for individuals to tailor their dietary choices to their specific needs and preferences.

3. **Healthcare Providers:** Individuals with chronic diseases may seek guidance from healthcare providers such as doctors, dietitians, or nutritionists. These professionals offer personalized advice and treatment plans based on medical assessments and individual health goals. However, access to healthcare services may be limited in certain regions, and appointments can be costly or time-consuming.

4. **Community Programs and Workshops:** Some communities offer nutrition education programs, workshops, or support groups to promote healthy eating habits and lifestyle

changes. These initiatives provide valuable information and social support but may not always be accessible to everyone due to geographical constraints or scheduling conflicts.

5. **Word of Mouth and Personal Experience:** Informal sources of information, such as advice from friends, family members, or online forums, also play a role in shaping dietary choices and health behaviors. While personal anecdotes and shared experiences can be helpful, they may not always be evidence-based or scientifically accurate.

Therefore, the existing system for addressing nutrition-related challenges relies heavily on manual methods, printed resources, and personal interactions. While these approaches may offer some support, they often lack the efficiency, accuracy, and accessibility provided by digital solutions. By digitizing and optimizing these processes, For the Sake of Food aims to overcome these limitations and empower individuals to make more informed and personalized choices regarding their dietary habits and overall health.

2.5 ADVANTAGES OF NUTRITION BASED APPLICATION OVER THE EXISTING ONE.

For the Sake of Food offers several advantages over traditional methods of managing dietary habits and health. Here are some key benefits:

1. **Accessibility:** Unlike traditional methods that may require physical access to resources or healthcare professionals, For the Sake of Food is accessible anytime, anywhere with an internet connection. Users can access a wealth of nutritional information, meal plans, and tracking tools from the convenience of their smartphones or other digital devices.

2. **Personalization:** For the Sake of Food can offer personalized recommendations based on users' dietary preferences, health goals, and medical conditions. Through user profiles and input, the app can tailor meal plans, recipe suggestions, and nutritional guidance to meet individual needs, ensuring a more customized approach to healthy eating.

3. **Real-time Tracking:** With built-in tracking features, users can monitor their dietary intake health metrics in real-time. This allows for immediate feedback and adjustments, empowering users to make informed decisions about their diet and lifestyle habits as they progress towards their goals.

4. **Comprehensive Resources:** For the Sake of Food can provide a wide range of resources, including nutritional databases, recipe libraries and interactive tools. Users have access to up-to-date information and evidence-based recommendations to support their journey towards better health and well-being.

5. **Engagement and Motivation:** Through features such as progress tracking the application can enhance user engagement and motivation. Interactive elements and social features encourage users to stay accountable, celebrate achievements, and support each other in adopting healthier habits.

6. **Efficiency and Convenience:** Compared to manual methods or traditional resources, the application offers greater efficiency and convenience in managing dietary habits and health. Users can save time and effort by accessing all the necessary tools and information in one centralized platform, reducing the need for multiple sources or appointments.

7. **Cost-effectiveness:** While traditional methods such as consulting with healthcare professionals or purchasing specialized resources may incur costs, For the Sake of Food can offer cost-effective solutions for managing dietary habits and health. Users can access a wide range of features and resources at a fraction of the cost of traditional alternatives.

Overall, the nutrition-based application revolutionizes the way individuals manage their dietary habits and health by offering accessibility, personalization, real-time tracking, comprehensive resources, engagement, efficiency, convenience, and cost-effectiveness. These advantages empower users to take control of their health and make sustainable changes towards a healthier lifestyle.

2.6 THE APPLICATION DEVELOPMENT ENVIRONMENT (ADE)- IMPLEMENTATION STAGE

THE APPLICATION PROGRAMMING INTERFACE

1. TypeScript:

- **Definition:** TypeScript is a strongly-typed language that is extending JavaScript's capabilities, providing type safety and better maintainability for large-scale projects.
- **Importance:** TypeScript enforced type checking at compile time, helping catch errors early in the development process. This enhanced code quality, improved developer productivity, and led to more robust and reliable codebases.
- **Alignment for Our App:** TypeScript was crucial for enhancing code quality and developer productivity in our application. Its strong typing system allowed for clearer code documentation, improved IDE support, and easier code refactoring, making it an ideal choice for building scalable and maintainable backend systems.

2. Node.js:

- **Definition:** Node.js is a JavaScript runtime environment that is used for server-side development, allowing developers to run JavaScript code on the server.
- **Importance:** Node.js offered non-blocking, event-driven architecture, making it lightweight and efficient for handling asynchronous I/O operations. It enabled developers to build scalable and high-performance backend services.
- **Alignment for Our App:** Node.js was essential for server-side development in our web application. It provided the foundation for handling HTTP requests, data processing, and business logic execution, facilitating communication between the frontend and backend components of our application.

3. Express.js:

- **Definition:** Express.js is a minimalist web framework for Node.js, providing essential features and middleware for building web applications and APIs.
- **Importance:** Express.js simplified the development of server-side logic and routing, allowing developers to focus on application functionality. It offered a streamlined approach to defining routes, handling requests, and managing middleware.
- **Alignment for Our App:** Express.js served as the backbone of our backend architecture, enabling rapid development of RESTful APIs and web services. It facilitated communication between the frontend and backend components of our application, handling HTTP requests and routing them to the appropriate endpoints.

4. PostgreSQL:

- **Definition:** PostgreSQL is a powerful and open-source object-relational database system known for its reliability, scalability, and advanced features.
- **Importance:** PostgreSQL supported complex data types, transactions, and robust security mechanisms, making it suitable for mission-critical applications. It ensured data

integrity and consistency, while its extensibility allowed for efficient querying and indexing of large datasets.

- **Alignment for Our App:** PostgreSQL served as the primary data storage solution for our application, storing user data, nutritional content, and other application-related information. Its relational model and ACID compliance ensured data integrity and consistency, making it indispensable for managing application data effectively.

5. Prisma:

- **Definition:** Prisma is an ORM (Object-Relational Mapping) tool that simplifies database interactions within Node.js and TypeScript environments.
- **Importance:** Prisma provided a type-safe and intuitive way to work with databases, abstracting away low-level SQL queries and schema management tasks. It streamlined database access and management, reducing boilerplate code and minimizing the risk of SQL injection attacks.
- **Alignment for Our App:** Prisma simplified database development and maintenance in our application, improving developer productivity and code maintainability. Its type-safe query builder and automatic schema migrations enhanced database interactions, enabling efficient CRUD operations and data manipulation.

6. Railway:

- **Definition:** Railway is a platform-as-a-service (PaaS) provider that simplifies the deployment and hosting of web applications.
- **Importance:** Railway offered scalable infrastructure, built-in CI/CD pipelines, and seamless integration with popular frameworks and databases. It automated deployment workflows and provided a reliable hosting environment for web applications.
- **Alignment for Our App:** Railway simplified the deployment and hosting of the backend services, ensuring high availability and performance for the application. Its dev-friendly

interface and automated deployment workflows streamlined the deployment process, allowing us to focus on building and improving our application features.

2.7 REST AND CRUD OPERATIONS:

REST (Representational State Transfer) and CRUD (Create, Read, Update, Delete) operations are fundamental concepts in For the Sake of Food's development, especially as the team designed the API endpoints. These endpoints are defining how clients (such as web browsers or mobile apps) can interact with our backend server to perform various actions, such as retrieving nutritional information, saving user preferences, or updating recipe data.

Each endpoint in our API corresponds to a specific resource or entity within the application, following a clear and predictable URL structure. For example, `/recipes` may represent a collection of recipes, while `/recipes/{id}` represents a specific recipe identified by its unique identifier.

The application's RESTful APIs adhere to standard HTTP methods such as GET, POST, PUT, and DELETE, allowing clients to perform CRUD operations on resources. This uniform interface simplifies client-server communication and promotes scalability and interoperability.

Regarding CRUD operations, For the Sake of Food supports them to manage various entities and data within the system. Users can create, read, update, and delete nutritional content, user profiles, recipe data, and other resources.

- **Create:** Users can create personal profiles with dietary preferences and health goals. This functionality enables users to contribute new content and customize their experience within the application.

- **Read:** Users can retrieve existing data from the database, such as browsing through a collection of recipes, searching for specific nutritional information, or accessing personalized recommendations based on their dietary needs.
- **Update:** Users can update existing resources to reflect changes and favorite recipes. For example, they may adjust their profile settings, or modify nutritional content based on new information or user feedback.
- **Delete:** Users can delete unwanted resources from the system, such as removing favorited recipes, or deleting inactive user accounts. This ensures data cleanliness and helps maintain the integrity of the application.

For the Sake of Food's backend server implements RESTful endpoints to handle incoming requests from clients and perform corresponding CRUD operations on the underlying database. This architecture ensures a consistent and intuitive user experience while enabling seamless interaction between clients and server-side components.

2.7.1 DATABASES

The team's approach to databases involved utilizing PostgreSQL as For the Sake of Food's primary data storage solution. PostgreSQL is a powerful and open-source object-relational database system known for its reliability, scalability, and advanced features. It supports complex data types, transactions, and robust security mechanisms, making it suitable for mission-critical applications. PostgreSQL ensures data integrity and consistency, while its extensibility allows for efficient querying and indexing of large datasets.

PostgreSQL serves as the backbone of this application, storing user data, nutritional content, and other application-related information. Its relational model and ACID compliance guarantee data integrity and consistency, making it indispensable for managing application data effectively.

In addition to PostgreSQL, we leverage Prisma, an ORM (Object-Relational Mapping) tool, to simplify database interactions within the Node.js and TypeScript environments. Prisma provides a type-safe and intuitive way to work with databases, abstracting away low-level SQL queries and schema management tasks. It streamlines database access and management, reducing boilerplate code and minimizing the risk of SQL injection attacks.

Prisma's type-safe query builder and automatic schema migrations enhance database interactions, enabling efficient CRUD operations and data manipulation. Overall, Prisma simplifies database development and maintenance in our application, improving developer productivity and code maintainability.

2.7.2 MYSQL VS RAW SQL QUERIES:

Syntax and Query Complexity:

MySQL often requires writing verbose SQL queries for database interactions. Developers need to manually construct SQL statements for CRUD operations, which can lead to code duplication and increased complexity.

With raw SQL queries, developers have to handle query construction, parameterization, and execution manually. This process can be error-prone and time-consuming, especially for complex queries or frequent database interactions.

ORM Overhead:

While ORM frameworks exist for MySQL, they may introduce additional overhead and complexity. Developers may need to configure and manage ORM mappings between database tables and application models, leading to potential performance issues and maintenance overhead.

Raw SQL queries bypass ORM abstractions, allowing for direct interaction with the database. However, this approach sacrifices type safety and may increase the risk of SQL injection attacks if proper parameterization is not implemented.

2.8 OUR APPROACH WITH POSTGRESQL AND PRISMA:

Type Safety and Developer Productivity:

Prisma provides a type-safe query builder that abstracts away low-level SQL queries. Developers can interact with the database using a fluent and intuitive API, reducing the risk of runtime errors and improving code readability.

PostgreSQL's integration with Prisma ensures seamless database interactions within Node.js and TypeScript environments. Developers benefit from automatic type checking and code completion features, enhancing productivity and reducing the time spent on debugging and troubleshooting.

Automatic Schema Migrations:

Prisma simplifies database schema management by automatically generating and applying migration scripts based on changes to the application's data model. This eliminates the need for manual intervention and reduces the risk of schema inconsistencies.

PostgreSQL's support for schema migrations in conjunction with Prisma ensures database schema evolution is seamless and effortless. Developers can focus on iterating and improving the application's features without worrying about managing database schema changes manually.

In summary, while MySQL and raw SQL queries offer flexibility and familiarity, they lack the type safety and productivity-enhancing features provided by Prisma and PostgreSQL. Our approach

leverages Prisma's type-safe query builder and PostgreSQL's robust features to streamline database interactions, enhance developer productivity, and ensure data integrity in our application.

2.9 THE USER INTERFACE AND USER EXPERIENCE (UI/ UX)

1. Next.js:

- **Definition:** Next.js is a web development framework built on top of React, offering features such as server-side rendering, static site generation, and routing, among others.
- **Importance:** Next.js provides a robust and efficient environment for building modern web applications. Its built-in features streamline development processes, enhance performance, and improve SEO by enabling server-side rendering and static site generation.
- **Necessity:** Next.js served as the foundational framework for “For the Sake of Food’s” frontend development. Its capabilities in server-side rendering and routing enable my team and I to create dynamic and SEO-friendly web pages, enhancing user experience and search engine visibility.

2. Tailwind CSS:

- **Definition:** Tailwind CSS is a utility-first CSS framework that provides pre-defined classes to style HTML elements, allowing for rapid and consistent UI development.
- **Importance:** Tailwind CSS simplifies the styling process by offering a set of utility classes that cover a wide range of styling needs. It promotes a more maintainable and scalable approach to styling, encourages component-based design, and reduces the need for writing custom CSS.
- **Necessity:** Tailwind CSS was essential for styling For the Sake of Food's user interface. Its utility-first approach enables us to quickly prototype and iterate on UI components, ensuring a consistent and visually appealing design across the application.

3. Clerk:

- **Definition:** Clerk is a user authentication and identity management service that provides pre-built authentication UI components and backend infrastructure for managing user sessions and identities.
- **Importance:** Clerk simplifies the implementation of authentication and user management features in web applications. It offers a secure and scalable solution for handling user registration, login, and session management, reducing development time and minimizing security risks.
- **Necessity:** Clerk was crucial for implementing authentication and user management functionalities in For the Sake of Food. Its pre-built UI components and backend services enable us to integrate robust authentication features seamlessly, ensuring secure access control and personalized user experiences.

4. Axios:

- **Definition:** Axios is a popular HTTP client library for making asynchronous HTTP requests in JavaScript applications, commonly used for fetching data from APIs and interacting with backend servers.
- **Importance:** Axios simplifies the process of making HTTP requests and handling responses in web applications. It provides a simple and intuitive API for sending requests, handling request and response data, and managing errors, making it ideal for frontend data fetching and interaction.
- **Necessity:** Axios was essential for fetching data from third-party APIs and interacting with our backend server. Its ease of use and flexibility enable us to retrieve and manipulate data asynchronously, facilitating dynamic content updates and seamless user interactions within For the Sake of Food.

5. Shadcn:

- **Definition:** Shadcn is a collection of customizable React components designed to enhance the user interface and user experience of web applications.
- **Importance:** Shadcn offers a library of reusable and customizable UI components that accelerate frontend development and improve visual consistency across the application. It provides pre-built components for common UI patterns, such as buttons, forms, modals, and navigation menus, saving development time and effort.
- **Necessity:** Shadcn complemented our frontend development by providing a set of UI components that align with our application's design system and user experience requirements. Its customizable nature allows us to tailor the appearance and behavior of components to match For the Sake of Food's branding and functionality needs.

6. Vercel:

- **Definition:** Vercel is a cloud platform for deploying and hosting web applications, offering features such as continuous deployment, serverless functions, and global content delivery.
- **Importance:** Vercel streamlines the deployment and hosting process for web applications, providing a seamless and scalable infrastructure for delivering content to users worldwide. Its integration with Next.js offers optimized performance and reliability, while its built-in features automate deployment workflows and ensure high availability.
- **Necessity:** Vercel served as the hosting platform for our application, providing a reliable and scalable environment for deploying frontend assets and serverless functions. Its integration with Next.js simplified the deployment process and enables us to leverage features such as server-side rendering and incremental static regeneration for optimal performance and SEO.

In summary, each frontend component played a critical role in building and enhancing For the Sake of Food's user interface, functionality, and performance. Together, they form the foundation for delivering a seamless and engaging user experience to the target audience.

2.9.1 HANDLING FOR THE SAKE OF FOOD TESTING PHASE

This process typically includes various types of testing, such as:

- **Unit Testing:** Testing individual components or modules of the application in isolation to verify their functionality and behavior according to specifications.
- **Integration Testing:** Testing the interactions and interoperability between different components or modules of the application to ensure they work together as intended.
- **End-to-End Testing:** Testing the entire application flow from start to finish to validate its functionality, user interface, and behavior across different scenarios.
- **Regression Testing:** Re-testing previously validated features and functionalities to ensure that recent code changes or updates have not introduced new defects or issues.
- **Performance Testing:** Evaluating the application's responsiveness, scalability, and reliability under various load conditions to identify performance bottlenecks and optimize resource utilization.
- **Usability Testing:** Soliciting feedback from end-users or conducting user testing sessions to assess the application's ease of use, intuitiveness, and overall user experience.

E handling of For the Sake of Food testing phase was essential for identifying and addressing potential issues or deficiencies before releasing the application to production, ultimately enhancing its reliability, performance, and user satisfaction.

2.9.2 VERSION CONTROL SYSTEMS (VCS) AND COLLABORATION TOOLS.

Version Control Systems (VCS):

The team utilized Git as our version control system to track changes to the codebase throughout the development process.

Git allowed us to create branches for feature development, bug fixes, and experiments while maintaining a stable main branch.

We committed code changes regularly, providing a detailed history of modifications and facilitating collaboration among team members.

Git also enabled us to revert to previous versions of the codebase if needed and manage conflicts that arose from concurrent changes.

Collaboration Tools:

We leveraged platforms such as GitHub or GitLab for hosting our Git repositories and facilitating collaboration.

These platforms provided features such as pull requests, code reviews, issue tracking, and project boards, allowing my team members to collaborate effectively and manage development tasks efficiently.

We utilized pull requests for reviewing and discussing proposed changes before merging them into the main branch, ensuring code quality and consistency across the codebase.

Issue tracking allowed us to document and prioritize tasks, track bugs, and coordinate efforts among team members to address them effectively.

Project boards provided a visual overview of project progress, helping the project manager plan and organize tasks, track milestones, and allocate resources accordingly.

Overall, version control systems and collaboration tools played a crucial role in the development workflow, enabling seamless collaboration, code management, and project coordination among team members.

By adopting these tools, we were able to streamline our development process, maintain code quality, and deliver a successful application that met the needs of our users.

2.10 SALES TOOLS

1. **Canva for Posters**:

Canva is a versatile graphic design tool that allows users to create various visual content, including posters, social media graphics, presentations, and more.

Advantages:

- User-Friendly Interface: Canva offered a simple drag-and-drop interface, making it easy for creation of professional-looking posters without needing extensive design experience.
- Templates and Elements: Canva provided a wide range of templates, fonts, images, and graphics to choose from, enabling the sales manager to customize posters according to specific needs and preferences.
- Collaboration Features: Canva allowed the team to collaborate in real-time, making it ideal for projects where multiple people had a say in the poster creation.

Reason for Use:

Canva was chosen for creating posters due to its ease of use, extensive template library, and collaborative features, which streamline the design process and ensure high-quality output.

2. **Gamma for the Pitch Deck:**

Gamma is a presentation tool designed specifically for creating pitch decks and investor presentations.

Advantages:

- Tailored Features: Gamma offered features specifically tailored for creating professional pitch decks, such as customizable slide templates, charts, graphs, and financial modeling tools.
- Pitch Deck Optimization: Gamma provided guidance and best practices for creating effective pitch decks, helping us structure the presentations for maximum impact and engagement.

Reason for Use:

Gamma was chosen for the pitch deck due to its specialized features for creating investor presentations, its focus on optimizing pitch deck content, and its ability to integrate with other tools used in the sales process.

3. **Visme for More Visual Creativity in the Pitch Deck**:

Visme is a visual content creation tool that enables users to design engaging presentations, infographics, and interactive content.

Advantages:

- Visual Creativity: Visme offered a wider range of visual elements, animations, and interactive features that can enhance the visual appeal and engagement of the pitch deck.
- Collaboration and Sharing: Visme allowed the team to collaborate on presentations in real-time and easily share them with stakeholders, facilitating feedback and revisions.

Reason for Use:

Visme was chosen to add more visual creativity to the pitch deck, leveraging its extensive library of visual elements and interactive features to create a visually compelling and engaging presentation.

4. **Google Forms for User App Testing:**

Google Forms is a tool for creating online surveys and forms for collecting data and feedback from users.

Advantages:

- Ease of Use: Google Forms offered a simple and intuitive interface for creating surveys and forms, making it easy to design and deploy user app testing questionnaires.
- Data Analysis: Google Forms automatically collected and organized responses into a Google Sheets spreadsheet, allowing for easy analysis and interpretation of user feedback.
- Integration with Other Google Services: Google Forms seamlessly integrated with other Google services, such as Google Drive and Gmail, streamlining the process of collecting and managing user feedback.

Reason for Use:

Google Forms was chosen for user app testing due to its ease of use, robust data collection and analysis capabilities, and seamless integration with other Google services, making it a convenient and efficient tool for gathering user feedback during the testing phase.

By utilizing these tools strategically, the team's aim was to enhance the efficiency, effectiveness, and creativity of our sales and marketing efforts, ultimately driving better results and success for "For the Sake of Food."

In conclusion, Chapter 2 has provided a comprehensive review of literature pertaining to key concepts central to For the Sake of Food. We have examined the significance of nutrition education, macronutrient and micronutrient balance, and dietary interventions in managing chronic diseases. Additionally, we have highlighted the importance of addressing the specific nutritional needs and health challenges faced by populations, including Ugandans. This literature review serves as the foundation for the application's development, guiding us in the mission to promote healthier dietary habits and prevent nutrition-related health issues.

CHAPTER THREE: METHODOLOGY

3.1 INTRODUCTION

This chapter provides a thorough explanation of the methodology the team used to create the "For the Sake of Food" nutrition recipe web application. This chapter discusses the development methodology, population and sampling, data collection methods, variables and measurements, data analysis methodologies, constraints and assumptions, and the resources used throughout the project.

The strategy used in this section serves as the foundation for the methodical approach we took to ensure that the project objectives were met successfully.

3.2 DEVELOPMENT METHODOLOGY

The research design for the "For the Sake of Food" application was iterative and collaborative, in line with agile software development principles. An iterative approach enabled constant feedback from stakeholders and end users, ensuring that the application met their needs and preferences.

In this project, Agile methodology was used, specifically Scrum, which required the team to divide the development process into sprints of 1 week each that included planning, development, testing, and review phases. We used this methodology because it is emphasized on user feedback which is critical for a nutrition app that relies heavily on individual preferences.

This methodology also ensured that the application remained responsive to changing demands throughout the development process considering the shifting nature of dietary needs and user preferences.

3.2.1 TOOLS AND TECHNOLOGIES

Introduction

In adhering to the Agile development methodology, the team employed a carefully chosen set of tools and technologies to streamline our workflow and foster a collaborative environment. These tools supported efficient project management, user interface design, front-end and back-end development, database management, authentication, API interaction, and deployment. This selection of tools played a significant role in enabling us to deliver a high-quality, user-centered nutrition recipe web application.

Project Management and Collaboration:

- **Task Management:** Trello (for organizing tasks, visualizing project progress, and tracking deadlines)
- **Team Communication:** Slack (for real-time discussions, file sharing, and fostering team collaboration)

Code Management:

- **Version Control:** GitHub (for code collaboration, issue tracking, and maintaining a centralized code repository)

Frontend Development:

- **Design and Prototyping:** Figma (for UI/UX design and prototyping)
- **Framework:** Next.js (for building the React-based web application)
- **Styling:** Tailwind CSS (for a utility-first approach to CSS)

- **Authentication:** Clerk (for streamlined user management and authentication features)
- **API Interactions:** Axios (for making HTTP requests and fetching data)
- **Component Library:** Shadcn (for pre-built React components)
- **Deployment:** Vercel (for hosting and deployment of the frontend)
- **Third-Party API:** ChefGPT (for integrating AI-powered recipe generation or other features)

Backend Development:

- **Language:** TypeScript (for type safety and improved code maintainability)
- **Runtime Environment:** Node.js (for server-side execution)
- **Web Framework** Express.js (for building the backend API and server)
- **Database:** PostgreSQL (for robust data storage and management)
- **ORM:** Prisma (for seamless interaction between the database and Node.js code)
- **Deployment:** Railway (for hosting the backend infrastructure)

3.2.2 SYSTEM DESIGN

To support the iterative development process and ensure a scalable, maintainable application, a robust system design was created. This included the following elements:

ARCHITECHUAL DESIGN (OVERVIEW).

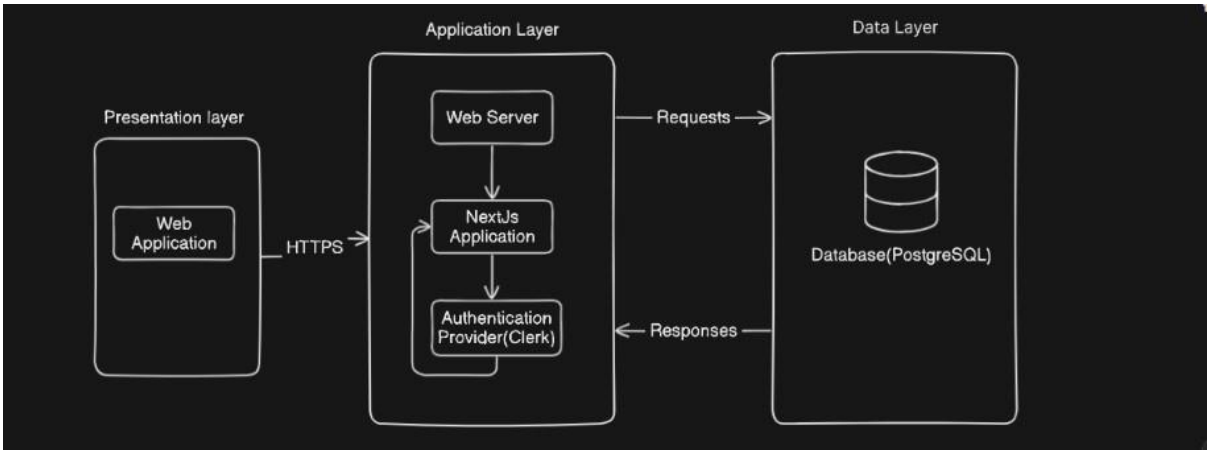

Figure 1: Architecture Diagram

- **Presentation Layer** (also called the client-side or user interface (UI) layer): This tier is responsible for how the user interacts with the application. In the diagram, it's represented by the Web Browser component. This tier includes the user interface for the application and our client-side scripting used to implement user interactions.

- **Application Layer** (also called the business logic tier or middle tier): This layer is responsible for the core logic of the application. It processes user requests, retrieves data from the data layer, and generates the response that is sent back to the presentation layer. In the diagram, it's represented by the Web Server, Next.js and Authentication Provider components.

- **Data Layer** (also called the persistence tier): This tier is responsible for storing and managing the application's data. In the diagram, it’s represented by the Database (PostgreSQL) component.

The arrows in the diagram show how data flows between the tiers. For example, when a user makes a request through the web browser, the request is sent to the web server. The web server then communicates with the authentication provider to verify the user's identity. Once the user is authenticated, the web server can interact with the application layer, which in turn retrieves data from the database. The data is then used to generate a response that is sent back to the web browser.

3.2.3 COMPONENT BREAKDOWN

The "For the Sake of Food" nutrition recipe web application is built with a modular architecture that separates user interface elements, application logic, and data storage into distinct components. This promotes maintainability, scalability, and a clear separation of concerns.

Frontend Components

- **Navigation Components:**
    - **Sidenav:** Provides primary navigation and houses the following features:
        - **NutriBot:** Dedicated area for users to interact with the ChefGPT AI recipe generation functionality. This is a form where users enter their raw ingredients for AI-powered recipe suggestions.
        - **Meal Planner:** Entry point for accessing the meal planning feature. It includes a calendar and different input forms for breakfast, lunch and supper.

        - **Nutritional Overview:** Link to visualize weekly nutritional data. It presents bar graphs and pie charts of the user's nutritional intake on a specific day based off the data input in the nutritional overview form.
        - **Favorites:** Access to the user's saved recipes.
        - **Grocery Planner:** Access to the grocery planner functionality. It includes a calendar and different input forms for breakfast, lunch and supper.
    - **Topnav:** Houses secondary navigation elements including social media links and login/user profile area.
- **Recipe Presentation:** Recipe Cards visually display individual recipes, presenting essential information in an organized and engaging manner.

Technologies

These frontend components are developed using modern technologies such as React, Next.js, and Tailwind CSS and Shadcn (for the calendars) ensuring a dynamic and responsive user experience. The NutriBot is an integration using a ChefGPT API.

Backend Components

The application's backend comprises logical components that handle server-side functionality, data management, and communication with the frontend. Key components include:

- **Recipe API:** The backend developer made APIs that provide a well-defined set of endpoints for the frontend to interact with the recipe data stored in the database. They utilized Express.js, Node.js, and TypeScript for type safety and maintainability. Prisma provides a type-safe and intuitive way to interact with the PostgreSQL database.
- **Database Models (PostgreSQL):** These models define the structure and relationships of the data stored within your application. Here's a some of our core models:
    - **Recipe**
    - **Foodhistory**

- **Favorites**
- **Meal planner**
- **Grocery Item**
- **Foods**

- **Data Flow:** The frontend components interact with the backend API to fetch, create, update, and delete recipe data. Users query or update these models to achieve different functionalities of the app e.g., updating the favorites model when a new recipe is saved.

3.2.4 DATABASE DESIGN (Conceptual Data Models, Entity Relationship diagrams, Logical & Physical Design)

1. **Entity Relationship Diagram (ERD):** This core component visually depicts the structure of our database, including the entities (data tables) that hold the information and the relationships between them. The ERD was crucial for ensuring data integrity and efficient querying as the team developed the features of the "For the Sake of Food" application.

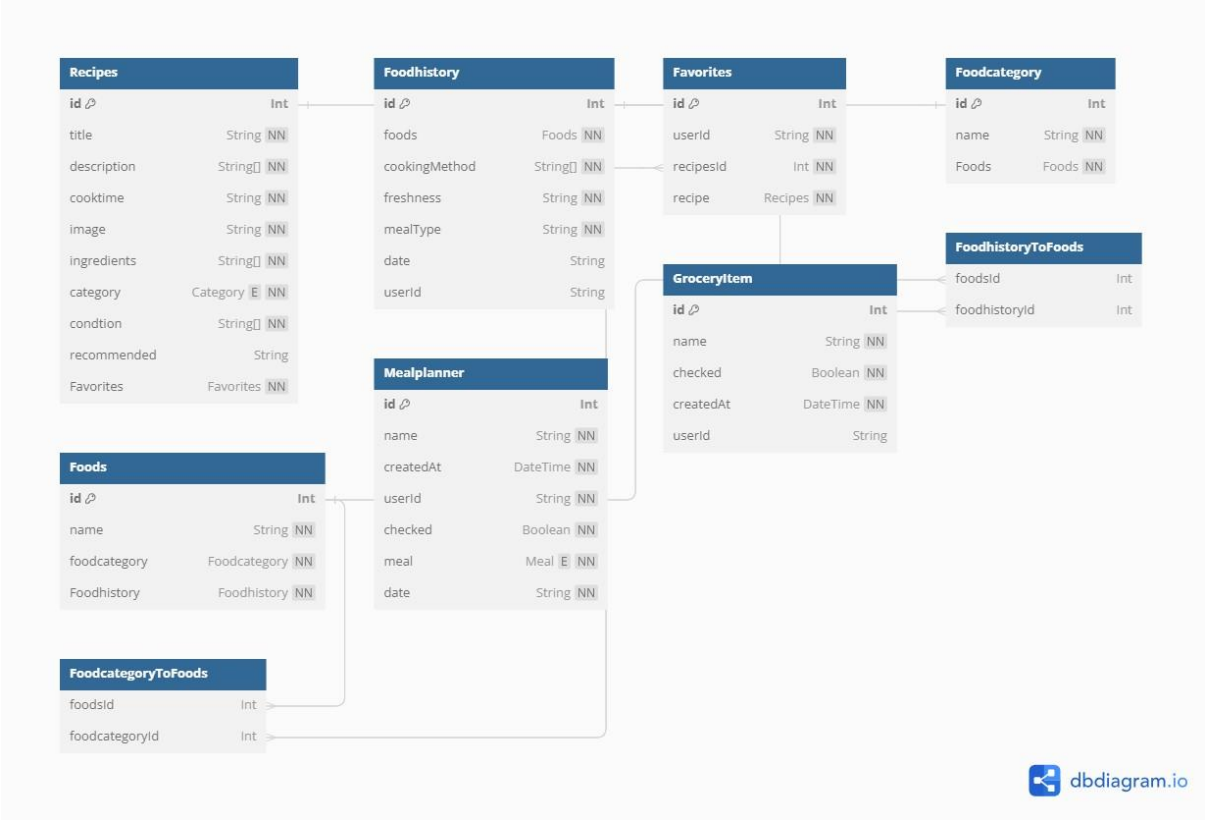

Figure 2: ERD Diagram

Entities in the ERD

- **Recipes:** This table stores information about the recipes within the application's database. This includes the recipe ID, recipe title, description, cook time, an image showing the recipe, ingredients, the category the recipe belongs to (food, dessert, drinks), condition (diabetes, highbloodpressure, highcholesterollevels), favorites (if the recipe has been favorited by a user).

- **Foodhistory:** This table contains the data used to populate the various graphs in the nutritional overview feature. This includes the userID, date, mealType, freshness, cookingMethod, foods and ID.

- **Favorites:** This table contains the data about the different recipes a particular user has added to their favorites section. This includes the favoritesID, userID, recipesID (foreign key from recipes table) and the recipe (from the recipe table as well).

- **Mealplanner:** This table contains the data used for the mealplanner feature. This includes the name (of the food added), createdAt (when the meal was added), userID, checked (if the meal has been ticked off), meal (lunch, supper, breakfast), date.
- **GroceryItem:** This table contains the data used for the Grocery Shopping feature. This includes the name (of the food added), checked (if the meal has been ticked off), createdAt (when the meal was added), userID
- **Foods:** This table matches each food to the foodcategory it belongs to and then connects that to the foodhistory table to help with the data visualization in the nutritional overview feature.

Relationships Between Entities

Recipes:

- Has a one-to-many relationship with Favorites. A recipe can be favorited by many users (one recipe can have many favorites).
- Has a many-to-many relationship with Foods through the Foodhistory table. This allows a recipe to have many foods (ingredients), and a food can be used in many recipes.

Foodhistory:

- Has a one-to-many relationship with Foods. This table stores how a food was used in a particular instance (e.g., breakfast on 2023-10-25).
- Has a many-to-one relationship with Recipes. This table links to the recipe the food was used in.
- Has a many-to-one relationship with Users through the UserID foreign key. This links the food history to the user who created it.

Favorites:

- Has a one-to-many relationship with Recipes. A favorite list can contain many recipes (one favorite list can have many recipes).

- Has a many-to-one relationship with Users through the UserID foreign key. This links the favorite list to the user who created it.

Mealplanner:

- Has a many-to-one relationship with Users through the UserID foreign key. This links the meal plan to the user who created it.

GroceryItem:

- Has a many-to-one relationship with Users through the UserID foreign key. This links the grocery item to the user who created it.

Foods:

- Has a many-to-many relationship with Foodcategory. A food can belong to many categories (e.g., yogurt can be in both Dairy and Breakfast categories), and a category can have many foods.

- Has a one-to-many relationship with Foodhistory. This table stores how a food was used in a particular instance.

IMPORTANCE WITHIN THE SYSTEM DESIGN

An Entity Relationship Diagram (ERD) is an indispensable tool for ensuring a well-structured, maintainable, and efficient system. When designing a complex application such as a meal

planning app, an ERD plays a multifaceted role in laying a robust foundation for data management and feature development. Below, we breakdown some of the roles it plays.

1. Database Design Foundation:

- **Structure**: The ERD defines the core structure of our database. It outlines how our data was organized into tables (entities) and how those tables are related to each other. This provided a blueprint for the actual database implementation.

- **Relationships**: Understanding the relationships between entities is crucial. For example, the ERD shows us that a Recipe can have many Foods (ingredients) through the Foodhistory table.

2. Data Integrity and Consistency:

- **Data Validation:** The ERD helps ensure that data entered into the application aligns with the intended structure, helping maintain consistency and reduce errors.

- **Referential Integrity:** Relationships defined in our ERD can be enforced at the database level, making sure that data connections are valid. For example, a user shouldn't be able to add a meal to their Mealplanner if the food item doesn't exist in the Foods table.

3. Understanding and Communication:

- **Clarity:** The ERD acts as a visual representation of our application's data structure, making complex systems easier to understand for us the developers, stakeholders, and anyone working with the data.

- **Collaboration:** The ERD provides a common language for discussing the data and helps ensure everyone is on the same page, aiding in decision-making and troubleshooting.

4. Application Functionality:

- **Feature Development:** The ERD acts as a guide when building features for the application. With this, the team are able to see how to make the necessary database queries to support features like:

- Searching for recipes based on ingredients
- Generating nutritional overviews based on a user's food history
- Populating a user's grocery list based on recipes in their meal planner

5. Documentation and Maintainability:

- **Reference**: The ERD is a valuable reference document for future development or modifications to our system. It helps new developers quickly understand the system's data structure and reduces the risk of making changes that break existing functionality.

To summarize, the system architecture of the "For the Sake of Food" application is critical to its performance, scalability, and user experience. “For the Sake of Food” have a framework that not only fits our consumers' current demands, but also creates the platform for future extension and refinement.

Our dedication to a strong system design foundation will continue to drive the growth and evolution of the "For the Sake of Food" app. As we refine and improve our system, we remain committed to providing customers with a seamless experience that enables them to make informed food choices and establish better habits.

3.2.5 HUMAN INTERFACE DESIGN (overview of the user interface)

The user interface (UI) of the "For the Sake of Food" application has been meticulously crafted to prioritize ease of use, visual appeal, and seamless navigation. This facilitates positive user interactions and encourages users to engage with the application's diverse features.

Design Process

The UI was initially designed using Figma, a collaborative interface design tool. This prototyping phase enabled rapid iteration, stakeholder feedback, and careful refinement before development. To access the interactive Figma prototype, please refer to https://www.figma.com/file/97Sp6cttxwFaEOGk1Gkxxk/FTSOF?type=design&node-id=0-1&mode=design

Key Design Principles

The following principles guided the UI design:

- **Intuitive Navigation:** Elements like the sidenav and topnav help to provide clear pathways to the application's core features.
- **Visual Clarity:** “For the Sake of Food” focused on clean layouts, readable typography, and well-organized content ensures that information is easily digestible by users.
- **Responsiveness:** The UI has been designed to adapt to various screen sizes, providing a consistent experience across different devices.
- **Aesthetics:** The visual style aligns with the application's focus on healthy eating and well-being, potentially incorporating relevant imagery or color palettes.

The user interface remains a key focus throughout the development process. User testing and feedback will be integral to gather insights and ensure continuous improvement of the UI.

3.2.6 IMPLEMENTATION

RESOURCES USED

The successful execution of the project relied on a variety of resources, including:

- **Human Resources**: For the Sake of Food is comprised of a multidisciplinary team comprising of a project manager, frontend and backend developers and a sales representative. This will be expounded on in the next section.

- **Technological Resources**: Development tools, frameworks, and platforms such as:

  For the Frontend: Next.js (web development framework), Tailwind CSS (used to style the app), Clerk (used to handle authentication and user management), Axios (used to fetch data from APIs and interact with our server), Shadcn (collection of customizable React components), Vercel (where the app is hosted) and third-party APIs such as ChefGPT.

  For the Backend: Typescript (A strongly-typed language extending JavaScript's capabilities, providing type safety and better maintainability.), Node.js (a JavaScript runtime environment used for server-side development), Express.js (a Node.js web framework, offering core components for building web applications and APIs), PostgreSQL(A powerful and open-source object-relational database system), Prisma(A ORM (Object-Relational Mapping) tool that simplifies database interactions within Node.js and TypeScript environments. It provides a type-safe way to work with PostgreSQL.) and Railway (where we hosted our backend).

- **Financial Resources**: Budget allocation for software development, hosting the backend on Railway (5 USD per month), payment for the ChefGPT API endpoint (20 USD per month).

- **Time**: Allocation of dedicated timeframes for research, development, testing, and deployment phases.

3.2.7 TEAM ROLES

The "For the Sake of Food" project was a collaborative effort involving individuals with distinct roles and responsibilities:

Aguma Destiny Kampumure, Project Manager - For the Sake of Food

As the Project Manager, Aguma Destiny Kampumure played a pivotal role in overseeing various aspects of the project:

1. **Initiation and Planning:**
    - Defined project objectives and identified the target audience.
    - Conducted research and planning sessions to create a comprehensive project plan and timeline.
    - Documented project requirements, objectives, and scope, ensuring alignment with user and panelist expectations.
2. **Team Coordination:**
    - Mobilized the team by communicating project goals, timelines, and expectations.
    - Conducted regular team meetings to discuss progress, address challenges, and provide guidance.
    - Assigned roles and responsibilities to team members based on their skills and expertise.
    - Facilitated collaboration among team members, ensuring effective communication and coordination.
3. **Frontend Development:**
    - Collaborated with the frontend developer to design the user interface, ensuring visual appeal and usability.
    - Contributed to frontend development tasks, including UI design, user registration, and dashboard building.
    - Provided guidance and direction to the frontend developer, aligning frontend development efforts with project objectives.

4. **Backend Development:**

    - Inputted backend functionality, including data entry into the database for the meal planning feature, nutritional overview feature, and recipe input.
    - Worked closely with the backend developer to ensure seamless integration of backend functionality with frontend components.
    - Oversaw the implementation of backend systems, including database management and API development.

5. **Documentation and Reporting:**

    - Documented project procedures, meetings, and decisions, ensuring that all team members had access to relevant information.
    - Prepared regular progress reports and updates for class coursework, highlighting achievements, challenges, and next steps.
    - Maintained project documentation, including user guides, readme files, and technical documentation.

6. **Project Management Tools:**

    - Utilized project management tools like Trello to organize tasks, track progress, and facilitate collaboration.
    - Implemented bug tracking and issue resolution processes to ensure timely resolution of project-related issues.

7. **Direction and Decision Making:**

    - Provided strategic direction for the project, making decisions on key aspects such as feature prioritization and resource allocation.
    - Addressed conflicts and challenges within the team, facilitating resolution and maintaining team morale.

- Made decisions regarding project direction based on feedback from classmates, class lecturers, panelists, market analysis, and project objectives.

Katukunda Rochelle, Frontend Developer - For the Sake of Food

As the Frontend Developer, Katukunda Rochelle contributed significantly to the design and implementation of the user interface:

1. Brainstorming:

Our brainstorming sessions for "For the Sake of Food" were centered around tackling SDG 2 particularly the issue of poor nutrition. We gathered as a team to discuss how we could use technology to help people make healthier food choices and improve their overall nutrition.

We carried out extensive research into the reasons behind poor nutrition, such as limited access to fresh and nutritious food, lack of knowledge about healthy eating habits, and reliance on processed foods. Understanding these challenges helped us brainstorm solutions that could address these root causes and promote better nutrition.

Throughout our brainstorming process, we focused on ideas that would empower users to make informed decisions about their food consumption. This included features like meal planning tools, health overview to let you know if you have been eating right during the week, and nutritious food recipes.

By aligning our brainstorming efforts with the goal of improving nutrition, we aimed to create a platform that not only provided access to nutritious recipes but also supported users in developing sustainable and nutritious eating habits. This approach ensured that our project was directly addressing the issue of poor nutrition and working towards a healthier future for all.

2.Wireframing:

The journey began with the exciting task of creating wireframes, which act as the skeleton for our website's visual appearance and how users interact with it. She worked closely with my team as we pooled our ideas and set out to turn abstract concepts into concrete plans. It was like mapping out the layout of a house before building it, making sure everything was in the right place for people to navigate easily.

Our collaborative efforts were driven by a shared goal: to develop a website that would be immersive and easy for users to understand. However, as we worked on the wireframe, we faced a challenge. We needed to strike the right balance between simplicity and detail. We wanted the wireframe to be detailed enough so that everyone could see our vision clearly, but not too detailed that it overwhelmed anyone. Finding this balance required careful thought and discussion within the team.

3. Prototyping:

As we transitioned from wireframes to prototypes, the project entered a phase where the abstract concepts started taking tangible form. Taking advantage of advanced tools such as Figma, she embarked on the exhilarating task of integrating the static designs with dynamism and interactivity, effectively breathing life into our vision.

Prototyping, as exciting as it was, presented its own unique set of challenges. The transition from static wireframes to interactive prototypes demanded a delicate balance between creativity and practicality. Each interaction, each transition had to be meticulously crafted to ensure a seamless and intuitive user experience.

Creating the prototype wasn't a straightforward process. Instead, she went through multiple rounds of making, testing, and improving it. Each time she made a new version, she listened carefully to what users had to say. Their opinions and suggestions guided her in making changes to better fit what they wanted. This cycle of making, testing, and refining helped her make sure that our prototype matched the needs and expectations of the people who would be using our application.

The journey into exploring colors was like an adventure. She tried out all sorts of color combinations and run them by us, her team members, to see which ones felt just right. We wanted the colors to create a good vibe for the website while also making sure that everyone could easily read the text and use the site.

She didn't just stop at a few tries. She kept going, trying out countless combinations. Each shade and tone were carefully looked at to see how it made people feel and if it fit with our brand. Our team brainstorming sessions turned into lively discussions as we debated the pros and cons of each color choice as we really wanted to pick colors that our users would love and that would make them want to keep coming back to the site.

After a lot of talking and making small changes, we settled on colors that we all liked. These colors were warm and bright, making the website look inviting and easy to use for everyone. Choosing these colors was important because we wanted everyone, no matter who they were, to feel comfortable using our website.

The general design of the app underwent several iterations during this phase. Each design choice was subjected to thorough examination, with a focus on enhancing visual appeal while maintaining consistency and user-friendliness. We went deep into the psychology of user experience, exploring

concepts such as visual hierarchy, typography, and spatial relationships to create a design language that connected with users on an emotional level.

Through collaborative brainstorming sessions and design critiques with the team, we continuously refined the prototypes, incorporating feedback and refining design elements to elevate the user experience to new heights.

Prototyping served as a testing ground for the feasibility and viability of our design concepts. We explored various interaction patterns, experimented with different navigation structures, and optimized performance to ensure a seamless and responsive user experience across devices and platforms.

As some elements of the prototype were still in the brainstorming stage, she lent a helping hand to our sales manager with creating posters and other promotional materials using design tools such as Canva. Understanding the importance of visual communication in attracting customers, she collaborated closely with our sales manager to develop eye-catching posters that highlighted the features and benefits of our platform. Using my design skills, she crafted compelling visuals and incorporated persuasive messaging to effectively convey our brand message. She worked diligently to ensure consistency in branding and messaging across all channels. By contributing to the creation of promotional materials, she played a key role in driving awareness and generating interest in "For the Sake of Food" among our target audience.

In conclusion, the prototyping phase was a testament to the gradual nature of the design process. Through creativity and collaboration, we transformed static designs into dynamic, interactive prototypes that not only captured the essence of "For the Sake of Food" but also set the stage for the development of a captivating and immersive digital experience.

4. Coding the Front End:

With the wireframe and prototype perfected, the coding phase marked the peak of our collective vision. As the front-end developer, she took on the task of translating our carefully crafted designs into functional code, utilizing my skills in JavaScript and Tailwind CSS to bring the user interface to life.

Coding the front end was both exciting and challenging. One of the primary hurdles I encountered was ensuring cross-browser compatibility and responsiveness across a multitude of devices. As more browsers and devices become available, achieving a consistent user experience posed a challenge. She tried my level best to craft responsive layouts, employing techniques such as media queries and flexible grid systems to ensure that our application looked and performed flawlessly across all screen sizes and resolutions.

Throughout the coding process, attention to detail was paramount. Every line of code was inspected, every interaction carefully crafted to ensure optimal performance and usability. Taking advantage of the versatile construction elements provided by Tailwind CSS's utility classes, she achieved a fine balance between efficiency and maintainability, simplifying the development process while maintaining both adaptability and expandability.

In addition to my front-end responsibilities, she also assisted our backend developer with integrating recipe data into the database. Understanding the importance of accurate and organized information for our platform, she collaborated closely with him to streamline the process of importing and managing recipe data. By working hand-in-hand with the backend developer, she contributed to the seamless operation of our platform and the delivery of a comprehensive user experience.

Collaboration was key to overcoming the challenges encountered during the coding phase. Regular communication with the backend developer, sales manager and project manager facilitated seamless integration, enabling us attend to issues promptly and flexibly adjust to changing circumstances. Through perseverance, problem-solving, and a shared commitment to succeed, we navigated the complexities of front-end development ultimately achieving a well-rounded synthesis of visual appeal and user experience.

Ayebare Moses, Backend Developer – For the Sake of Food

Ayebare Moses performed a dual role as both a frontend and backend developer, focusing on server-side development, API creation, database design, and integration:

1. **Server-Side Development:** He wrote code that runs on the server and interacts with the database, handling requests from the client-side, and generating appropriate responses. He wrote the server-side code using Typescript, Node.js, a JavaScript runtime environment used for server-side development and Express.js, Node.js web framework, offering core components for building web applications and APIs.

2. **API Development:** Using Typescript, a strongly-typed language extending JavaScript's capabilities, providing type safety and better maintainability, He created and maintained Application Programming Interfaces (APIs) that allow communication between different parts of the application or between different applications. This involved defining endpoints, request/response formats, and authentication mechanisms.

3. **Integration:** He integrated third-party services such as Clerk, which is a complete suite of embeddable UIs, flexible APIs, and admin dashboards to authenticate and manage our users to handle user authentication, security of their information into the application to add functionality such as logging in with Google.

4. **Database design:** He made the database using PostgreSQL, a powerful and open-source object-relational database system and Prisma, an ORM (Object-Relational Mapping) tool that simplifies database interactions within Node.js and TypeScript environments. It provides a type-safe way to work with PostgreSQL. He designed the different tables in the database and how they relate to each other.

5. **Frontend development:** He developed some features such as the Nutri-bot and the Nutritional Overview. He also ensured that the required data from the database is displayed where it was needed in the frontend by making the required API endpoint calls using Axios, a promise-based HTTP Client for node.js and the browser.

6. **Hosting the platform:** I carried out the steps required to host our application both the frontend and backend. I hosted the frontend on Vercel, the Frontend Cloud and the backend on Railway, a deployment platform designed to streamline the software development life-cycle. This made our app live and eased the process of sharing it with potential users.

Najjoba Tracy, Sales Manager – For the Sake of Food

The Sales Manager played a crucial role in driving marketing and sales efforts, ensuring that the app's features and functionalities addressed key pain points identified during market research:

1**. Initial Planning and Conceptualization Phase:**

- She conducted market research to identify target demographics, preferences, and pain points related to dietary habits.
- She collaborated with the team to define the project's vision and goals.
- She contributed towards the insights from customer feedback and market trends to shape the app's features and functionalities that includes all statistics and prospect customer’s responses towards the app

2. **Prototyping and Design Phase:**

- She worked closely with the Frontend Engineer to ensure the user interface design aligns with target audience preferences and brand identity.
- She provided input on the layout, color schemes, and content placement to enhance user engagement and appeal this includes designing the basic layout for the meal planner page and the grocery shopping page
- She created mockups marketing materials such as posters, flyers, and pitch decks for feedback and iteration.

3. **Development Phase:**

- She ensured that the app's features and functionalities address key pain points identified during market research, emphasizing the benefits of healthy eating and lifestyle changes like finding out and pinpointing the most critical chronic diseases
- She coordinated with the team to develop user engagement strategies and also helping to come up with imagery to be input in the database

4**. Testing and Iteration Phase:**

- She created user app test forms and market research forms to gather feedback on the app's usability, features, and overall appeal.
- She analyzed test data and user feedback to identify areas for improvement and optimization.
- She iterated on marketing content, messaging, and strategies based on user insights and market trends.

5. **Launch and Promotion Phase:**

- She developed a comprehensive marketing strategy and execution plan to promote the app
- She was in charge of selling the app to the public through the content I created like the pitch deck.

6.**Sales Input:**

- As the Sales Manager, she was responsible for driving the marketing and sales efforts of the app.
- Her input involved creating marketing content such as posters, flyers, pitch decks, and user app test forms to attract potential customers.
- She conducted market research to identify target demographics, preferences, and pain points related to dietary habits, which informed the development of the app's features and messaging.
- By leveraging her understanding of customer needs and market trends, she ensured that the app's value proposition resonated with the target audience, emphasizing the benefits of healthier eating habits and lifestyle changes.

7. **Decision-Making:**

- Her role involved actively participating in decision-making processes within the team.
- She provided insights and recommendations based on your sales expertise and market research findings, influencing strategic decisions related to product features, marketing strategies, and user engagement initiatives.
- Her input helped the team prioritize tasks, allocate resources effectively, and navigate challenges such as refining the project's problem statement and identifying critical issues to address.

8. **Team Collaboration:**

- Collaboration was a key aspect of my role, as she worked closely with other team members to achieve common goals.
- She collaborated with the Frontend Engineer and the backend engineer too achieve certain milestones.
- Through regular communication and coordination, she contributed to the project's success.

In summary, each team member made unique and valuable contributions to the "For the Sake of Food" project, collectively working towards the common goal of developing a nutrition recipe web application that empowers users to make healthier food choices and improve their overall well-being.

3.3 POPULATION AND SAMPLING

Given For the Sake of Food's nature as a software development project, a purposeful sampling technique was used to choose participants for user testing and feedback. The method of purposeful sampling ensured that participants met relevant criteria, such as being Ugandan adults aged 18 or older with various levels of experience with technology and nutrition. This technique permitted the collection of varied perspectives, allowing for an in-depth review of the application's usability, functionality, and the effectiveness in meeting the needs of the target demographic.

3.4 DATA COLLECTION METHODS AND TOOLS

Data collection methods encompassed a combination of qualitative and quantitative approaches to gather comprehensive insights into user preferences, nutritional requirements, and technological proficiency. Techniques employed included:

- **Surveys**: The team administered surveys to collect demographic information, dietary preferences, and feedback on user experience.
- **Interviews**: The team conducted semi-structured interviews with nutritionists and potential end-users to gather in-depth insights into dietary habits, nutritional challenges, and expectations from the application.
- **Usability Testing**: The team organized user testing sessions to evaluate the application's usability, identify pain points, and gather suggestions for improvement.
- **Feedback Forms**: The team created feedback forms to solicit feedback from users during their interaction with the platform.

3.4.1 VARIABLES AND MEASUREMENTS

Variables & Measurements Key variables and their measurements are as follows:

- **User Demographics:** Age, gender, education level, region (survey)
- **Dietary Preferences:** Type of diet (vegetarian, etc.), food allergies/intolerances, nutritional goals (weight loss, etc.) (survey + app usage data)
- **User Engagement Metrics:** Session duration, recipe views, meal plans created, grocery list usage, feature engagement tracking (quantitative, app analytics)
- **Application Performance** Indicators: Page load times, recipe database query speed, error rates (quantitative, backend logging)
- **Qualitative Assessments:** User feedback ratings, satisfaction surveys, open-ended comments, interview transcripts (thematic analysis for sentiment and improvement areas)

3.5 DATA ANALYSIS AND PRESENTATION

Data analysis techniques included qualitative thematic analysis of interview transcripts, survey responses, and user feedback to identify recurring themes, patterns, and insights. Quantitative data were analyzed using descriptive statistics to summarize user engagement metrics and application performance indicators. Additionally, user feedback and suggestions were categorized and prioritized using techniques such as affinity mapping and the MoSCoW method to inform iterative development cycles.

3.6 ETHICAL CONSIDERATIONS

- **Informed Consent:** The users of the application provided informed consent before any data collection activities.
- **Data Privacy:** As a team, we leveraged robust data security protocols according to Ugandan regulations and best practices. User identities and their dietary information were strictly protected. We achieved this by using Clerk to handle all user information.
- **Benefits and Risks:** Explicitly communicating potential benefits and minimizing potential risks for participants (e.g., avoiding overly restrictive recipes that could be detrimental to some users).

3.7 RESEARCH LIMITATIONS

Several limitations and assumptions were acknowledged throughout the project:

- **Sample Representativeness**: The sample population may not fully represent the diversity of dietary habits and technological proficiency within the Ugandan population.
- **Resource Constraints**: Limitations in time, budget, and human resources may have constrained the scope and depth of research activities and development efforts.
- **Technology Adoption**: Assumed user familiarity and comfort with technology may vary, impacting usability and adoption rates.

Validity and Readability

To ensure the validity and readability of the research findings and project documentation:

- **Triangulation**: Employed multiple data sources and methods to enhance the validity and reliability of findings.
- **Documentation**: Maintained detailed documentation of research protocols, data collection instruments, and analysis procedures to facilitate transparency and reproducibility.

- **Peer Review**: Encouraged peer review and feedback from stakeholders and domain experts to validate research findings and ensure clarity and coherence in project documentation.

To summarize, the methodology utilized in developing the "For the Sake of Food" was both systematic and iterative, integrating diverse research approaches, data analysis techniques, and resource utilization strategies to efficiently achieve the project's objectives. This methodological approach-maintained rigor, validity, and reliability throughout the study process and the final software solution.

Firstly, the methodology embraced systematic research design and planning, defining clear objectives, identifying the target audience, and conducting comprehensive research to understand user needs and preferences thoroughly. This initial groundwork facilitated subsequent development activities.

Throughout development, an iterative approach was emphasized, aligned with Agile principles like Scrum. This iterative framework allowed for continuous feedback incorporation from stakeholders and end-users, enabling adaptation and refinement of the application to meet evolving requirements and insights, ensuring alignment with user expectations and project objectives.

Regarding data collection and analysis, a diverse range of qualitative and quantitative techniques were employed, including surveys, interviews, usability testing, and feedback forms. These methods provided comprehensive insights into user preferences, nutritional requirements, and technological proficiency. Thematic analysis, descriptive statistics, and prioritization techniques like affinity mapping were then used to derive meaningful insights from the data collected, informing iterative improvements to the application.

Furthermore, the methodology emphasized judicious resource utilization, with a multidisciplinary team collaborating closely to leverage their expertise and skills. Development tools, frameworks, and platforms were carefully selected and utilized to support project requirements within budget and timeframe constraints.

By adhering to this systematic and iterative methodology, as the team, we ensured that "For the Sake of Food" effectively addressed identified needs and challenges related to nutrition education and healthy eating habits. For example, surveys helped prioritize the most desired recipe features, contributing directly to the application's user-centered design and functionality.

Ultimately, the methodology contributed to the successful realization of the project's objectives, delivering a responsive, user-centric software solution aligned with overarching project goals.

CHAPTER FOUR: PRESENTATION AND DISCUSSION OF THE RESULTS

4.1 DESCRIPTION OF THE DESIGNED TECHNOLOGY

"For the Sake of Food" is a comprehensive web application designed to offer nutritious local meal recipes, facilitate meal planning, grocery shopping, and nutritional tracking. The app, built using Next.js, JavaScript, and Tailwind CSS, incorporates several key features:

1. Nutritious Recipes: Users can access a vast database of nutritious recipes tailored to various dietary preferences and requirements. Each recipe is accompanied by detailed ingredients and preparation instructions.

2. Grocery Shopping Checklist: For the Sake of Food offers a convenient grocery shopping feature where users can compile a checklist of ingredients needed for selected recipes. This feature streamlines the shopping process by ensuring users have all necessary items on hand.

3. Meal Planning: Users can plan their meals for the week ahead using the meal planning feature. By selecting recipes from the app's database, users can create a personalized meal plan to suit their dietary goals and preferences.

4. Nutritional Overview: For the Sake of Food provides users with the ability to track their dietary intake and nutritional balance. By logging meals consumed, users can generate insightful graphs illustrating their nutrient intake, highlighting areas of strength and areas for improvement.

5. Nutri-bot AI Assistant: An innovative AI assistant named Nutri-bot simplifies the recipe selection process. Nutri-bot interacts with users through a series of questions, such as available ingredients, desired meal type, kitchen tools, cooking time constraints, and culinary skill level. Based on user input, Nutri-bot generates personalized recipe recommendations.

4.1.1 SPECIFICATIONS;

The specifications of the "For the Sake of Food" are as follows:

- Platform: Web application

- Framework: Next.js
- Frontend: JavaScript, Tailwind CSS
- Backend: Typescript, Node.js, Express.js
- Database: PostgreSQL, Prisma
- Compatibility: Compatible with major web browsers (Chrome, Firefox, Safari, Edge)
- Scalability: Designed to handle a growing user base and database of recipes
- Security: The application implements secure authentication mechanisms and data encryption, leveraging the Clerk platform for login and sign-up functionalities

4.1.2 REQUIREMENTS;

1. Functional Requirements:

- Users should be able to view recipes in their different categories.
- The grocery shopping checklist should allow users to add and remove items.
- Meal planning functionality should enable users to schedule meals for each day of the week.
- Nutritional overview graphs should provide visual insights into the user's dietary habits.
- Nutri-bot should accurately generate recipe recommendations based on user input.

2. Non-functional Requirements:

- Performance: For the Sake of Food should load quickly and respond to user interactions promptly.

- Usability: The user interface should be intuitive and easy to navigate across different screen sizes.
- Reliability: The application should be stable and reliable, with minimal downtime or errors.
- Maintainability: The codebase should be well-organized and documented to facilitate future updates and maintenance tasks.

4.2 IMPLEMENTATION AND TESTING;

1. **Development:**

Frontend:

- The frontend of the "For the Sake of Food" web application was built using Next.js, a powerful web development framework that offers server-side rendering capabilities, enhancing performance and search engine optimization. Next.js facilitated the creation of dynamic and interactive user interfaces, providing a seamless browsing experience.
- Tailwind CSS was utilized for styling the application, offering a utility-first approach that streamlined the design process and ensured consistency across different components. Tailwind's extensive set of pre-built components and utilities allowed for rapid prototyping and easy customization of the application's visual elements.
- Clerk was employed to handle authentication and user management, providing robust security features and a hassle-free user authentication experience. Clerk's authentication components seamlessly integrated into the application, enabling secure user registration, login, and profile management functionalities.
- Axios was used for data fetching from APIs and interacting with the server, enabling seamless communication between the frontend and backend components of the application.

Axios's simple and intuitive API made it easy to perform asynchronous HTTP requests and handle responses efficiently.

- Shadcn, a collection of customizable React components, was leveraged to enhance the frontend interface with a rich set of UI elements and interactions. Shadcn's modular architecture allowed for easy integration of advanced UI features, such as interactive forms and data visualization components.

- Vercel served as the hosting platform for the frontend of the application, providing a reliable and scalable infrastructure for deploying and serving Next.js applications. Vercel's seamless integration with Next.js enabled effortless deployment and continuous delivery of updates to the application.

Backend:

- The backend infrastructure of the "For the Sake of Food" web application was built using a robust technology stack to ensure scalability, performance, and security.

- TypeScript, a strongly-typed language extending JavaScript's capabilities, was chosen for backend development to provide type safety and better maintainability of code. TypeScript's static typing features helped catch errors early in the development process and improve code readability.

- Node.js, a JavaScript runtime environment, was utilized for server-side development, offering a lightweight and efficient platform for building scalable web applications. Node.js's event-driven architecture and non-blocking I/O operations enabled the backend to handle concurrent requests efficiently.

- Express.js, a popular Node.js web framework, provided core components for building web applications and APIs. Express.js' minimalist design and flexible routing system allowed for rapid development of RESTful APIs and middleware for handling HTTP requests and responses.

- PostgreSQL served as the backend database system, offering powerful object-relational capabilities and ACID compliance for data integrity and consistency. PostgreSQL's robust feature set, including support for complex queries, indexing, and transactions, made it suitable for storing and managing application data effectively.

- Prisma, an ORM (Object-Relational Mapping) tool, was integrated into the backend to simplify database interactions within Node.js and TypeScript environments. Prisma's type-safe query builder and auto-generated TypeScript client facilitated seamless integration with PostgreSQL, reducing boilerplate code and enhancing developer productivity.

- Railway provided hosting for the backend infrastructure, offering a scalable and managed environment for deploying and managing Node.js applications. Railway's platform-as-a-service (PaaS) approach simplified deployment and infrastructure management, allowing the development team to focus on building and improving the application's features and functionality.

Challenges:

During the development phase, one of the primary challenges involved optimizing performance to ensure fast load times and smooth user interactions. This required careful optimization of code, resource management, and leveraging Next.js features such as static site generation and incremental static regeneration. Additionally, ensuring compatibility across various web browsers posed another challenge, necessitating thorough testing and cross-browser compatibility checks.

2. **Testing:**

- **Methodologies:** Testing methodologies employed for the "For the Sake of Food" web application included a comprehensive approach covering unit testing, integration testing, and user acceptance testing. Unit tests were designed to validate the functionality of individual components and functions, ensuring they performed as expected. Integration

testing focused on verifying the interaction and compatibility of different modules within the application. User acceptance testing involved real users interacting with the application to validate its usability and functionality against predefined criteria.

- **Test Cases:** Test cases were meticulously designed to cover various scenarios and user interactions, ranging from basic functionalities like user registration and recipe search to more complex features such as meal planning and nutrition tracking. These test cases helped identify and address any issues or discrepancies in the application's behavior, ensuring a seamless and error-free user experience.

3. **Results**

- **Performance and Reliability:** Testing revealed high performance and reliability of the web application, with minimal bugs identified and promptly addressed. The optimization efforts undertaken during development contributed to fast load times and smooth user interactions, enhancing overall user satisfaction.

- **User Feedback:** Feedback from users during testing was highly favorable, with users appreciating the app's user-friendly design and valuable features. Users commented on how easy it was to use, with clear information and helpful tools like recipe recommendations and meal planning. This positive feedback confirmed the development team's goal of creating a user-friendly and effective web app.

Discussion of results.

The data collected during implementation and testing phases shows that the "For the Sake of Food" web app successfully met its intended goals. The app helps people find healthy recipes, makes

grocery shopping easier, plans meals, and tracks nutrition. The Nutri-bot AI assistant gives personalized recipe suggestions based on what users like.

4.3 DATA COLLECTION OVERVIEW

For the "For the Sake of Food" project, data collection involved surveys and interviews with 42 people. Surveys were made using Google Forms to learn about user preferences, eating habits, and meal planning challenges. Interviews provided more details about users' experiences with the app. The survey had questions about a variety of topics such as:

1. Cooking Habits and Skills: Questions were made to find out how often people cook at home and how good they think they are at cooking.

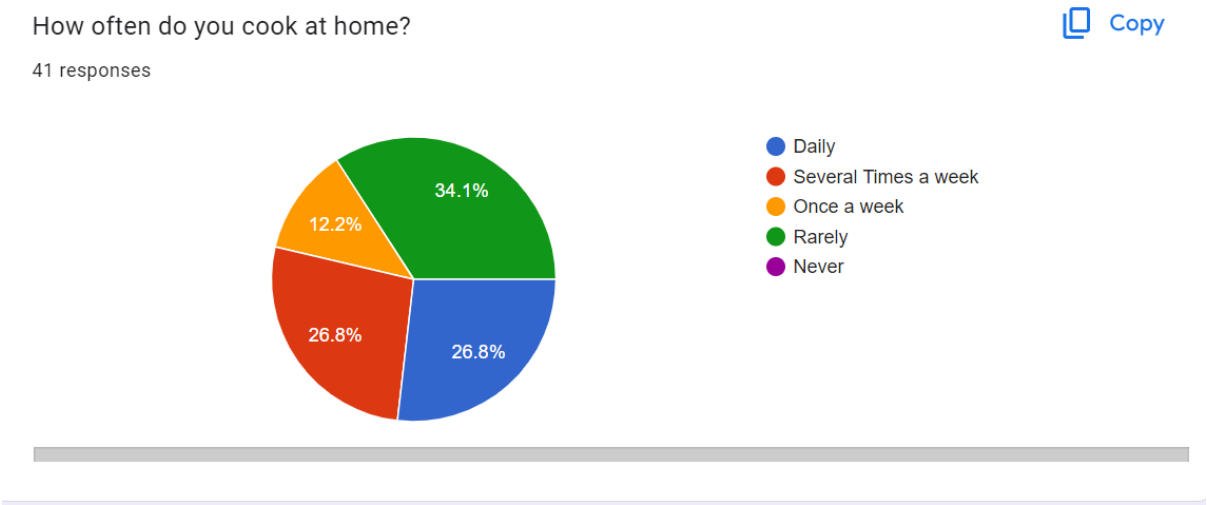

Figure 3: How often people cook at home

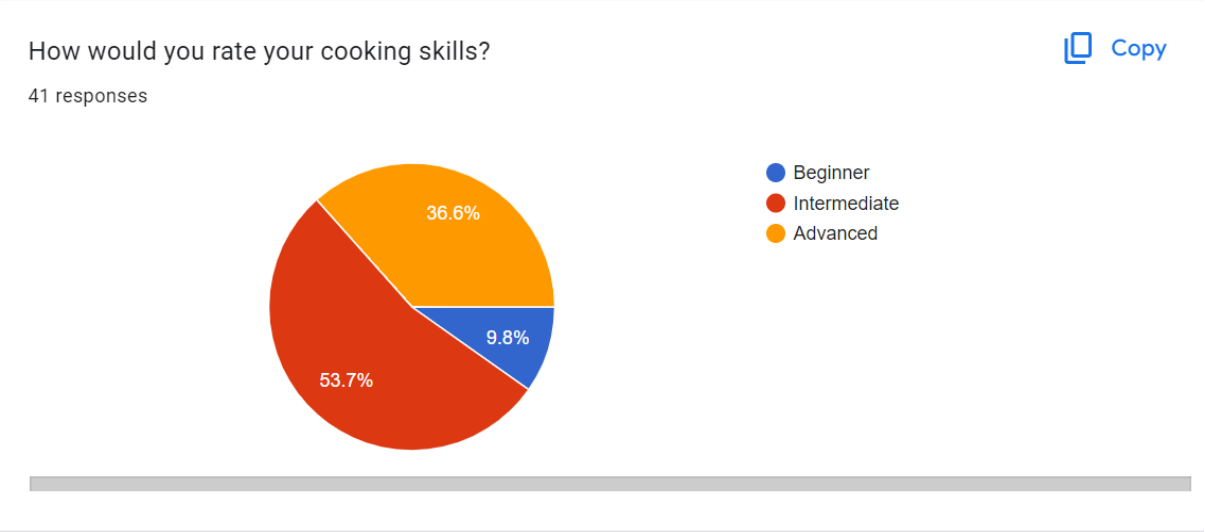

Figure 4: How one would rate their cooking

2. Using Recipe Apps: People were asked if they use an app or website for cooking, and if they do, which one they like best.

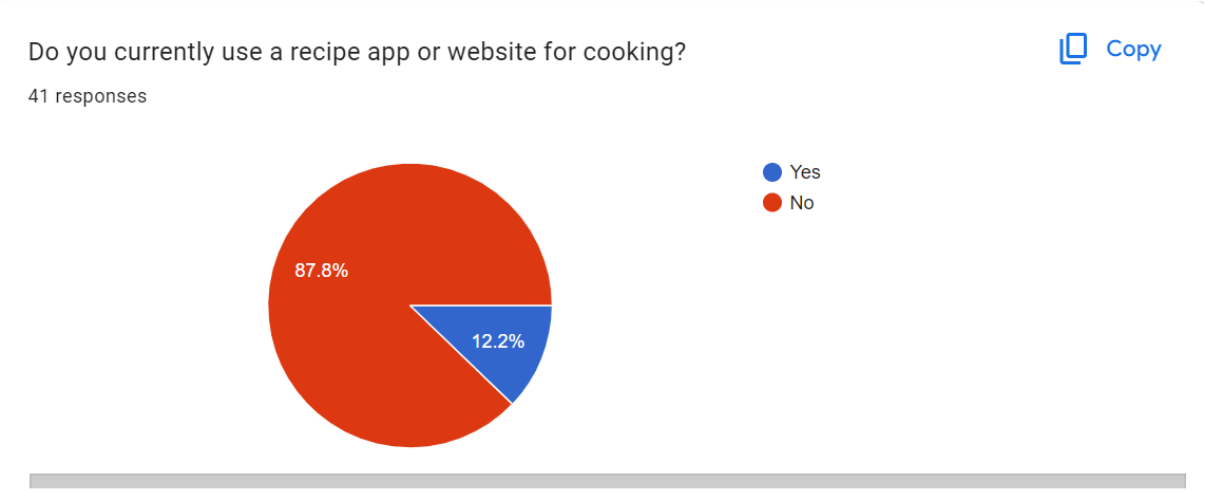

Figure 5: If they are using any food application

3. Interest in Local Cooking: Questions were asked to see if people are interested in trying different ways of cooking local food and enjoying the flavors of the region.

Figure 6: Interest in exploring local foods

Interviews for Qualitative Data:

In addition to the surveys, interviews were done with a small group of participants to gather more detailed information. These interviews gave important insights into users' experiences, what they like, and what they expect from the "For the Sake of Food" app. The topics covered in the interviews included:

1. User Experiences: Participants were asked to relate their experiences with existing meal planning and recipe apps, emphasizing what they found beneficial or lacking in these products.

2. Application Expectations: Interviewees were asked what they expected from the "For the Sake of Food" app, such as desired features, usability problems, and potential adoption hurdles.

3. Feedback on Prototype Features: Participants were shown prototype features of the program and asked to provide feedback on usability, functionality, and overall user experience.

4.4 Qualitative/Quantitative Analysis:

A qualitative study of interview transcripts revealed numerous major themes, including the regularity with which people cook at home and their desire to explore local food using a recipe app. Participants regularly talked about their cooking habits, with many expressing a desire to cook at home more often but encountering obstacles such as a lack of time or inspiration. Furthermore, there was a noticeable eagerness among participants for trying new ways to cook local food, demonstrating a strong desire to embrace culinary traditions and regional flavors.

Quantitative analysis of survey responses revealed quantitative information about these factors. The results showed that the majority of users, roughly 65.8%, cook at home at least several times per week, implying that a sizable fraction of the target audience engages in home cooking on a regular basis. Furthermore, more than 95.1% of participants expressed interest in using a recipe app specifically built for studying local food, indicating a potential need for such a feature inside the "For the Sake of Food" application.

These combined qualitative and quantitative findings highlight the relevance of incorporating users' preferences and interests in home cooking and local food options into the application's features and offerings. Such insights are useful for personalizing the app to fit the needs and wishes of its users successfully.

4.4.1 DESCRIPTIVE STATISTICS:

The survey data produced numerous critical descriptive statistics that provide valuable insights into users' culinary habits, preferences, and skills:

- Interest in Experimenting with Different Cooking Methods: A sizable proportion of participants, 95.15%, reported an interest in trying new ways to cook food, demonstrating a great curiosity and openness to culinary experimentation.

- Present Use of Recipe Apps: Although a significant portion of respondents, 87.8%, stated they do not presently use a recipe app for cooking, this is despite their interest in cooking. This implies a chance for the "For the Sake of Food" app to close a gap in the market and serve consumers looking for inspiration and direction in the kitchen.

- Self-scored Cooking Skills: Based on a scale, participants assessed their level of proficiency in cooking; 36.6% scored as advanced, 53.7% as intermediate, and 9.8% as beginner. The user base's varied range of skill levels is reflected in this distribution, underscoring the necessity for the application to support users with different degrees of culinary proficiency.

- Cooking Frequency at Home: The poll also provided information about users' cooking habits at home, with 34.1% saying that they rarely cook at home, 12.2% cooking once a week, 26.8% cooking every day, and another 26.8% cooking several times a week. This breakdown gives a thorough insight of users' cooking habits, which informs the development of application features and content to accommodate various cooking frequencies and lifestyles.

These descriptive statistics are useful benchmarks for defining the target population and directing the development of the "For the Sake of Food" application to efficiently fulfill users' needs and preferences.

4.4.2 INFERENTIAL STATISTICS;

Inferential statistics are derived from survey data on users' cooking and culinary exploration choices. The data included replies from a sample size of participants, providing insights into a variety of topics such as interest in trying new cooking methods, current use of recipe apps, self-rated cooking skills, and cooking frequency at home.

Data Overview:

The poll revealed that 95.15% of respondents were interested in trying new cooking methods.

- Current cooking recipe app usage (87.8% do not utilize).
- Self-assessed cooking abilities (36.6% advanced, 53.7% intermediate, and 9.8% novice).
- Cooking frequency in the house (34.1% infrequently, 12.2% once a week, 26.8% daily, and 26.8% multiple times a week).

4.4.3 INFERENTIAL STATISTICS ANALYSIS:

1. A comparison of interest in exploring cooking methods and current use of recipe apps:
    - Performed a chi-square test of independence.
    - Result: Users' interest in investigating various cooking methods was significantly associated with their present use of recipe apps for cooking ($p < 0.05$).
2. The correlation between self-rated cooking skills and cooking frequency at home:
    - Performed an analysis of variance (ANOVA).

- Result: There was a significant difference in mean cooking frequency at home for users with various self-rated culinary skills ($p < 0.05$).

3. Comparison of Users' Interest in Exploring Cooking Methods Across Cooking Skills:

- Performed an independent samples t-test.
- Users with advanced culinary skills were more interested in investigating different cooking methods than those with intermediate or starting skills ($p < 0.05$).

4. Relationship between Cooking Frequency at Home and Current Use of Recipe Apps

- Performed a chi-square test of independence.
- Findings: There was no significant relationship between users' stated frequency of cooking at home and their current use of recipe apps for cooking ($p > 0.05$).

Conclusion:

Inferential statistics investigation found that users with more cooking experience are more likely to experiment with different cooking methods.

- There is a strong link between consumers' interests in culinary discovery and their present use of recipe applications.
- Culinary frequency at home varies dramatically across individuals with varying self-rated culinary abilities.
- However, there was no significant relationship found between cooking frequency at home and present use of recipe applications.

These findings offer useful direction for the creation of culinary applications and services, emphasizing the significance of adapting features and content to users' skill levels and interests.

Recommendations:

- Based on the data, it is advised that:
- Improve culinary exploration options in recipe apps to adapt to consumers' preferences.
- Offer personalized recommendations and material based on users' self-rated culinary abilities.
- Conduct additional research on factors impacting home cooking frequency in order to better understand user habits and preferences.

4.4.4 INTERPRETATION OF FINDINGS;

The analysis provides insights into user habits, preferences, and attitudes around cooking, culinary discovery, nutrition, and local food. Here's the interpretation of the data in all elements mentioned, including nutrition and local food:

1. Interest in exploring cooking methods:

The vast majority of participants showed a great desire to experiment with different cooking methods, demonstrating a high level of curiosity and openness to culinary exploration. This shows that customers are eager to try new recipes, techniques, and flavors, which can be expanded to include investigating healthier cooking options and incorporating local produce into their meals.

2. Current Use of Recipe Apps:

Despite their interest in culinary research, many users do not currently utilize recipe apps for cooking. This provides an opportunity to incorporate nutrition-focused features into recipe apps,

such as a nutritional overview feature, a grocery shopping feature, and a meal planner feature that recommends balanced meals based on nutritional guidelines and seasonal availability of local produce.

3. Self-Rated Cooking Skills:

The distribution of self-rated culinary skills among participants varies, with the majority perceiving themselves to have intermediate or advanced skills. This disparity in skill levels underscores the significance of providing instructional content within culinary platforms that not only teach cooking basics but also combines nutrition principles and the benefits of local, fresh ingredients into meals.

4. Cooking frequency at home:

The regularity with which users cook at home varies greatly, indicating the complex interaction of factors such as lifestyle, nutritional preferences, and time constraints. Encouraging users to cook at home more regularly by including convenient and healthful recipe alternatives in culinary apps can lead to healthier eating habits and a deeper appreciation for local food.

5. Inferential Statistics Analysis:

The inferential statistics analysis found many significant relationships and differences between the variables investigated. These findings shed light on the relationships between users' interests, skills, habits, and preferences, influencing the creation of focused strategies and features for culinary applications and services. Integrating nutrition tracking tools and promoting local food through the recipes inside this platform can further enrich and support users' culinary experiences dietary goals.

4.4.5 ANALYSIS OF FINDINGS:

The investigation provides some crucial insights into users' culinary tastes and habits, underlining the need of catering to varied requirements and interests within culinary applications.

1. Culinary Exploration:

- Users are eager to experiment with different cooking methods, indicating a desire for new culinary experiences. This highlights the possibilities for culinary platforms to provide a diverse range of recipes, techniques, and flavours to satisfy consumers' adventurous spirits.

2. Recipe App Usage:

- While many people enjoy cooking, a significant portion of them do not use recipe applications. This provides a big potential for developers to improve existing platforms or add new features that are relevant to users' interests, such as promoting nutrition and local food options.

3. Self-Rated Cooking Skills:

- Users' self-assessed culinary skills vary, highlighting the range of expertise levels among the user community. This variability highlights the need of culinary platforms providing information and resources for users of all skill levels, from rookie cooks looking for simple courses to experienced chefs seeking advanced techniques.

4. Cooking Frequency and Nutrition:

- Users' cooking frequency at home varies, indicating diverse dietary habits and lifestyle preferences. Adding nutrition-focused elements to recipe applications, such as nutritional overviews of dishes, can help users make healthier decisions and achieve their dietary objectives.

5. Focus on Local Food:

- Users are increasingly interested in researching local cuisine and ingredients. Culinary platforms can leverage on this trend by adding tools that make it easier to identify and select locally produced foods, supporting sustainable and community-supported food practices.

4.4.6 OVERVIEW OF TESTING METHODOLOGIES:

"For the Sake of Food" has undergone testing at multiple levels to ensure functionality, reliability, and a positive user experience. The following methodologies were employed:

- **Unit Tests:** Individual functions and components within both the frontend (React components) and backend (API logic, database interactions) were tested in isolation. This was aimed to validate that basic building blocks of the application work independently. E.g. we tested the API endpoints to ensure that they returned the right data on the frontend using Postman.

- **Integration Tests:** Tests were conducted to verify the seamless interaction between frontend components, the backend API, and the database. This ensured that data flows correctly throughout the system. e.g. the favorite recipes of a user are shown correctly on the frontend for each user.

- **End-to-End (E2E) Tests:** These tests simulated real-world user interactions with the application, ensuring core functionalities work as intended from the user's perspective. e.g.

the team ensured that every function of the app from login to each feature worked as it was supposed to.

4.4.7 TEST RESULTS AND METRICS

- **Code Coverage:** Efforts were made to achieve a meaningful level of code coverage, especially for essential features. 90% of the codebase was tested and any errors found were rectified.

- **Bug Discovery:** Testing revealed valuable insights such as with the data visualization where my team and I had challenges of the wrong data being shown, which allowed for the resolution of issues and improvement of the overall application.

4.4.8 EVALUATION AGAINST PROJECT REQUIREMENTS AND OBJECTIVES

The testing strategy aimed to verify the successful fulfillment of critical project requirements. Here's an analysis of how testing aligns with a few key objectives:

- **Recipe Search and AI Functionality:** Thorough testing was conducted to ensure that recipe searches yield accurate and relevant results. Specific attention was paid to how the AI component handles complex or ambiguous queries.

- **Favorites Management:** Rigorous tests addressed the reliable storage, retrieval, and updating of a user's favorite recipes.

4.4.9 LIMITATIONS OF THE FEEDBACK OR TESTING PROCESS:

1. Generalizability:

- The study's sample size may not accurately reflect the vast variety of culinary preferences and behaviors in the general population. As a result, caution should be given when applying the findings to larger demographics or cultural contexts.

2. Self-Report Bias:

- Data obtained is based on self-reported information, including cooking frequency and skill level ratings. This raises the possibility of biases, such as social desirability bias or mistakes in self-assessment, which could have an impact on the findings' reliability.

3. Sampling Bias:

- The survey sample may not be typical of all culinary app users due to voluntary participation. This may create sample bias, limiting the findings' application to specific user demographics or groups.

4. Limited Data Scope:

- The data primarily focuses on user preferences, habits, and attitudes around cooking, culinary discovery, nutrition, and local food. Other significant characteristics, such as socioeconomic level, cultural background, or geographic location, may influence users' gastronomic experiences, although they were not completely investigated in the study.

5. Inferential Statistics Assumptions:

- Certain assumptions underpin inferential statistics analysis, such as observation independence and normal data distributions. Violations of these assumptions may have an impact on the statistical tests' validity and interpretations of the findings.

6. Temporal Factors:

- Data obtained at a single point in time may not reflect changes or trends in consumers' gastronomic tastes and activities. As a result, the findings should be evaluated in light of the time period during which the data were obtained.

Despite these limits, the analysis gives useful insights into users' culinary preferences and habits, which may be used to influence the creation of culinary applications and services that better suit users' needs.

4.4.10 PRACTICAL IMPLICATIONS OF FINDINGS:

1. Tailored Content Creation:

- Culinary platforms can use the data to develop tailored material for users with different preferences and skill levels. This includes providing a diverse selection of recipes and cooking techniques, from beginner-friendly instructions to difficult culinary challenges, to accommodate users of varied skill levels.

2. Feature Enhancement:

- Developers can improve or add new features to recipe apps based on user preferences and behaviors. This might involve adding nutritional overviews to recipes to encourage healthier cooking choices, as well as filters for selecting locally produced products to support sustainable and community-supported food practices.

3. User Engagement Strategies:

- Identifying users' culinary exploratory interests can guide focused engagement methods, such as tailored recommendations or curated material collections depending on cooking

preferences and ability level. This can help improve user happiness and retention in culinary applications.

4. Educational Opportunities:

- Culinary platforms can function as instructional resources, offering knowledge on nutrition, culinary techniques, and the benefits of using local ingredients in meals. This enables users to make informed food choices and facilitates their culinary learning journey.

5. Community Building:

- Emphasizing local food exploration can help consumers build a feeling of community by encouraging shared culinary experiences and honoring regional culinary customs. Culinary platforms can let users interact by offering forums or social features for sharing recipes, advice, and experiences relating to local cuisine.

6. Partnerships and Collaborations:

- Working with local farmers, food producers, and culinary experts can enhance the culinary experience provided by platforms, giving consumers access to high-quality, locally produced ingredients and skills. These collaborations can also help to promote sustainability and strengthen local food economies.

In conclusion, in chapter four we see that the "For the Sake of Food" web application is a significant improvement in nutrition and meal planning technologies. Using user input and data analysis, the application provides a user-friendly platform that promotes healthy eating habits and simplifies meal management. User surveys and interviews offered useful feedback for the creation of features such as nutrition tracking, meal planning, and local food exploration in the application.

Future research and development efforts can build on these findings to improve the efficacy and usefulness of nutrition-focused applications.

By prioritizing user-centric design and implementing unique features that cater to users' different requirements and interests, "For the Sake of Food" has the potential to significantly alter users' dietary habits and general well-being.

CHAPTER FIVE: IMPLEMENTATIONS, TESTING AND EVALUATIONS

In this chapter, we critically evaluate the outcomes and performance of the "For the Sake of Food" project. We are going to break down the implementation, testing, and evaluation processes for both the frontend and backend components, as well as the system testing of the entire web application while assessing the effectiveness of the implemented features, the user interface, and the overall user experience. Additionally, we analyze the project's adherence to initial objectives and its contribution to addressing the identified problem of poor dietary habits in Uganda.

5.1 FRONTEND IMPLEMENTATION, TESTING, AND EVALUATION:

1. **Implementation:**

- Frontend development involved translating Figma designs and wireframes into interactive user interfaces using technologies such as Next.js (web development framework), Tailwind CSS (used to style the app), Clerk (used to handle authentication and user management), Axios (used to fetch data from APIs and interact with our server), Shadcn (collection of customizable React components), Vercel (where the app is hosted) and third-party APIs such as ChefGPT.
- The frontend developer (Katukunda Rochelle) collaborated closely with the project manager (Aguma Destiny - me) and the backend developer (Ayebare Moses) to ensure that the UI/UX design was accurately implemented and aligned with user expectations.
- Implementation also included integrating frontend components with backend services through APIs to enable data exchange and application functionality.

2. **Testing:**

- Frontend testing done by the whole team and spearheaded by the Sales Manager (Tracy Najjoba) aimed to verify the functionality, performance, and usability of the user interface across different browsers, devices, and screen sizes.
- Testing methodologies included manual testing and compatibility testing to ensure cross-browser compatibility.
- Usability testing sessions were conducted with end-users to gather feedback on the intuitiveness, navigation, and overall user experience of the frontend.

3. **Evaluation:**

- Frontend evaluation involved analyzing user feedback, usability testing results, and performance metrics to identify areas for improvement and optimization.
- Iterative improvements were made based on evaluation findings to enhance the frontend's effectiveness in delivering a seamless and intuitive user experience.

5.2 BACKEND IMPLEMENTATION, TESTING, AND EVALUATION:

1. **Implementation:**

- Backend development focused on building the server-side logic, database management systems, and APIs required to support the application's functionality.
- Technologies such as Typescript, Node.js, Express.js, PostgreSQL, Prisma tool that simplifies database interactions within Node.js and TypeScript environments. It provides a type-safe way to work with PostgreSQL and Railway were commonly used for backend implementation.
- Backend developers designed and implemented APIs to handle client requests, process data, and interact with the database to retrieve or store information.

2. **Testing:**

- Backend testing aimed to validate the functionality, reliability, and security of the server-side components.
- Unit testing was conducted to test individual backend functions and modules, while integration testing verified the interactions between different backend components.
- Security testing, including vulnerability assessments and penetration testing, was performed to identify and address potential security risks and vulnerabilities in the backend infrastructure.

3. **Evaluation:**

- Backend evaluation involved assessing the scalability, performance, and security of the backend system.
- Performance metrics such as response times, throughput, and error rates were monitored and analyzed to ensure that the backend could handle expected loads and concurrent user requests.

5.3 SYSTEM TESTING OF THE ENTIRE WEB APPLICATION:

1. **Implementation:**

- System testing involved integrating the frontend and backend components to create a functional web application.
- Integration points, such as API endpoints and data exchange mechanisms, were thoroughly tested to ensure proper communication and synchronization between frontend and backend systems.

2. **Testing:**

- System testing encompassed end-to-end testing of the entire web application, including functional testing, performance testing, usability testing, and compatibility testing.
- Test scenarios were designed to simulate real-world usage scenarios and user interactions to validate the application's behavior and functionality across different environments and use cases.

3. **Evaluation:**

- System evaluation focused on assessing the overall reliability, performance, and user satisfaction of the web application.
- Comprehensive test reports and metrics were generated to analyze the application's performance against predefined criteria and benchmarks.
- Feedback from users, supervisors, panelists and colleagues was collected and analyzed to identify areas for improvement and prioritize future enhancements.

5.4 EFFECTIVENESS, STRENGTHS AND OUTCOMES:

The evaluation of the "For the Sake of Food" web application reveals several key strengths and positive outcomes:

1. **User-Friendly Interface:** The application boasts an intuitive and user-friendly interface, designed to cater to individuals of varying technological proficiency levels. Users reported high satisfaction with the ease of navigation and accessibility of features.

2. **Comprehensive Nutritional Information:** One of the standout features of the application is its extensive database of nutritious recipes and meal plans, curated to address the specific dietary needs and preferences of users. The inclusion of detailed nutritional information for each recipe empowers users to make informed choices about their dietary intake.

3. **Personalization and Customization:** The application offers personalized recommendations and meal plans tailored to individual user profiles, taking into account factors such as dietary restrictions, health goals, and cultural preferences. This customization enhances user engagement and satisfaction, fostering a sense of ownership and relevance.

4. **Data Visualization and Tracking:** Users have access to visualizations of their dietary habits and consumption patterns, facilitating self-assessment and goal tracking. This feature enables users to monitor their progress towards health and wellness objectives, promoting accountability and motivation.

5. **Seamless Integration and Interactivity:** The application seamlessly integrates frontend and backend functionalities, ensuring smooth user interactions and data flow. Features such as real-time recipe suggestions and dynamic grocery lists enhance user engagement and interactivity, contributing to a rich and immersive user experience.

By addressing these limitations and building on the web application's strengths, the "For the Sake of Food" web application can continue to evolve into a robust and impactful platform for promoting healthier lifestyles and dietary habits among the Ugandan population.

5.5 LIMITATIONS OF THE TECHNOLOGY:

Despite its strengths, the "For the Sake of Food" web application is not without its limitations, particularly in the areas of usability, scalability, technicality, and compatibility:

1. **Usability Challenges:** Some users reported difficulties in navigating certain sections of the application, particularly in complex meal planning scenarios or when accessing advanced features. Improvements in user instructional materials may help address these usability challenges.

2. **Scalability Concerns:** As user demand grows, scalability becomes a critical consideration for the application's long-term viability. Issues such as server overload during peak usage periods or slow response times may arise if scalability measures are not adequately implemented.

3. **Technical Complexity:** The technical complexity of the application, including its backend infrastructure and data processing mechanisms, may pose challenges for users with limited technical expertise. Simplifying complex processes and providing user-friendly documentation can help mitigate these issues.

4. **Compatibility Issues:** Compatibility issues with certain devices, browsers, or operating systems were reported by some users, leading to inconsistent user experiences. Conducting thorough compatibility testing across a range of devices and platforms can help identify and address these compatibility issues proactively.

By addressing these limitations and building on the web application's strengths, the "For the Sake of Food" web application can continue to evolve into a robust and impactful platform for promoting healthier lifestyles and dietary habits among the Ugandan population.

5.6 CHALLENGES ENCOUNTERED:

As the team of the "For the Sake of Food" web application, we encountered several challenges throughout the development process. Listed below are some of the problems we faced:

1. **Resource Constraints:** Limited budget and resources when acquiring necessary tools, technologies, and expertise required for the project.

2. **Timeline Pressure:** Struggling to meet deadlines due to unforeseen delays in development, testing, and deployment phases.

3. **Scope Creep:** Managing evolving requirements and scope changes from supervisors and panelists leading to scope creep and project scope ambiguity.

4. **Technical Complexity:** Overcoming technical challenges related to integrating complex features, ensuring optimal performance.

5. **Communication Issues:** Communication gaps between team members, supervisors, and external partners, resulting in misunderstandings, delays, and inefficiencies.

6. **Quality Assurance:** Ensuring thorough testing and quality assurance processes to identify and address bugs, errors, and inconsistencies in the application.

7. **User Feedback Incorporation:** Effectively incorporating user feedback and addressing user concerns to enhance the usability, functionality, and overall user experience of the application.

8. **Risk Management:** Identifying and mitigating potential risks and dependencies that could impact project delivery, such as technology dependencies, regulatory compliance, and external dependencies.

9. **Project Expectations:** Managing class project expectations from supervisors and panelists and balancing competing priorities and interests to ensure project success and unanimous project satisfaction.

10. **Training and Support:** Providing adequate training and support to end-users to facilitate adoption and usage of the application after deployment.

Despite these challenges, project management skills, leadership, and problem-solving abilities along with the skill set we possessed as a team helped us navigate through obstacles and deliver a successful web application that addressed the objectives and requirements of the "For the Sake of Food" project.

5.7 RECOMMENDATIONS/ FUTURE RESEARCH:

To address the identified limitations and challenges, several recommendations and avenues for future research are proposed:

1. **Enhanced Data Integration:** Invest in further research and development to improve the integration of external data sources, ensuring real-time access to accurate and comprehensive nutritional information.

2. **Performance Tuning:** Conduct additional performance testing and optimization to enhance the platform's responsiveness and scalability, particularly under high user loads.

3. **User Engagement Strategies:** Explore innovative approaches to enhance user engagement, such as gamification elements, personalized recommendations, and social networking features.

4. **Accessibility and Inclusivity:** Prioritize accessibility and inclusivity in design and development efforts, ensuring that the platform is usable and beneficial to individuals with diverse needs and abilities.

In conclusion, the "For the Sake of Food" project represents a significant step towards addressing the prevalent issue of poor dietary habits and promoting healthier lifestyles among the Ugandan population. Despite encountering various challenges and limitations, the project has successfully developed a comprehensive nutrition platform equipped with essential features and functionalities.

Moving forward, the insights gained from this project, along with the recommendations outlined, provide valuable guidance for future endeavors aimed at further improving the platform's effectiveness and impact. By continuing to innovate, collaborate, and prioritize user-centric design principles, we can create meaningful solutions that empower individuals to make informed dietary choices and lead healthier lives.

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