Team name:Culinary CodeCrafters

Project Title: Food Management Systems

1. Executive Summary

First, the background of this problem will be discussed, along with the significance of this project. Then, there will be an explanation of why the team deemed it to be valuable for society, and then, the chapter dives into a discussion on the scope of this project. Then, after diving into the technical details of this project, this report will finally end with the financial aspects of this project.

2. Introduction

Food, the very fuel of our existence, unfortunately, carries a heavy burden of waste. Globally, an estimated one-third of all food produced goes uneaten, translating to not only a colossal loss of resources and wasted money but also a significant contributor to environmental degradation and societal injustice. This staggering statistic paints a grim picture of our relationship with food, one urgently demanding a solution.

Enter innovative technology, a beacon of hope in the fight against food waste. By harnessing the power of artificial intelligence and data analysis, we can now envision a future where food is cherished, optimised, and consumed responsibly. This food management application, poised to reshape our relationship with food, stands as a testament to this vision.

3. Problem Statement

Despite food being a necessary item to survive, it is estimated that global food losses and waste amount to 940 billion dollars per year at the same time, the United Nations has estimated that around 821 million people suffer from hunger and malnutrition worldwide. This waste originates in both consumer behaviour and inefficiencies within the food system. Consumers often struggle with overbuying, improper storage, and poor planning, leading to food spoilage and unnecessary discarding. The food system grapples with overproduction, inefficient supply chains, and inadequate storage techniques, further exacerbating the problem. To address this global crisis, we need a multifaceted solution that empowers both consumers and businesses to optimise food management and minimise waste.

This project proposes a food management application utilising AI to tackle this issue at both consumer and industry levels. By empowering consumers through meal planning, spoilage prediction, and donation platforms and simultaneously optimising the food system through demand forecasting, supply chain streamlining, and dynamic pricing, we aim to significantly reduce food waste and create a more sustainable food ecosystem.

This project will address the following specific -problems:
Consumers: Wasteful purchasing, insufficient storage and confusion around expiration dates.
Businesses: Overproduction, inefficient supply chains, inadequate storage, and lack of dynamic pricing models.

By successfully implementing this AI-powered food management solution, the team aims to achieve the following goals:

- Reduce food waste significantly, contributing to environmental sustainability and food security.
- Increase consumer awareness and responsibility towards food consumption.
- Optimise food production and distribution within the supply chain.
- Improve profitability for businesses through waste reduction and dynamic pricing.
- Create a more sustainable and efficient food system for a healthier planet and society.

4. Aim

This food management project's main goal is to develop and implement an AI-powered application that will successfully address the widespread problem of food waste. To drastically reduce food waste at the consumer and industry levels, the main goal is to create an intuitive and user-friendly artificial intelligence application. Features like customised meal planning, storage advice, and easy donation of excess food are all part of the desired result—features that enable end-users to make well-informed decisions. Along with tackling issues with demand forecasting, supply chain efficiency, and the application of dynamic pricing models, the project also aims to optimise the larger food system by integrating AI-driven solutions. Educational content within the application aims to elevate user awareness about the consequences of food waste, fostering a sense of responsibility toward sustainable food practices. Technological innovation, exemplified by features like spoilage prediction and real-time analytics, ensures the application's sophistication and user-centricity. The project also seeks to contribute to societal well-being by cultivating healthier communities and addressing socioeconomic disparities linked to food access. In alignment with business objectives, the application is poised to enhance profitability within the food supply chain by minimising waste and optimising resource utilisation. Ultimately, the project envisions laying the foundation for a sustainable and efficient food system, reshaping consumption patterns and industry practices for the enduring benefit of environmental and societal health.

5. Proposed Solution

This food management application leverages the power of Artificial Intelligence (AI) to combat food waste across the entire food ecosystem, empowering both consumers and businesses to reduce their environmental impact and save money. By addressing waste at each stage, from grocery aisles to restaurant kitchens, we aim to create a more sustainable and efficient food system.

For Consumers:

- Smart Meal Planning and Inventory Management: Generate personalised meal plans based on available ingredients, preferences, and nearing expiry dates. Track pantry and fridge contents using barcode scanning or manual entry, optimising shopping lists and minimising food waste.
- Food Spoilage Prediction and Repurposing: AI algorithms analyse inventory and predict potential spoilage, prompting users to consume or repurpose food before it reaches waste. Receive recipe suggestions and creative ideas for extending the shelf life of your groceries.
- Food Donation and Redistribution: Connect users with local food banks, shelters, and charities willing to accept their surplus food. Utilise AI to optimise food distribution based on location, need, and dietary restrictions, minimising spoilage and ensuring efficient allocation of resources.
- Educational Insights and Community Support: Generate personalised reports on users' food waste habits, highlighting patterns and areas for improvement. Offer gamified challenges and reward systems to motivate mindful consumption and foster a supportive community focused on reducing food waste.

For Businesses:

- Demand Forecasting and Supply Chain Optimisation: Use AI to predict food demand more accurately, preventing overproduction and reducing waste. Optimise procurement, transportation, and storage methods to minimise spoilage and extend shelf life.
- Dynamic Pricing and Rescuing Surplus Food: Implement AI-driven dynamic pricing models based on demand and expiration dates, encouraging timely consumption and reducing waste. Partner with organisations seeking rescued food, offering surplus food at discounted prices or donating it to those in need.
- Smart Packaging and Storage Solutions: Explore AI-powered optimization of packaging materials and storage conditions to extend shelf life further and minimise spoilage.
- Data-Driven Analytics and Transparency: Leverage data analysis to identify inefficiencies within the supply chain and suggest improvements for more

sustainable practices. Promote transparency by sharing food waste data and progress within the industry.

This comprehensive approach, supported by the power of AI, goes beyond individual actions to create a systemic shift towards a more sustainable food system. By empowering both consumers and businesses, we can significantly reduce food waste, conserve resources, and create a healthier planet for future generations.

6. Project Scope

This food management application tackles the global food waste crisis head-on, catering to diverse audiences worldwide, from middle and high-income consumers to small and medium-scale producers, suppliers, and sellers. Our mission is to empower all stakeholders to actively reduce food waste and foster a more sustainable food system.

6.1 In Scope:

- Consumer Functionality:
    - Smart Meal Planning and Inventory Management: AI-powered meal suggestions based on user preferences, available ingredients, and nearing expiry dates.
    - Food Spoilage Prediction and Repurposing: Alerts with recipe suggestions and repurposing ideas to prevent wastage.
    - Food Donation and Redistribution: A platform connecting users with local charities and organisations seeking edible surplus food.
    - Educational Insights and Community Support: Personalised reports, gamified challenges, and a supportive community promoting mindful consumption habits.

- Business Functionality:
    - Demand Forecasting and Supply Chain Optimization: AI-driven optimization of production, procurement, transportation, and storage to minimise waste.
    - Dynamic Pricing and Rescuing Surplus Food: Dynamic pricing models based on demand and expiry dates, along with partnerships for surplus food redistribution.
    - Data-driven analytics and Transparency: Sharing data insights and progress reports to promote best practices within the industry.
    - Modular Design: Adaptable interface and scalable features to cater to the needs of various business sizes and sectors.

6.2 Out of Scope:

- Leftover Food Pickup Services: The initial phase will focus on connecting users and organisations, leaving specific delivery and pickup logistics to third-party services.
- Hardware Integration: We initially focused on a software solution accessible through mobile devices and web platforms. Hardware integrations with smart fridges or pantry systems may be explored in future versions.
- Advanced Farm Management Tools: Although we offer insights for producers, advanced farm management tools like crop yield prediction or soil analysis are not currently within the scope.
- Governmental Policy Advocacy: While the application aims to encourage responsible behaviour, direct interaction with policy changes is not part of the immediate roadmap.

6.3 Target Audience: Empowering Diverse Stakeholders

Our comprehensive food management application strives to engage and empower audiences across the global food ecosystem, with a specific focus on the following key groups:

Consumers:

- Middle and High-Income Consumers: With greater resources and purchasing power, these individuals can significantly influence food waste patterns. The application provides them with tools for planning, optimising, and repurposing their food choices and promoting responsible consumption habits.
- Young Adults and Students: This tech-savvy demographic can readily adopt the application's AI-powered features and gamified elements, contributing to a positive ripple effect within their social circles.
- Families and Households: Catering to diverse family needs and preferences, the application helps plan meals, manage inventories, and prevent food waste, particularly impactful for larger households.

Businesses:

- Small and Medium-Scale Producers, Suppliers, and Sellers: Often lacking access to sophisticated forecasting and logistics solutions, these businesses benefit from the application's demand prediction tools, optimised storage recommendations,

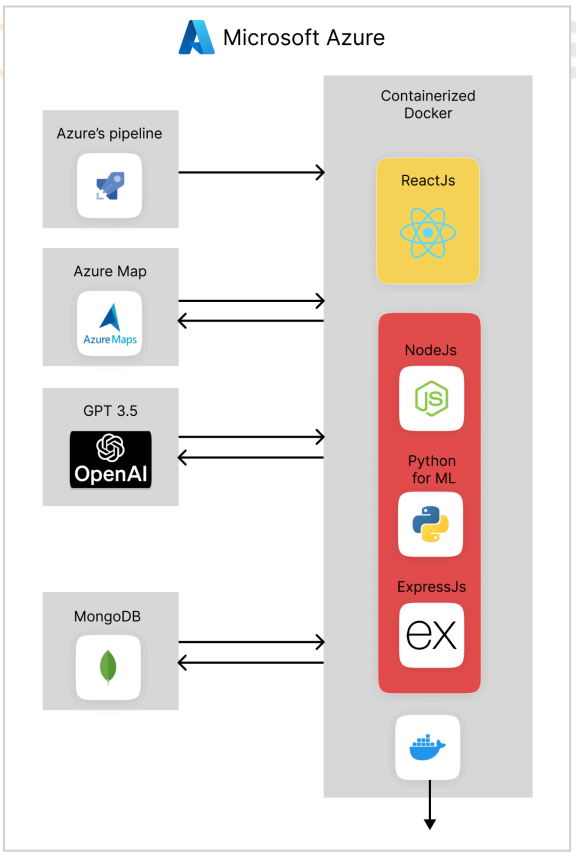
and dynamic pricing models, reducing their own food waste and increasing profitability.

- Restaurants and Food Service Providers: Managing perishable inventory and fluctuating demand can be challenging for restaurants. The application's AI-powered solutions support optimal ordering, portioning, and surplus food allocation, minimising waste and promoting sustainable practices.
- Grocery Stores and Supermarkets: Facing significant inventory management challenges, these businesses can utilise the application's demand forecasting and dynamic pricing functionalities to prevent overstocking and reduce shrinkage.

Additional Stakeholder Groups:

- Food Banks and Charity Organizations: The application facilitates efficient surplus food redistribution, connecting donors with organisations catering to vulnerable populations.
- Educational Institutions and Public Awareness Platforms: Educational resources and community forums within the application can empower schools, NGOs, and public health sectors to raise awareness about food waste and its global impact.

7. Technical overview



8. Market potential

1. Profitability Through Efficiency: The application facilitates on-demand production and supply chain optimization, translating to substantial operational cost savings and heightened profitability for businesses.

2. Consumer-Centric Affordability: Enhanced efficiency allows businesses to offer competitively priced food products, appealing to a broader consumer base and driving increased market share.

3. Strategic Geographic Customization: Geographical customization streamlines processes, reducing time and resource wastage, and enhances market penetration strategies, ensuring a targeted and efficient approach.

4. Environmental Stewardship: The application positions businesses as leaders in environmental sustainability by repurposing food waste. This aligns with global sustainability goals, attracting environmentally conscious consumers and investors.

5. Global Market Resilience: The universal relevance of the application ensures its adaptability to diverse global markets, providing investors with a scalable solution capable of navigating economic fluctuations and regional challenges.

6. Data-Driven Decision-Making Edge: Businesses gain a competitive edge with data-driven decision-making capabilities, fostering innovation and adaptability in an ever-evolving market landscape.

7. Reduced Legal and Regulatory Risks: The application aids businesses in complying with stringent environmental regulations, mitigating legal risks, and ensuring a positive standing in the eyes of consumers and regulators.

8. Positioning for Technological Leadership: Embracing cutting-edge technology in food management establishes businesses as technological leaders, attracting investors looking for ventures at the forefront of innovation.

9. Supply Chain Resilience and Risk Mitigation: The optimised supply chain not only improves efficiency but also enhances resilience against unforeseen disruptions, minimising risks and ensuring continuous operations.

10. Brand Loyalty and Reputation: By promoting sustainable practices, businesses can build brand loyalty and a positive reputation, crucial factors for investor confidence in long-term success and market dominance.

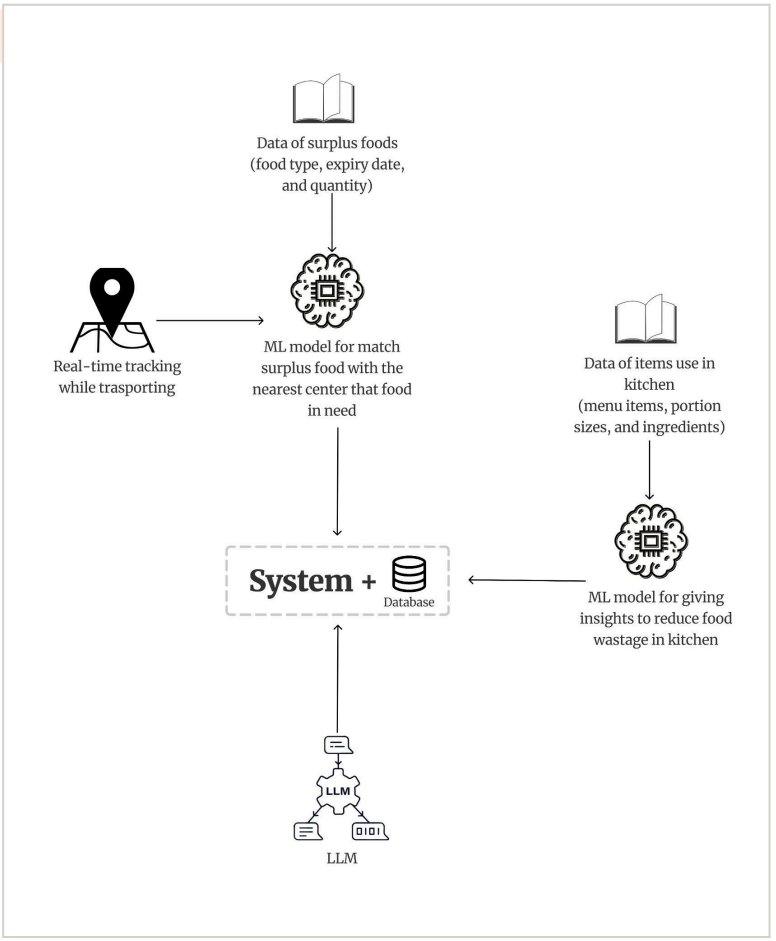
11. Job Creation Potential: As businesses expand and innovate, there is a direct potential for job creation, contributing to economic growth and showcasing the application's positive societal impact.

12. Educational and Social Impact: Investors can support a venture that not only promises financial returns but also contributes to educating consumers about responsible

food consumption, creating a positive social impact aligned with corporate social responsibility goals.

9. AI approach

Our food management application employs a robust AI approach to tackle global food waste. Key components include Smart Meal Planning and Inventory Management, offering personalised meal suggestions based on user preferences, available ingredients, and expiration dates. Machine learning algorithms continuously learn and adapt to user behaviour, refining recommendations over time. Additionally, Food Spoilage Prediction and Repurposing features utilise AI to analyse inventory, predict spoilage, and suggest creative recipes. On the business side, Demand Forecasting and Supply Chain Optimization leverage AI to predict food demand, reducing overproduction and supply chain inefficiencies. The application employs Natural Language Processing for user-friendly interactions, predictive analytics for demand trend prediction, and image recognition for barcode scanning in inventory management. Our AI-driven system actively shapes and optimises the entire food ecosystem by considering industry practices and customer behaviours beyond mere recommendations.



1. Redistribution-related machine learning model:

Matching Donors and Recipients: Implements an efficient algorithm to match donors (individuals or businesses with surplus food) with appropriate recipients. Examples: local charities, food banks, community groups, etc.

- This system uses a K-neighbours classifier ML model to match surplus food with the nearest food bank or shelter in need.
- The model is trained using the data of surplus food, which contains information about the food type, expiry date, and quantity.
- Once the model is trained with an initial dataset, it can be used to make predictions on new data and help match surplus food with the nearest food bank or shelter in need.
- A tracking system is embedded for this machine learning model as following features;

1.1 Real-time Tracking:

This provides real-time tracking capabilities for donors and recipients to monitor the condition and location of excess food during transportation.

1.2 Logistics and Transportation Optimization:

This feature optimises the logistics of transporting surplus food by considering factors such as traffic, weather, and delivery windows.

2. Food-cooking waste reduction machine learning model

For reducing cooking waste in kitchens: Using analysed data from the kitchens**.** Examples: Hotel kitchens and kitchens in food banks.

- This model uses a linear regression ML model to analyse kitchen data and provide insights on how to reduce food waste.
- The model is trained using data that includes information about menu items, portion sizes, and ingredients.
- Once the model is trained**,** it can be used to make predictions on new data to help identify which menu items are generating more waste than expected and suggest adjustments to reduce waste.

3. User awareness about food management

The LLM model allows customers to integrate with the system to learn about anything they want to know about food management.

All the data corresponding to these three models will be stored in the system's database.

10. Business model canvas

KEY PARTNERS

NGO's that are focused on food security

Consumers of food

Food suppliers

Food producers

Logistics and Distribution Partners

Recycling Agents

Technology Providers (Azure,OpenAI for GPT integretion)

KEY FEATURES

Developing and Training ML Models (Demand Forecasting, Production Planning)

Food Production Planning

Route Optimization for Distribution

Route Optimization for Distribution

KEY RESOURCES

Hosting platform

Research data for training the AI model

VALUE PROPOSITION

For Sellers: Providing optimal prices for food items

For suppliers: Provide suppliers with advice on how to make the supply chain more efficient

Real-time Route Optimization for Fresh Food Delivery

Sustainable and Automated Recycling Processes

CUSTOMER RELATIONSHIPS

Direct Engagement
- Mobile and web platform for individual users
- Dedicated account managers

Automated Support
- In app chatbots

CHANNELS

Online Platforms for Food Ordering

Mobile Applications for Customer Interaction

Chatbots for Customer Support

CUSTOMER SEGMENTS

This is aimed generally at the whole world regardless of whether the country is a developing country or is already a developed country

Special focus: Middle and high income consumers

Special focus: Low and medium scale suppliers

COST STRUCTURE

Software development and update cost

Cloud Service Costs (Azure)

Marketing costs

REVENUE STREAMS

Patreon donations from individual consumers

Grants from governments

In app ads revenue

FUTURE

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