Food tracking system

Project Report

1,Introduction

1.1 Project overview

A food shortage, which has increased with the climate crisis, will be one of the biggestproblems of the world, together with water scarcity, in the future and will damage the sustainability of the food supply system. With the effect of the COVID-19 pandemic, food resources are decreasing,and food prices are rising all over the world. The decrease in food sources increases the importance of food tracking even more. The exorbitant price increases after the COVID-19 pandemic are the most concrete indicators of this. Blockchain-based food tracking systems will be of critical importance because they will prevent exorbitant price increases with their contribution to food tracking processes, such as reliability and transparency. In this study, the establishment of a blockchain-based food tracking system in Turkey, its operation, and its results will be discussed. It was concluded that 97.54% of the participants using the established system found the application useful and wanted such an application to become widespread. In addition, comparing the performance data of the established blockchain-based system with other blockchain infrastructures, a value of 0.038 s for latency is 435 times better than Ethereum, one of the most popular blockchain infrastructures. A transmission per second value of 285, reception per second value of 335, and CPU load rate value of 19.22 are obtained with the proposed system.

The food industry is undergoing a significant transformation, with increasing demand for transparency and traceability throughout the supply chain. Food safety, authenticity, and sustainability are paramount concerns for consumers, regulators, and producers alike. Blockchain technology, with its decentralized and immutable ledger, offers a promising solution to address these concerns. This paper presents a novel approach to implementing a food tracking system using smart contracts on the Ethereum blockchain.The proposed system leverages Ethereum's smart contract capabilities to create a transparent and secure platform for tracking food products from farm to fork. Each food item is assigned a unique digital identity, and its journey through the supply chain is recorded on the blockchain. This digital ledger ensures data integrity and enables real-time access to critical information such as origin, processing, and transportation details.

1.2 purpose

The awareness of protecting human health, which has increased on a global scale in recent years, has also shown itself in the food industry, and it has gained great importance that food be safe in order to lead a healthy life. Access to and the consumption of safe food is a right that every person should have. Food safety covers the whole process from the production stage of the food until it reaches the consumer [1]. More than 60% or about 1 billion tons of food is wasted within the supply chain while harvesting, processing, shipping, and storing [2]. For instance, nearly 492 million tons of perishable food were wasted in the year 2011 because of the ineffective and poor management of the food tracking systems [3].According to the FAO (UN Food and Agriculture Organization), food security is defined as the ability of every person to have access to sufficient, safe, and nutritious food at all times to lead an active and healthy life [4]. Food safety is possible by taking every step of the food under control in the whole process, starting from the raw material until It reaches our table. Especially with the spread of digitalization, it is expected that the number and success of food tracking systems will increase [5]. The benefits of digitalization will be most clearly and largely achieved through the use of emerging technologies.With the maturation and spread of emerging technologies, it has started to becomea part of our daily life, shaping life and paving the way for digitalization [6]. One of the main reasons for digitalization is to reduce or even eliminate the need for manpower [7]. Undoubtedly, one of the prominent technologies at this point is blockchain technology,which is the infrastructure of cryptocurrencies such as Bitcoin, and many application areas have begun to emerge with the possibility of making transactions without intermediaries.

2. LITERATURE SURVEY

One of the foremost blockchain-based food tracking systems is the "Food Trust" system developed by IBM. Announced for the first time in 2017, Food Trust has provided traceability in the food supply chain to 80 different brands so far by using blockchain technology. With this traceability, the supply process from producers to consumers can be followed in detail. IBM's open-source technology based on Hyperledger Fabric allows companies to set their own rules on the system. It is argued that the traceability offered by the Food Trust not only helps food safety but also helps producers with food freshness, sustainability, and waste. Announcing that more than 5 million food products already on the shelves are included in the system, IBM seems confident that this platform will grow strongly. Among the companies using this application are giants such as Dile, Kroger, McCormick and Company, Nestle, Tyson Foods, and Unilever [11].

Walmart has used blockchain to record where every piece of meat it buys from China comes from, where it is processed, where it is stored, and all transactions related to its sale, along with its historical course. All detailed information about the farm where the meat comes from, the factory where it is processed, the batch number of the product, the storage temperature of the product, and transportation can be tracked on the blockchain. In addition to the benefits of processing speed, information sharing, and transparency, the main purpose is summarized as increasing food safety [12].

Provenance has conducted a blockchain-based pilot project in Indonesia to transparently track the movement of products from sea to table in the fishing industry. The seafood trade consists of a very large fishing network, and it is a very difficult sector to control quality. There is no reliable audit in the sector. This project aims to help stop illegal, excessive, harmful to the sea and the environment, and non-sanitary fishing violations in the tuna fish industry. Thus, consumers will be able to view the source of the food they supply transparently, and a legal basis will be established to combat illegal fishing. With the use of this example, the aim is that the use of blockchain technology will facilitate transparency, tracking, and auditing, thus ensuring the safety of food products, preventing illegal and excessive fishing, and preventing damage to the environment [13].

Kim proposes a blockchain-based traceability system with different ontologies, where each one could accomplish and be part of certain transactions. He offers the use of smart contracts. Ethereum, with the Solidity programming language, was used in his study [14]. Feng Tian et al. propose a blockchain solution for agriculture traceability to ensure that the HACCP principles and requirements are addressed during the production, transportation, and preservation of a product [15].

Moreover, Daniel Tse et al. focus on the increasingly serious problem of food safety in China and propose a blockchain solution for the agriculture supply chain, based on the information and transaction security between all the involved parties. In this work, a PEST (political, economic, social, and technological) environment analysis took place to define the challenges and the opportunities of the DLT (Distributed Ledger Technologies) solution [16].

In addition, Francesco Marinello et al. offer a blockchain-based solution focusing on the animal products supply chain in Italy [17]. Kumar et al. propose a rice supply chain system that uses blockchain technology to assure the safety of rice during its flow through the supply chain [18].

Maria Elena Latino et al. propose another interesting idea regarding the agriculture supply chain and the use of Industry 4.0 principles [19]. They refer to the idea of food democracy, according to which consumers are considered citizens and the food is not a good but a civil right. The authors advertise the idea of voluntary traceability and combine it with Industry 4.0 technologies. The significance of voluntary traceability is highlighted, focusing on the volume and the quality of the data collected for each product, as well as the need for a big data platform to handle them.

Islam and others published work about the visualization of food supply chain management. Their research aims to propose a new visualization approach that allows supply

3. IDEATION & PROPOSED SOLUTION

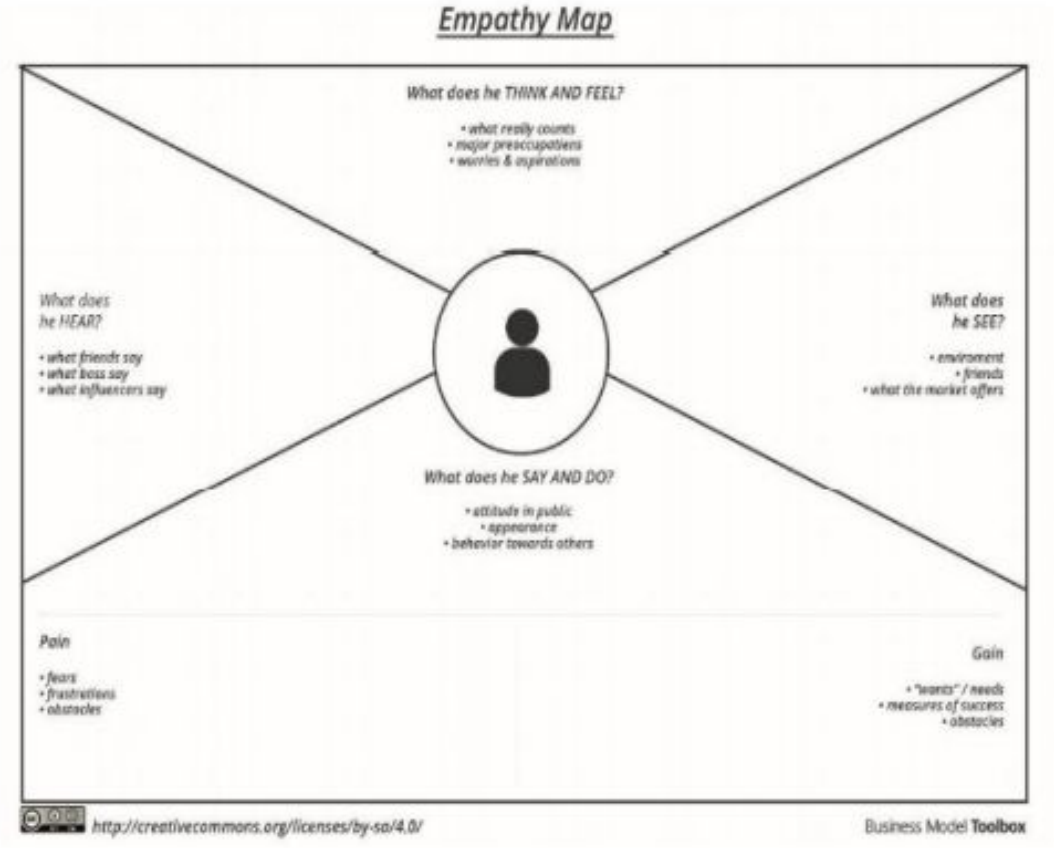
3.1 Empathy Map Canvas

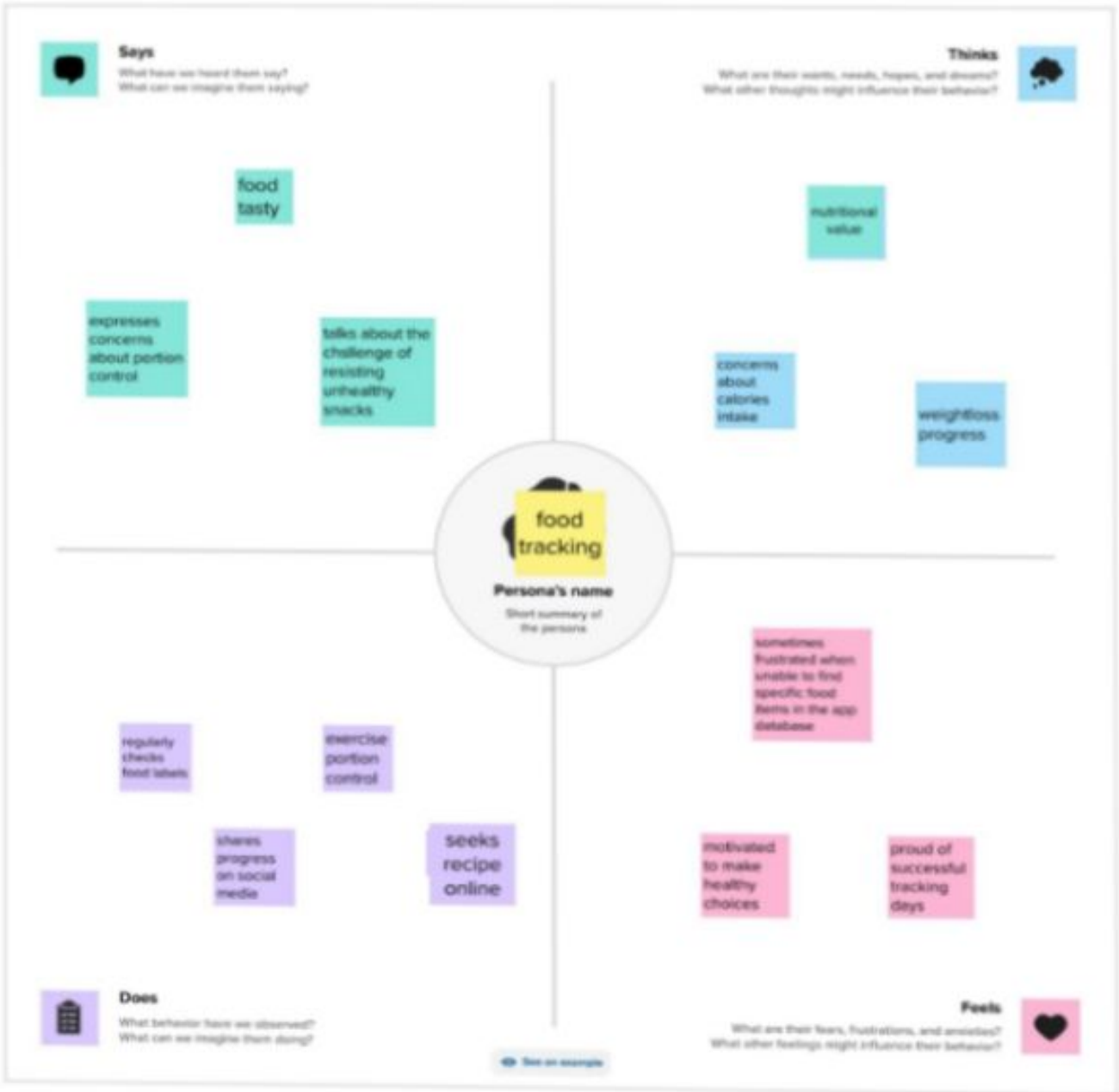
Empathy Map Canvas:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.

It is a useful tool to helps teams better understand their users.
Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

Example:



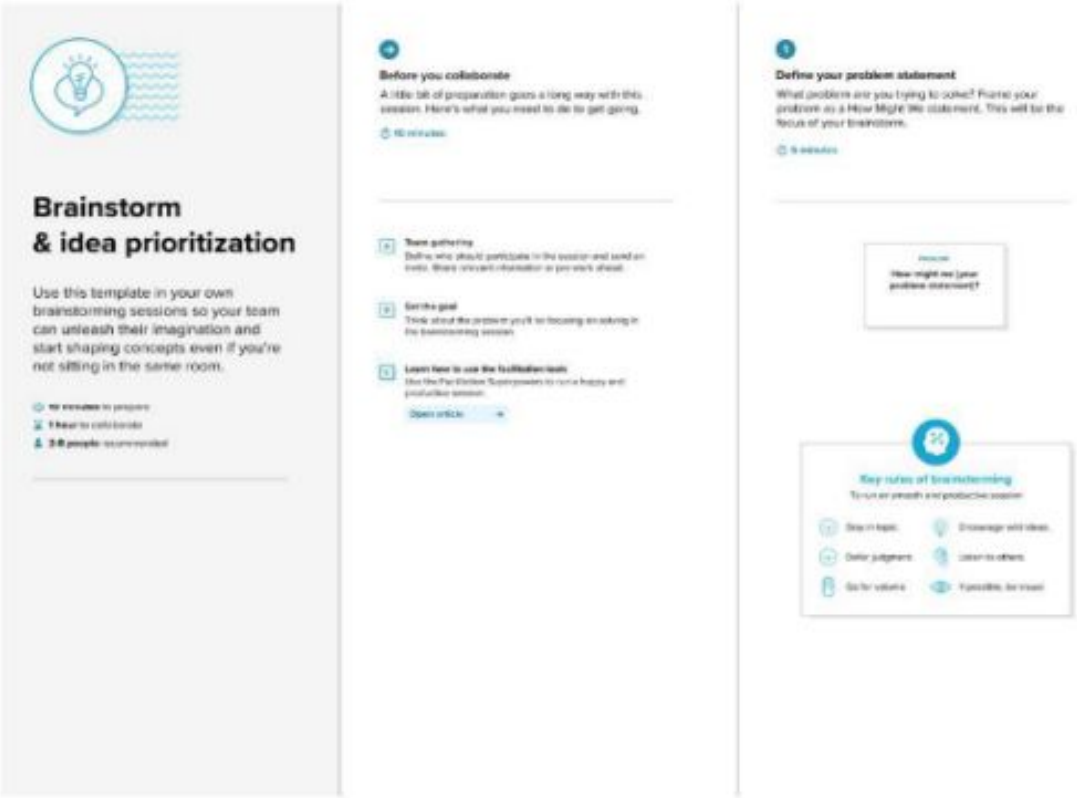

Says
What have we heard them say?
What can we imagine them saying?
food tasty
expresses concerns about portion control
talks about the challenge of resisting unhealthy snacks
Thinks
What are their wants, needs, hopes, and dreams?
What other thoughts might influence their behavior?
nutritional value
concerns about calories intake
weightloss progress
food tracking
Persona's name
Short summary of the persona
regularly checks food labels
exercise portion control
shares progress on social media
seeks recipe online
sometimes frustrated when unable to find specific food items in the app database
motivated to make healthy choices
proud of successful tracking days
Does
What behavior have we observed?
What can we imagine them doing?
Feels
What are their fears, frustrations, and anxieties?
What other feelings might influence their behavior?
See an example

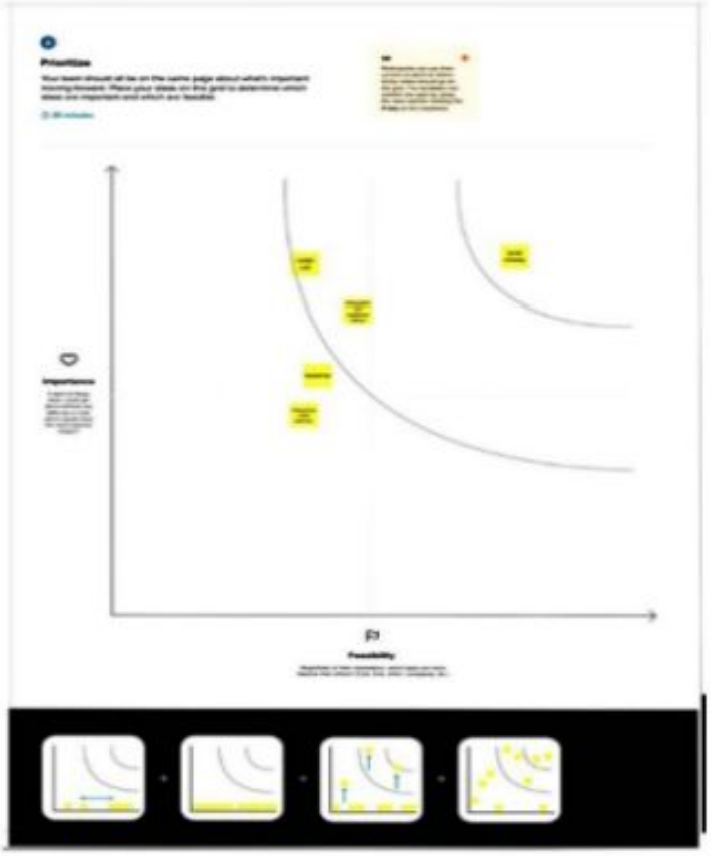
3.2 Ideation & Brainstorming

Brainstorm & Idea Prioritization Template:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.




Prioritize
Importance
Feasibility

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

1,This subsection presents the identified functional requirements for the subject RMOS. Initially, general requirements that pertain to the whole system are given. Where possible, subsequent requirements have been demarcated based on their relevance to the users of the system, that is, customers, waiters, chefs and supervisors

2,Customer should be able to view the status of their orders,including when they were placed,when they are expected to be ready,and when they have been delivered.

3,Order modification: Customers should be allowed to make changes to their orders until they are ready for preparation by the kitchen.

4.2 Non-Functional requirements

1,This subsection presents the identified non-functional requirements for the subject RMOS. The subcategories of non-functional requirements given are safety, security, interface, human engineering, qualification, operational and maintenance.

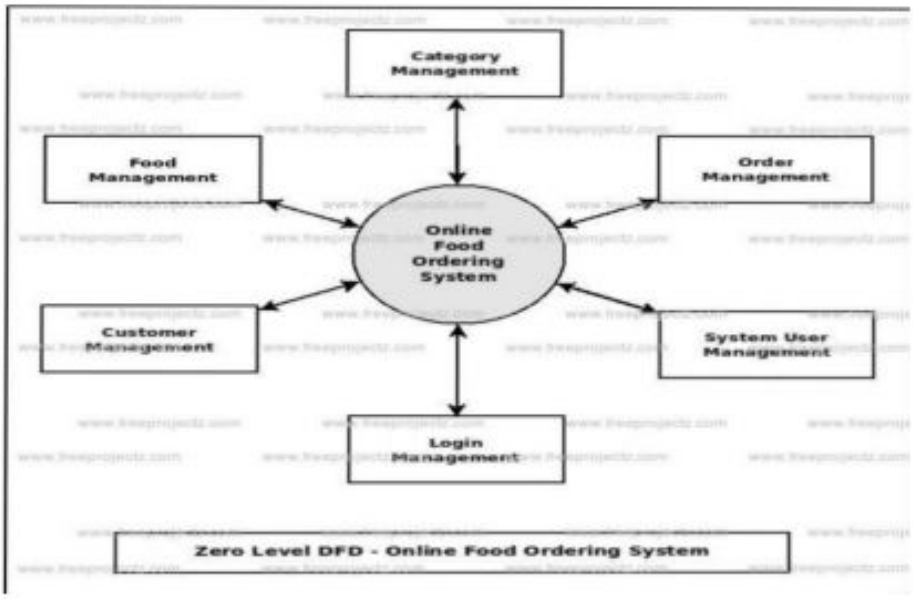
2,Security: The system should prevent unauthorised access or misuse of sensitive information , such as consumer payment and personal information.This could include regulations for the use of encryption, secure servers, and other data integrity safeguards.

3,Scalability refers to the system's ability to accommodate increases in the number of users or orders without deteriorating performance.This could include the capacity to add more servers or other hardware as needed to accommodate rising demand.

4,Maintainability: With a clear and well-documented codebase and a solid testing and deployment procedure, the system should be simple to upgrade and maintain over time.This could include requirements for using version control, automated testing, and other tools and processes to keep the system reliable and up to date.

5. PROJECT DESIGN

5.1 Data Flow Diagrams & User Stories



1,As a busy professional, I want to be able to quickly and easily order food from my favorite restaurants for delivery or pickup so that I don't have to spend time cooking or eating out.

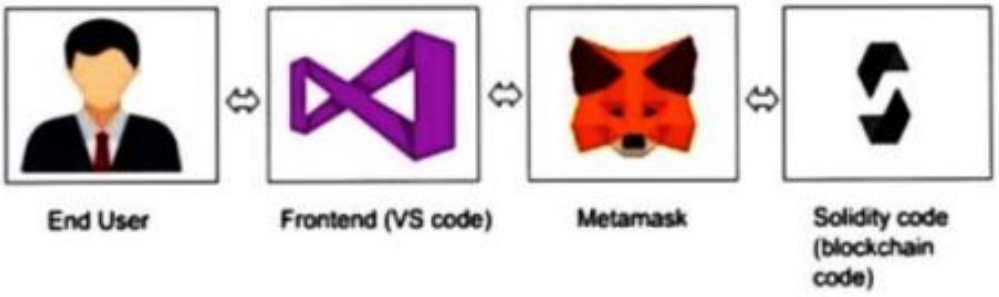
2,As a customer with dietary restrictions, I want to be able to easily filter restaurants and menu items by dietary preference (e.g. vegan, gluten-free) so that I can find options that suit my needs

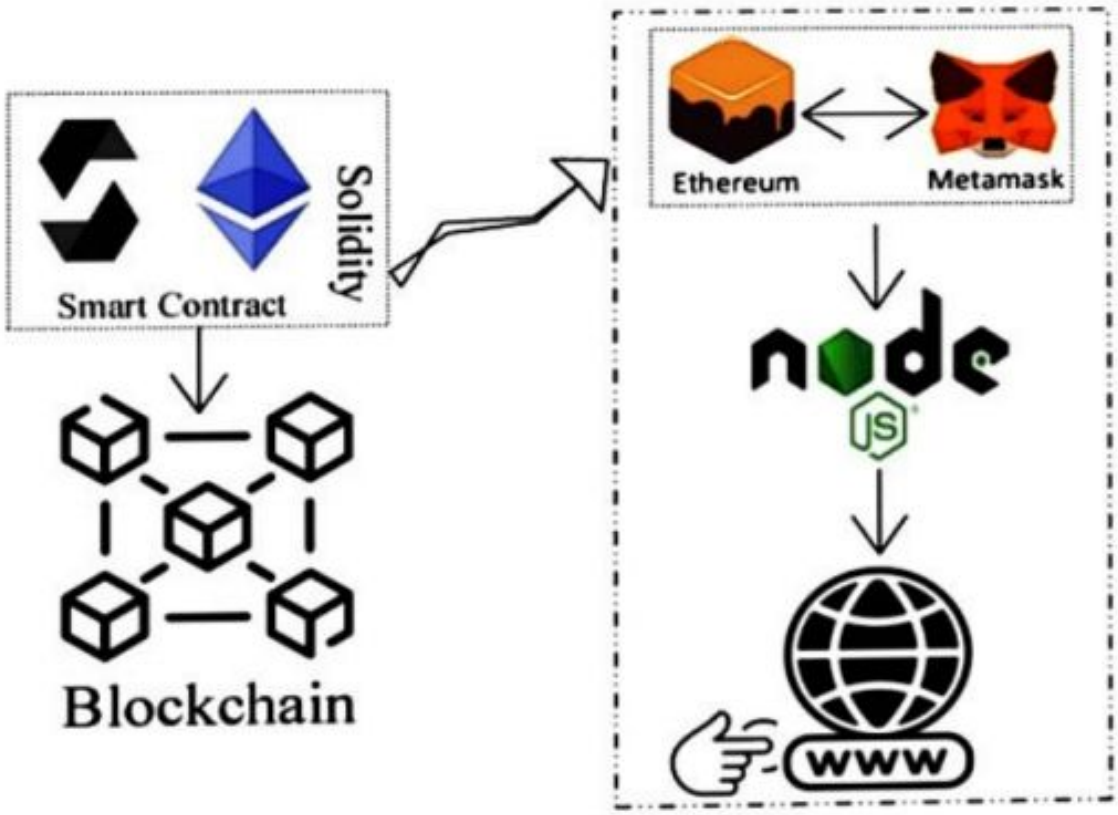
3,As a customer who is ordering food for a group, I want to be able to split the cost of the order among multiple people so that everyone can pay their fair share.

4,As a customer who is ordering food for the first time, I want to be able to easily create an account and save my payment and delivery information for future orders so that I don't have to enter it each time.

5,As a customer who is ordering food from a restaurant that I've never tried before, I want to be able to view ratings and reviews from other users so that I can make an informed decision about what to order.

5.2 Solution Architecture

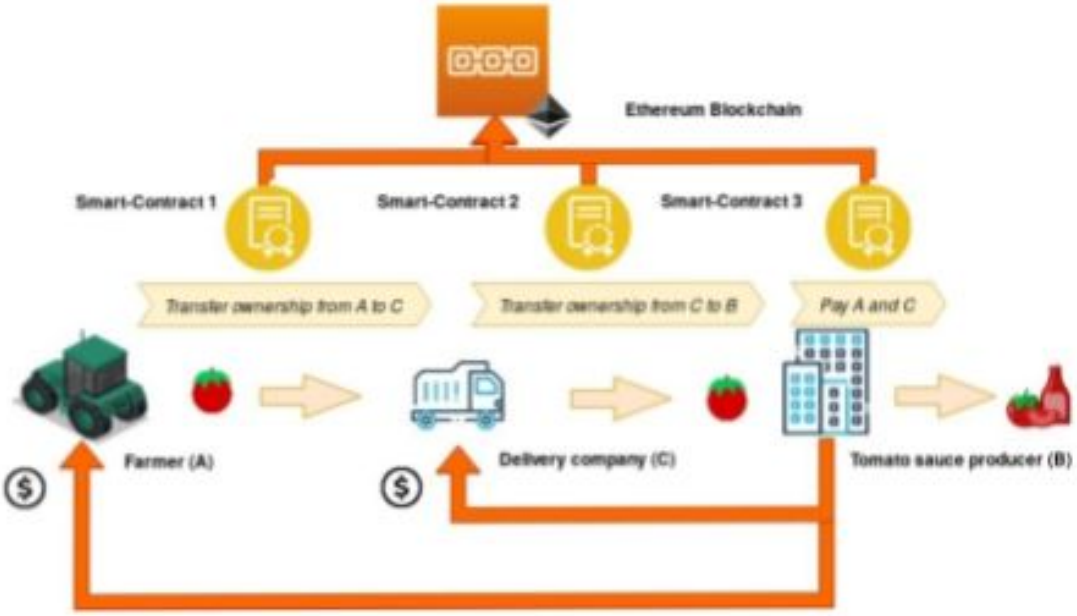




Interaction between web and the Contract

6. PROJECT PLANNING & SCHEDULING

TECHNICAL ARCHITECTURE



SPRINT PLANNING & ESTIMATION

Sprint Planning:

1. Product Backlog Refinement: Start with refining the product backlog, which is a prioritized list of features, user stories, and tasks. Ensure that the most critical and valuable items are at the top of the backlog.

2. Sprint Duration: Decide on the sprint duration. Common durations are 2-4 weeks, but it can vary based on the project's complexity and the team's velocity.

3. Sprint Goal: Define a sprint goal for each sprint. For a food tracking system, it could be something like "Implement end-to-end product tracking for a specific food item."

4. Sprint Backlog: Select the top items from the product backlog that align with the sprint goal. These items will become your sprint backlog for the upcoming sprint.

5. Task Breakdown: For each item in the sprint backlog, break them down into smaller, actionable tasks. Tasks might include designing, coding, testing, and documentation.

6. Estimation: Estimate the effort required for each task. Common estimation techniques include story points, ideal days, or hours. The team should reach a consensus on these estimates.

7. Assign Tasks: Assign tasks to team members based on their skills and availability. Ensure that the team collectively owns the sprint backlog.

Sprint Execution:

During the sprint, the team will work on completing the tasks from the sprint backlog. Daily stand-up meetings can be used to track progress and discuss any impediments or issues.

Sprint Review:

At the end of the sprint, the team should hold a sprint review meeting to showcase the work completed during the sprint. Stakeholders can provide feedback, and the product owner can decide whether to accept the work or not.

Sprint Retrospective:

Conduct a sprint retrospective to reflect on what went well and what could be improved in the next sprint. This helps the team continuously adapt and improve their processes.

Repeat:

Repeat the sprint planning, execution, review, and retrospective process for subsequent sprints until the project is completed.

Estimation Techniques:

Story Points: Assign relative values (story points) to user stories or tasks. The team estimates based on complexity, effort, and risk.

Planning Poker: A collaborative technique where team members use a deck of cards with numbers representing effort. It helps reach a consensus on estimates.

Ideal Days: Estimate tasks based on how many ideal working days it will take to complete them.
Hours: Estimate tasks in hours. This approach provides a more granular view of effort.

SPRINT DELIVERY SCHEDULE

The schedule can vary based on the complexity of the project, team capacity, and specific requirements. A typical sprint duration is 2-4 weeks.

Sprint 1: Setting Up the Environment
Duration: 2 weeks
Goals:

- Set up the blockchain network environment (e.g., Hyperledger Fabric, Ethereum).
- Create a basic smart contract for product creation and registration.
- Develop a simple user interface for product registration.

Deliverables:
- A functioning blockchain network.
- Smart contract for product registration.
- Basic product registration interface.

Sprint 2: Basic Product Tracking
Duration: 3 weeks
Goals:
- Enhance the smart contract to include basic product tracking (e.g., timestamps, location).
- Develop a user interface for product tracking.
- Implement basic supply chain data integration with IoT devices (e.g., temperature sensors, GPS trackers).

Deliverables:
- Smart contract with enhanced tracking capabilities.
- User interface for tracking products.
- Basic IoT data integration.

Sprint 3: Identity and Security
Duration: 3 weeks
Goals:
- Implement decentralized identity for participants.
- Enhance security features, including authentication and authorization.
- Set up a blockchain explorer for transparency.

Deliverables:
- Decentralized identity integration.
- Improved security measures.

- Blockchain explorer for auditing.

Sprint 4: Quality and Compliance
Duration: 4 weeks
Goals:
- Integrate quality control data into the system.
- Implement verification of certifications and inspections.
- Ensure compliance with relevant food safety regulations.

Deliverables:
- Quality control data integration.
- Verification of certifications and inspections.
- Compliance features.

Sprint 5: User-Facing Features
Duration: 3 weeks
Goals:
- Develop consumer-facing mobile apps and web interfaces for product tracking and verification.
- Enable consumers to access information about scanned products.

Deliverables:
- Consumer-facing mobile and web applications.
- QR code scanning and product information display.

Sprint 6: Integration and Scalability
Duration: 4 weeks
Goals:
- Integrate the blockchain system with legacy supply chain management and ERP systems.
- Ensure scalability and performance optimization.

Deliverables:

- Successful integration with legacy systems.
- Scalability improvements.

Sprint 7: Analytics and Reporting
Duration: 3 weeks
Goals:
- Implement monitoring and analytics tools to gain insights into the supply chain.
- Generate reports for stakeholders.
Deliverables:
- Monitoring and analytics tools.
- Customized reports.

Sprint 8: Final Testing and Refinement
- Duration:2 weeks
- Goals:
- Perform thorough testing and address any issues.
- Refine the user interfaces and functionality based on feedback.
Deliverables:
- A thoroughly tested and refined system.

Sprint 9: Documentation and Training
Duration: 2 weeks
Goals:
- Create user documentation and training materials.
- Train users and stakeholders on how to use the system effectively.
Deliverables:
- Comprehensive documentation.
- Trained users.

Sprint 10: Deployment
Duration: 2 weeks

Goals:

- Deploy the system in a production environment.
- Ensure a smooth transition from any existing systems.

Deliverables:

- A fully deployed and operational blockchain-based food tracking system.

7. CODINGN & SOLUTIONING

FEATURES 1

1. Product Registration:
   - Each food product is registered on the blockchain with unique identifiers.
   -Include details such as product name, batch/lot number, and producer information.

2. Supply Chain Visibility:
   -Real-time tracking of product movement throughout the supply chain.
   -Information on the product's origin, location, and journey.

3. IoT Integration:
   - Integration with Internet of Things (IoT) devices for data collection (e.g., temperature, humidity, GPS).
   - Ensure data from sensors is recorded on the blockchain for transparency.

4. Decentralized Identity:
   - Each participant in the supply chain has a verifiable and unique identity on the blockchain.
   - Ensures trust and accountability in the system.

5. Smart Contracts:

- Automation of supply chain processes through smart contracts.
- Trigger actions such as quality checks, certifications, and ownership transfers.

6. Verification of Certifications:
- Ability to verify the authenticity of certifications (e.g., organic, halal, kosher) directly on the blockchain.

7. Quality Control Data:
- Recording and tracking of quality control data at various checkpoints in the supply chain.
- Include factors like temperature, humidity, and handling conditions.

8. Consumer Access:
- Enable consumers to access product information by scanning QR codes or using mobile apps.
- Information on the product's journey and quality.

9. Blockchain Explorer:
- A user-friendly tool for viewing the blockchain's transaction history and product details.
- Transparency for all stakeholders.

10. Compliance and Regulations:
- Ensure compliance with food safety regulations and standards (e.g., FDA regulations, FSMA in the United States).
- Automated reporting for regulatory purposes.

11. Immutable Records:
- All data recorded on the blockchain is tamper-proof and immutable.
- Important for traceability and accountability.

12. Interoperability:

- Standards for data exchange with other blockchain networks and legacy systems.
- Facilitate integration with existing supply chain management software.

13. Security:
- Robust security measures, including encryption, authentication, and authorization.
- Use of digital signatures to verify transaction authenticity.

14. Scalability:
- Design the system to handle a large volume of transactions and data as the supply chain grows.

15. Analytics and Reporting:
- Monitoring and analytics tools to gain insights into the supply chain.
- Generate reports for stakeholders to make informed decisions.

16. Legacy System Integration:
- Ensure compatibility with legacy supply chain management systems and ERP software.
- Facilitate a smooth transition to the blockchain system.

17. Task Automation:
- Automation of routine tasks, such as product verification and data entry, through smart contracts.

18. Mobile and Web Interfaces:
- User-friendly interfaces for participants and consumers to interact with the system.

19. User and Role Management:
- Role-based access control to ensure that users have the appropriate permissions.

20. Documentation and Training:

- Comprehensive user documentation and training materials for system users.

FEATURE 2

1.Decentralization

With blockchain the information is distributed across the network rather than at one central point. This also makes the control of information to be distributed and handled by consensus reached upon by shared input from the nodes connected on the network. The data that was before concentrated at one central point is now handled by many trusted entities.

2) Data Transparency

Achieving data transparency in any technology is to have a trust based relationship between entities. The data or record at stake should be secured and temper proof. Any data being stored on the blockchain is not concentrated at one place and is not controlled by one node but is instead distributed across the network. The ownership of data is now shared and this makes it to be transparent and secure from any third party intervention.

3. Security and Privacy

Blockchain technology uses cryptographic functions to provide security to the nodes connected on its network. It uses SHA-256 cryptographic algorithm on the hashes that are stored on the blocks. SHA stands for Secure Hashing Algorithm, these hashes provide security to the blockchain as data integrity is ensured by

them. Cryptographic hashes are strong one way functions that generate checksum for digital data that cannot be used for data extraction. This makes blockchain as such a decentralized platform made secure by the cryptographic approaches which makes it to be a good option for privacy protection of certain applications

8. PERFORMANCE TESTING

PERFORMANCE METRICS

Performance metrics for a food tracking system can vary depending on the specific goals and requirements of the system. However, here are some common performance metrics that can be considered when evaluating the effectiveness of a food tracking system:

1. Accuracy: Accuracy measures how well the system correctly identifies and records the foods that users consume. It is often expressed as a percentage and is calculated by dividing the number of correctly identified foods by the total number of foods recorded.

2. Precision: Precision measures the system's ability to correctly identify true positive food items while minimizing false positives. In the context of food tracking, precision reflects how often the system correctly recognizes and records the foods users consume.

3. Recall (Sensitivity): Recall measures the system's ability to identify all relevant food items, including true positives, while minimizing false negatives. It is particularly important for capturing all the foods users eat.

4. F1 Score: The F1 score is the harmonic mean of precision and recall and provides a balance between these two metrics. It can be

useful for systems where both false positives and false negatives are important to consider.

5. Specificity: Specificity measures the system's ability to correctly identify true negative food items, which are foods that were not consumed. It's important to minimize false positives in this context.

6. User Satisfaction: This metric measures user satisfaction with the system. You can collect feedback from users through surveys or user ratings to assess how well the system meets their needs and expectations.

7. Real-Time Data Entry: Assess how quickly the system allows users to input their food consumption data. A faster and more efficient data entry process can lead to better user experiences.

8. Data Completeness: Evaluate how often users are able to log all their meals and snacks. Incomplete data can affect the system's accuracy and usefulness.

9. Data Consistency: Check for consistency in data entry, such as standardizing food names, portion sizes, and meal times. Inconsistent data can lead to inaccuracies.

10. Integration with Wearables: If the system integrates with wearable devices, assess how well it captures data from these devices, such as fitness trackers or smartwatches.

11. Food Recognition Speed: Measure the time it takes for the system to recognize and log a food item. Faster recognition can enhance the user experience.

12. Database Coverage: Evaluate the breadth of the system's food database. A comprehensive database with a wide range of food items can improve the accuracy of food recognition.

13. Privacy and Security: Assess the system's security features to ensure that users' food consumption data is protected.

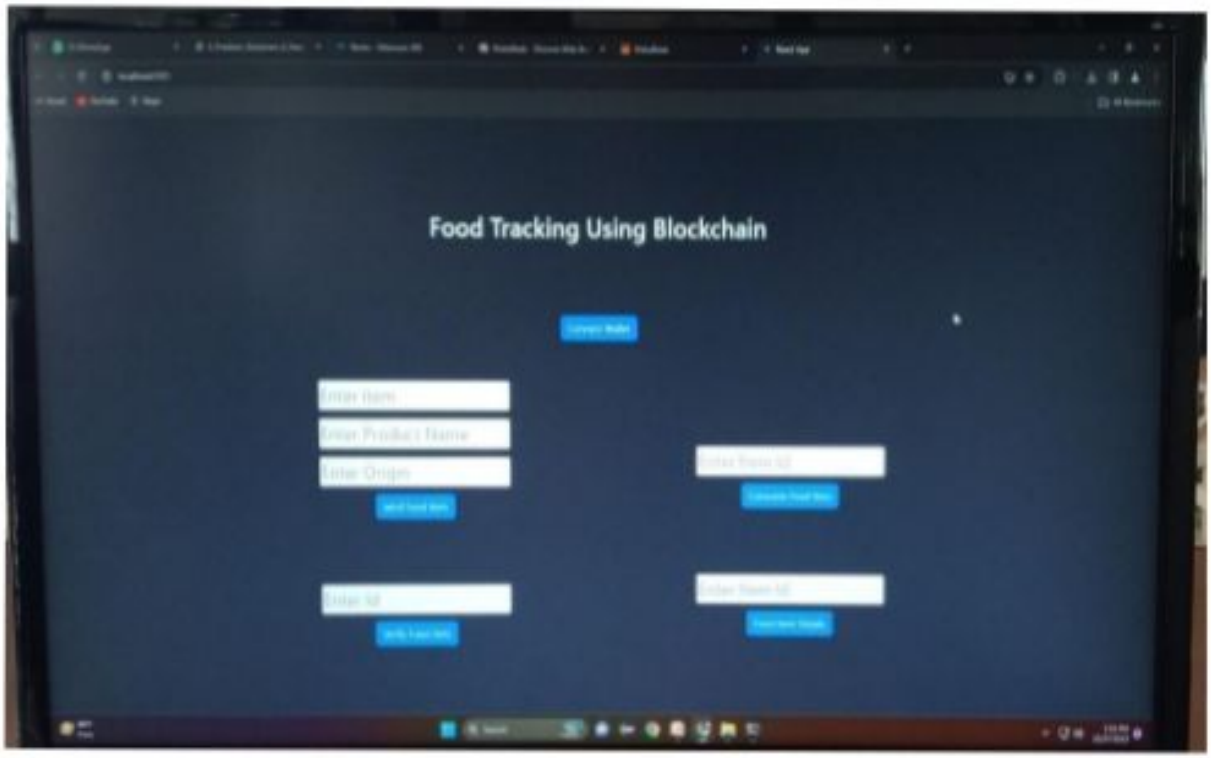
14. Data Visualization: Evaluate the effectiveness of the data presentation, including charts and reports, to help users understand their food consumption patterns.

15. Error Rate: Measure the rate of incorrect food identifications or data entry errors. Minimizing errors is crucial for accurate tracking.

16. Machine Learning Model Performance: If the system uses machine learning for food recognition, assess the model's performance, including its precision, recall, and F1 score.

9. RESULTS

OUTPUT SCREENSHOTS



10. ADVANTAGES & DISADVANTAGES

ADVANTAGES

1. Improved Awareness: Food tracking helps users become more aware of what they eat and drink. It encourages mindfulness about food choices and portion sizes, which can lead to healthier eating habits.

2. Weight Management: Food tracking is a valuable tool for weight management. It allows users to track their calorie intake, helping them achieve weight loss or maintenance goals by creating a calorie deficit or surplus.

3. Nutritional Balance: Users can monitor their intake of essential nutrients, such as proteins, fats, carbohydrates, vitamins, and minerals, ensuring they meet their nutritional needs.

4. Allergen and Dietary Restriction Management: Food tracking can be especially useful for individuals with allergies, dietary restrictions, or specific health conditions (e.g., diabetes, celiac disease). It helps them avoid allergens and manage their condition through accurate food monitoring.

5. Goal Setting: Food tracking systems often allow users to set dietary and health goals, such as daily calorie targets, macronutrient ratios, or specific dietary plans. Tracking progress toward these goals can be motivating.

6. Accountability: Users can hold themselves accountable for their dietary choices. Knowing that they'll record what they eat can deter unhealthy snacking or overeating

7. Behavioral Change: Over time, food tracking can lead to behavior change. Users may naturally gravitate toward healthier food choices and portion control as they see the impact of their choices on their health and fitness goals.

8. Identifying Patterns: Tracking data over an extended period allows users to identify eating patterns and triggers. They can learn about their eating habits and make adjustments accordingly.

9. Customization: Many food tracking systems offer customization options, allowing users to input their dietary preferences, allergies, and restrictions, ensuring that the system aligns with their unique needs.

10. Data-Driven Decision-Making: Users can make informed decisions about their food choices based on the data they collect. For example, they can see which foods are contributing to their calorie intake and make substitutions accordingly.

11. Community and Social Support: Some food tracking systems include social features where users can connect with friends or a community. This social support can help individuals stay motivated and share experiences.

12. Professional Guidance: Some systems offer integration with healthcare professionals, nutritionists, or dietitians, allowing for remote monitoring and support.

13. Long-Term Health Benefits: Consistent food tracking can contribute to long-term health benefits, such as reduced risk of chronic diseases, improved digestion, and better overall well-being.

14. Fitness and Athletic Performance: For athletes and fitness enthusiasts, tracking food intake can help optimize energy levels, nutrient timing, and recovery.

15. Research and Insights: Aggregate data from food tracking systems can provide valuable insights for researchers and public health organizations. This data can inform policies and recommendations.

16. Convenience: Food tracking systems are often convenient to use, with the ability to scan barcodes, search for foods, and store favorite meals for quick entry.

17. Visual Feedback: Many systems provide visual charts and reports that make it easy for users to see their progress and trends over time.

18. Mood and Energy: Users may discover how their diet affects their mood and energy levels, leading to adjustments that enhance their overall quality of life.

DISADVANTAGES

1. Time-Consuming: Tracking every meal and snack can be time-consuming, especially for people with busy schedules. It requires a commitment to logging food consistently.

2. Inaccuracy: Accuracy in tracking can be challenging, as it relies on users' estimates of portion sizes and the completeness of the food database. Inaccurate data can lead to unreliable results.

3. Obsessive Behavior: For some individuals, food tracking can become an obsession, leading to unhealthy eating habits or the development of eating disorders like orthorexia or anorexia nervosa.

4. Stress and Anxiety: The pressure to meet daily calorie or nutrient goals can lead to stress and anxiety, causing users to become overly fixated on their diets.

5. Limited Food Database: The comprehensiveness of the food database can vary between different tracking systems. Users may struggle to find certain regional or homemade foods.

6. Social Awkwardness: Constantly logging food in social situations can be socially awkward or lead to social isolation. It may also detract from the enjoyment of meals with friends and family.

7. User Compliance: Some users may find it challenging to consistently track their food intake, leading to incomplete or inconsistent data, which can impact the system's effectiveness.

8. Privacy Concerns: Users may have concerns about the privacy and security of their dietary data, particularly when using apps or websites that collect personal information.

9. Overemphasis on Numbers: Users may become overly focused on numbers (calories, macros, etc.) rather than the quality of their food choices. This can lead to unhealthy dietary decisions.

10. Lack of Context: Food tracking systems often don't consider the broader context of eating, such as emotional eating, cravings, or social influences on food choices.

11. Dependency: Some users may become overly dependent on food tracking apps and lose the ability to make intuitive, mindful food choices without the app.

12. Cost: While many food tracking apps offer free versions, premium features or subscriptions can incur additional costs.

13. Technology and Accessibility: Not everyone has access to smartphones or the internet, which can limit the use of these systems, particularly in underserved communities.

14. Food Quality vs. Quantity: Food tracking tends to focus on quantity (calories, macros) rather than the quality of the food. Users may prioritize low-calorie processed foods over nutrient-dense whole foods.

15. Unrealistic Expectations: Food tracking can sometimes foster unrealistic expectations about weight loss and body image, potentially leading to disappointment or body dissatisfaction.

16. Eating Disorders Trigger: For individuals with a history of eating disorders or disordered eating patterns, food tracking can be a trigger for relapse.

17. Loss of Spontaneity: Users may feel that they lose the spontaneity and pleasure of eating when they have to meticulously track every morsel they consume.

18. Not Suitable for Everyone: Food tracking may not be appropriate for people with certain medical conditions or mental health issues. It's important to consult with healthcare professionals for personalized advice.

11. CONCLUSION

The application is based on user's requirement and is user centered. All issues related to all user which are included in this system are developed by this system. If people know how to operate android smart phone wide variety of people can use the application. This system will solve the various issues related to tracking the Food service. To help and solve important problems of people implementation of Online Food Tracking system is done.
It can be concluded that, based on the application: Tracking of food is easily by this system; Information needed in making order to customer is provided by the system. Receiving orders and tracking the food is possible through the application and it also helps admin in controlling all the Food system.

12. FUTURE SCOPE

1. Personalized Nutrition: Food tracking systems are likely to become more personalized, taking into account an individual's unique dietary preferences, health goals, genetics, and lifestyle. Machine learning and AI algorithms can help provide tailored dietary recommendations.

2. Integration with Wearable Devices: The integration of food tracking with wearable devices and sensors will continue to grow. Devices like smartwatches and fitness trackers can provide real-time data on physical activity, heart rate, and even metabolic information, enhancing the accuracy of calorie expenditure calculations.

3. Biofeedback: Advancements in biofeedback technology may enable real-time monitoring of physiological responses to food. This can provide insights into how different foods affect an individual's body, helping with personalized dietary choices.

4. Meal Planning and Preparation: Food tracking systems may expand to offer meal planning and preparation features, helping users create and follow balanced meal plans based on their dietary goals and preferences.

5. Nutrient Quality Assessment: Future systems could place a greater emphasis on nutrient quality rather than just calorie counting, helping users make healthier food choices based on their nutritional value.

6. AI-Powered Food Recognition: Improved AI algorithms will enhance the accuracy and speed of food recognition. Users may simply need to take a photo of their meal, and the system can accurately identify and log the foods.

7. Blockchain for Food Traceability: Blockchain technology can be used to provide a transparent and secure way to trace the origin of food products. This can help users make informed choices about the sources and quality of their food.

8. Augmented Reality (AR) Integration: AR can be used to provide users with real-time information about the nutritional content of foods by simply pointing a smartphone or smart glasses at the food item.

9. Healthcare Integration: Food tracking systems may integrate more closely with healthcare providers. Physicians and dietitians can access a patient's food intake data remotely, enabling more targeted recommendations and monitoring.

10. Behavioral Psychology Integration: Behavioral psychology principles can be incorporated into food tracking systems to address psychological aspects of eating, such as emotional eating, cravings, and habit formation.

13. APPENDIX

SOURCE CODE

Food Tracking.sol

```
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.0;

contract FoodTracking {
    address public owner;

    enum FoodStatus {
        Unverified,
        Verified,
```

```
    Consumed
  }

  struct FoodItem {
    string itemId;
    string productName;
    string origin;
    uint256 sentTimestamp;
    FoodStatus status;
  }

  mapping(string => FoodItem) public foodItems;

  event FoodItemSent(
    string indexed itemId,
    string productName,
    string origin,
    uint256 sentTimestamp
  );
  event FoodItemVerified(string indexed itemId);
  event FoodItemConsumed(string indexed itemId);

  constructor() {
    owner = msg.sender;
  }

  modifier onlyOwner() {
      require(msg.sender == owner, "Only contract owner can call
this");
      _;
  }

  modifier onlyUnconsumed(string memory itemId) {
    require(
      foodItems[itemId].status == FoodStatus.Verified,
```

```
            "Item is not verified or already consumed"
        );
        _;
    }

    function sendFoodItem(
        string memory itemId,
        string memory productName,
        string memory origin
    ) external onlyOwner {
        require(
            bytes(foodItems[itemId].itemId).length == 0,
            "Item already exists"
        );

        foodItems[itemId] = FoodItem({
            itemId: itemId,
            productName: productName,
            origin: origin,
            sentTimestamp: block.timestamp,
            status: FoodStatus.Unverified
        });

                    emit FoodItemSent(itemId, productName, origin,
block.timestamp);
    }

        function verifyFoodItem(string memory itemId) external
onlyOwner {
        require(
            bytes(foodItems[itemId].itemId).length > 0,
            "Item does not exist"
        );
        require(
            foodItems[itemId].status == FoodStatus.Unverified,
```

```
            "Item is already verified or consumed"
        );

        foodItems[itemId].status = FoodStatus.Verified;

        emit FoodItemVerified(itemId);
    }

    function consumeFoodItem(
        string memory itemId
    ) external onlyUnconsumed(itemId) {
        foodItems[itemId].status = FoodStatus.Consumed;

        emit FoodItemConsumed(itemId);
    }

    function getFoodItemDetails(
        string memory itemId
    )
        external
        view
        returns (string memory, string memory, uint256, FoodStatus)
    {
        FoodItem memory item = foodItems[itemId];
          return (item.productName, item.origin, item.sentTimestamp,
item.status);
    }
}
```

GITHUB & PROJECT DEMO LINK

https://github.com/lavanyavasanthi/BLOCKCHAIN

Demo link:

https://drive.google.com/file/d/131VYb9VkV2uf20H3uUq5msA9we_y2_U-/view?usp=drivesdk