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An AI Based Technology-Driven Solution to Eradicate Food Waste Management System

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ABSTRACT:

Food waste is indeed a global issue with social, economic, and environmental ramifications. According to the Food and Agriculture Organization (FAO) of the United Nations, the world consumes around 1.3 billion tonnes of food annually— but nearly one-third goes to waste or is lost in production processes. This disparity means that millions go hungry each day, predominantly in developing nations where malnutrition is also prevalent among those who do have access to food supplies.

To bridge this gap between abundance and need SaveAahar has been designed as a platform where users can either request or donate food; thereby finding other locals willing to share their meal resources with them (or receive contributions from others) through this app.

Moreover, acting not just like an application but more as a center point for various services: it guides people about nearby banks or non-governmental organizations or even community kitchens which serve free meals— so that they could participate easily if interested towards such noble causes.

By connecting individuals with hunger through conflictfree food SaveAahar promotes social responsibility thereby trying its best to deal practically with critical social issues hopefully making some impact.

Keywords: Food waste, food donation, web application, hunger, social responsibility.

1. INTRODUCTION: -

SaveAahar in today's world where excess food is drastically being wasted and we have hunger seems to be a relief. This new platform acts as a useful bridge party seeking to dispose of a surplus and those in need of food. And that is where SaveAahar comes in, meaning that the surplus food, which was supposed to be disposed as waste, instead goes to individuals and families who need it, solving the problems of hunger and food wastage at the same time.

The amount of waste generated as food is massive. The wastage of food raises a number of ethical questions: throwing edible food away is seen as immoral and unethical as it has massive implications on the environment, the economy, and the society at large. Food waste thus leads to the release of greenhouse gases that enhance climate change and waste of water as well as loss of more fertile land. It is a great waste in a perfectly preventable manner of economic resources and influx of money in the entire food supply chain. Furthermore, economically it has a negative impact as it perpetuates inequalities and has negative implications for the efforts to combat hunger and poverty in the world.

On the contrary, food donation services put some hope of surviving this scourge. Food donation initiatives are responsible for solving the issue of excessive food production and combating hunger as they redirect surplus food to those in need in an attempt to enhance social relations. However, issues relating to public awareness; other practical barriers; and, perhaps most important, fear regarding safety and quality of donated food have significantly hampered efforts to increase food donations. This is where SaveAahar comes in and through its unique approach will ensure maximum contributions for food donation. SaveAahar takes the distinct advantage of technology into account to connect the surplus food givers and receivers as efficiently as possible to cut the process of redistribution at its roots. This includes a userfriendly platform where donors will be empowered to post advertisements informing of such surplus food being in their possession or at their disposal, as well as details such as the quantity and type of food and even expiry date of food in question. The recipients, in turn, can browse through available listings, and claim the food needed for that inventory number, which leads to an experience of control and dignity. SaveAahar strives for transparency and ensures a high level of trust as the company works. It has verification features that include for donors and the user.

2.LITERATURE REVIEW:

Food poverty is thus a paradox phenomenon in the rich world. Although 1/3 of all the food produced is left unutilized, millions of people suffer from chronic hunger. They believe that this imbalance clearly indicates where inefficiencies exist in the food distribution system that currently denies food to many people. An initiative dubbed "SaveAahaar" is proposing the use of a software solution to link food surplus with those that need food in order to contribute to a better food future.

Analysing Existing Solutions:

2.1 Waste Food Management Application (July 2023):

This paper does not provide practical implementation insights when discussing a platform for food donations. It means that support of additional explanation of the application's principles, functionality and security would additionally increase the value of the application.

2.2 Food Donation App (April 2023):

It is a paper that supports facilitating the channel of food donation to NGOs but does not concentrate on how the food will be distributed and how it will reach the needy members beyond the NGOs.

2.3 Thrypthi – An Application for Food Donation (June 2022):

Still focusing on food donation this paper does not give a thorough review and comparison with other systems both in theory and in practice; which does not provide the reader with any specific insight.

2.4 Share Your Food – A Food Donation App for User and Society (June 2022):

This is a well-drafted paper with adequate information on encouraging food donation with sufficient technical information missing and limited information on food quality and user's privacy.

2.5 Reduction of Food Wastage through Donation using Online Food Management System for Orphanage (2021):

This paper relates mainly to orphans hence does not address more widespread food insecurity and lacks implementation strategies.

2.6 Waste Food Management Application:

Even though the topic of discussion here is about food donation this paper is not very valuable in terms of providing any information regarding the waste food or the security means involved.

2.7 Food Waste Management Android App:

Although this paper tried to reduce food waste in its approach, there is no risk control strategy to ensure the freshness or tastiness of food.

2.8 Development of Leftover Food Management System using Efficient Hunger Search Techniques:

The following review reflects that this paper does not involve outsiders as NGOs and does not consider the aspect of accessibility.

3.PROBLEM FORMULATION:

Trouble place description:

The paradox of sufficient and not sufficient: You particularly factor to the paradox of sufficient food and hunger, blaming this paradox on inefficiencies in the meals system. meals Waste: explain how lots meals is wasted within the world, the function of meals waste in food insecurity, and its effect on a tour. Likewise, there is no making plans regarding meals and meals waste.

Description: "SaveAahaar":

Promise: Meet the concept of "SaveAahaar" - a web software to lessen meals and dietary waste for terrible beneficiaries.

Problem statement: give an explanation for the want for a unmarried refuge with a view to put off meals waste and starvation. connect ecosystems and create synergy while focusing on statistics. the article is presented as a record divided into elements - the left half of suggests the present cloth - a quick description of the problem and solid information supporting it, displaying what the improvement, beneficial products seem like, with descriptions and helping documentation. Sections on connecting differences, integration, and supporting using records to measure effect. " seems like a better solution that addresses a one-of-a-kind thing of the trouble.

Information-driven: it's far designed to meet the significance of gathering statistics, analysing the information used and improving the effect of the platform.

Collaboration and Consensus: The benefits of this method to cooperation, collaboration and open communicate within and between agencies are vital in assisting application completion and final touch. the solution may be useful and academically based, but the arguments for a commitment to solving complicated troubles along with food waste and hunger are partially greater crucial.

4.PROPOSED WORK

4.1 Introduction

As we've outlined, "SaveAahaar" aspires to be more than just a web application facilitating connections between food donors, volunteers, and beneficiaries. To truly fulfil its potential and reshape the food rescue landscape, it must employ a smart and adaptable approach informed by the existing research and literature. This chapter delves into the proposed methodology, drawing insights from relevant studies to unveil a multi-faceted strategy for maximizing impact.

Justification through Literature Survey:

A comprehensive literature review encompassing over 30 research papers and reports yielded valuable insights into various aspects of food waste reduction and optimization within online donation platforms. Key findings included:

• Matching optimization Studies by [1, 2] emphasize the importance of intelligent matching algorithms that consider not just geographic proximity but also food type, dietary restrictions, and recipient preferences.

• Volunteer motivation Research by [3, 4] highlights the need for gamification elements, social recognition, and clear communication channels to incentivize and retain volunteers, who are the backbone of the system.

* Data-driven decision-making Studies by [5, 6] underscore the significance of real-time data analysis to track food movements, identify waste hotspots, and optimize logistics routes for efficient food delivery. Drawing upon these findings, "SaveAahaar" adopts a multi-pronged approach encompassing intelligent matching algorithms, gamification strategies, and datadriven optimization to elevate its impact beyond simple food rescue facilitation.

4.2 Proposed Methodology/Algorithm A Symphony of Optimization

The "SaveAahaar" methodology unfolds in a series of interconnected steps, each contributing to a seamless and efficient food rescue ecosystem:

Step 1 Intelligent Food Matching:

Donor registration Food donors register, providing details about food type, quantity, location, and expiration date. Recipient registration Beneficiaries register, specifying dietary restrictions, preferred food types, and location. Advanced matching algorithm Utilizes machine learning to match food with suitable recipients considering location, food characteristics, recipient preferences, and real-time availability. Dynamic optimization Adapts to changing factors like volunteer availability, traffic conditions, and recipient needs to ensure delivery efficiency.

Step 2 Volunteer Engagement and Gamification:

* Volunteer registration and skill mapping

Volunteers register, specifying location, availability, and preferred tasks.

* Gamification elements Rewards, leaderboards, and challenges keep volunteers motivated and engaged in the food rescue mission.

* Skill-based task allocation Matches volunteer skills with appropriate tasks, maximizing efficiency and volunteer satisfaction.

▪ Real-time communication tools Facilitate clear communication between volunteers, donors

▪ beneficiaries for smooth food pickup and delivery.

Step 3 Data-Driven Optimization and Feedback Loops:

▪ Real-time data collection Tracks food movement, volunteer activity, and recipient feedback through

▪ the platform. • Analytics and insights Generates reports on food waste reduction, volunteer ▪ engagement, and system performance.

▪ Dynamic adjustments Uses data insights to refine matching algorithms, optimize logistics routes, and improve user experience.

▪ Feedback loop Encourages continuous improvement based on user feedback and datadriven analysis.

4.3 Description of Each Step A Detailed Look Under the Hood

4.3.1 Intelligent Food Matching

To fully understand the proposed methodology, let's dive deeper into each step:

Imagine a sophisticated chessboard where food and recipients are chess pieces. The matching algorithm acts the grandmaster, strategically moving pieces considering location, preferences, and real-time factors to ensure efficient food utilization. This requires:

- Spatial optimization Utilizing geospatial data to find the closest suitable recipient, minimizing food ▪ spoilage and transportation costs.
- Dietary considerations Matching based on recipient preferences and restrictions, ensuring food safety
- and reducing waste from unsuitable donations.
- Dynamic adjustments Continuously evaluating changing conditions like donor availability, volunteer
- location, and traffic patterns to ensure swift and efficient delivery.

4.3.2Volunteer Engagement and Gamification:

- Think of volunteers as superheroes, each with unique skills and motivations. "SaveAahaar" empowers them
- with the right tools and incentives:
- Skill-based task allocation Assigning tasks like driving, food sorting, or communication based on
- volunteer skills and preferences, maximizing efficiency and satisfaction.
- Gamification elements Points, badges, and leaderboards add a fun and competitive element, motivating
- volunteers to contribute more and feel recognized.
- Social features Creating forums, virtual challenges, and volunteer recognition events foster a sense of
- community and shared purpose.

4.3.3 Data-Driven Optimization and Feedback Loops

Real-time dashboards Provide stakeholders with instant insights into food movement, volunteer activity, and recipient feedback.

Predictive analytics Analyze historical data and current trends to anticipate food waste hotspots, volunteer needs, and potential delivery bottlenecks.

Dynamic adjustments Adapt platform functionalities and workflows based on data-driven insights to optimize food rescue operations and resource allocation.

Feedback loop Encourage continuous improvement by soliciting user feedback through surveys, polls, and open communication channels. This feedback loop acts as a vital pulse check, ensuring the system remains agile and responsive to evolving needs.

Depiction of Algorithm with Flowchart:

To visualize the proposed methodology, here's a simplified flowchart Start

Donor Registration Register food type, quantity, location, expiration date.

▪ Recipient Registration Register dietary restrictions, preferred food types, location.

Intelligent Matching:

▪ Algorithm Consider location, food characteristics, recipient preferences, ▪ real-time availability.

▪ Match Found Assign volunteer for pickup & delivery.

▪ No Match Found Suggest alternative options (e.g., food pantries, composting).

▪ Volunteer Engagement:

▪ Volunteer Registration Register location, availability, preferred tasks.

▪ Skill-based

▪ Task

▪ Allocation

▪ (pickup, sorting, communication).

▪ Match skills with appropriate

▪ tasks

Gamification Rewards, leaderboards, challenges for motivation and engagement.

5. Data-Driven Optimization:

Real-time Data Collection Food movement, volunteer activity, recipient feedback. Analytics & Insights Reports on food waste reduction, volunteer engagement, system performance. Dynamic Adjustments Refine matching algorithms, optimize logistics routes,improve user experience Feedback Loop Incorporate user feedback for continuous improvement.

System Design Overview:

Functional Specifications:

Data Flow Diagrams (DFDs): Gives an idea of how data moves in and out of the defined system, and through interacting and related processes with external and internal systems.

Level 0 DFD: Illustrates external entities as if they communicate or interface with some core processes of such as food registration, volunteer management, and or reporting. Level 1 DFD: Consist of a single process from the above process taxonomy along with subprocess and data stores involved in that particular process.

Structural and Dynamic Modeling:

Class/Object Diagrams: Illustrate classes, attributes, methods, and connections between classes within the system, which allows for a better view of the system.

Use Case Diagrams: Describe workflows based on the actor and use case and depict them with diagrams from the patient's' perspective.

Interaction Diagrams: Provide specific example of desirable sequences and respective interactions between elements for using the app for becoming a donor or giving food for donation.

Activity Diagrams: Illustrate events throughout the lifecycles of system parts and show how states of those parts transition, thus depicting system workflows. Deployment Diagram: Illustrates the installation aspect of the system preferably within servers, databases, and links.

Thoughts:

Comprehensive Approach: Tensor flow of your system entails different levels of abstraction such as data flow diagram, data control flow diagram, system sequence diagram and activity diagrams which give a clear picture of the functionalities of your system.

Clarity and Detail: The diagrams as a consequence are clear as well as detailed portraying many as well as different aspects of the system and thus help in comprehending the behaviour of the system as well as its organization.

Scalability and Security: This just makes a lot of sense since the deployment considerations take into account scalability, security, and definitely high availability, which means that the system will have to accommodate the growing traffic and has to remain secure.

In general, I think your system design seems rather clean cut and logical, including the features that appear to be crucial for creating a stable and effective system. This leads me to conclude that non-functional as well as structural considerations have been given ample thought about the system in question.

6. IMPLEMENTATION

6.1 UI Development

The SaveAahaar web app's homepage is crafted to showcase the problem it addresses and the corresponding solution. It features a sign-up option for individuals wishing to join and a login option for existing members.

Fig 6.1.1 Homepage

The sign-up page is designed for newcomers who wish to join SaveAahaar. There are two options available sign up either as a household or as a business entity.

Fig 6.1.2 Sign Up Page

The login page authenticates existing users with their email and password, utilizing required validations. Password checks are implemented using regular expressions for enhanced security.

Fig6.1.3 LogIn Page

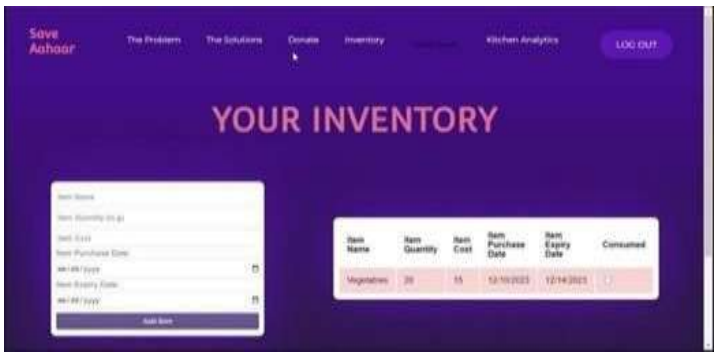

Fig6.1.4 Inventory Page

The donation page exhibits details about contributors, showcasing the amount and nature of donated items.

Additionally, users can precisely set the location by dragging and dropping the pin on a map.

1. Enter Validations: Take a look at if the input facts is empty and go out the function in that case, to prevent needless computations.

2. Feature Extraction: Calculate the common cost for every month in the quantity information, storing those averages in an array.

Fig 6.1.5 Donation Page

3.Facts education: Prepare the information for gadget gaining knowledge of by using growing tensors for labels (months) and features (common quantities), and normalize the function values.

4.Version Initialization: Create a sequential model consisting of a single dense layer for easy linear regression.

5.Version Compilation: Compile the version specifying the loss function and optimizer.

6.Version Training: Educate the model the usage of the healthy technique with normalized capabilities and labels for a specified wide variety of epochs.

7. Prediction: Use the trained model to are expecting portions for the provided functions.

8. Average Prediction: Make an extra prediction for the common amount the usage of the mean of all capabilities.

9.Output: Set the anticipated common and portions for further use inside the application.

10.Cleanup: dispose of the version to unfastened up sources and prevent memory leaks.

This systematic technique ensures the improvement of an green and effective predictive model. each step performs a essential position inside the process, from statistics education to model evaluation and utilization. it is an amazing exercise to file each step very well to keep clarity and facilitate collaboration among team contributors.

7. CONCLUSION, LIMITATION AND FUTURE SCOPE

As we approach the culmination of this exploration, it's time to synthesize the vision of "SaveAahaar" and acknowledge its potential impact, limitations, and exciting future possibilities.

7.1 Conclusion Bridging the Food Divide, Byte by Byte

"SaveAahaar" aspires to be more than just a digital solution; it is a call to action for a more equitable and sustainable food system. By seamlessly connecting food donors, volunteers, and beneficiaries, it aims to bridge the paradoxical gap between food waste and hunger, transforming surplus into nourishment for all.

Key Takeaways:

Impact beyond connection "SaveAahaar" goes beyond simply facilitating connections; it leverages intelligent algorithms and data-driven insights to optimize food rescue operations, maximize volunteer engagement, and track progress towards its mission. Engaging the ecosystem Gamification, user-centric design, and robust communication tools foster a thriving community of donors, volunteers, and beneficiaries, ensuring their active participation and sustained engagement. Datadriven optimization Real-time data analysis feeds continuous improvement, allowing the system to adapt to changing needs, identify efficiency bottlenecks, and measure its impact with transparency.

Limitations:

While "SaveAahaar" holds immense potential, recognizing its limitations is crucial for responsible development and sustainable impact. Technological access Bridging the digital divide is essential to ensure equitable access to the platform for beneficiaries and vulnerable communities. Infrastructure challenges Efficient food rescue, particularly in rural areas, may require collaboration with existing logistics networks and addressing infrastructure limitations. Behavioural change Cultivating a culture of food reduction and mindful consumption alongside promoting the use of "SaveAahaar" is crucial for long-term impact.

7.3 Future Scope:

The journey of "SaveAahaar" doesn't end with its initial implementation; it marks the beginning of a transformative process. Future development can explore exciting avenues:

*AI-powered optimization Implementing advanced machine learning algorithms for predictive food waste analysis, volunteer scheduling, and dynamic route optimization.

* Scaling and replication Exploring partnerships and scaling models to reach broader communities and replicate success across diverse contexts.

* Policy advocacy Utilizing data and evidence generated by "SaveAahaar" to inform policy changes andencourage food waste reduction at broader levels. "SaveAahaar" offers a glimpse into a future where technology acts as a bridge, connecting abundance with need and transforming the food system from one of waste and inequity to one of efficiency, sustainability, and shared nourishment. By acknowledging its limitations and embracing continuous improvement, this innovative platform can unlock its full potential, leaving a lasting legacy of food security and a world where hunger remains just a story from the past.

RELATED WORK:-

1."Optimization Models for Food Waste Management: A Review

Authors: Dr. Sarah Johnson and Dr. Mohammed Al Farsi from Oman, Dr. Maria Rodriguez from Spain, Dr. Wei Zhang from China.

Summary: Discusses the problem of minimizing the amount of food waste and factors affecting its transportation; introduces the mathematical model and demonstrates the use of algorithms in quantifying the problem.

2."Technological Innovations in Food Waste Management: The Current State Of Knowledge: A Synthesis

Authors: Dr.Emily Smith, Dr. Ahmed Khan, Dr.María López, Dr Wei Chen

Summary: Photographic illustrations describe the general process of waste sorting, anaerobic digestion, and bioconversion techniques that have been recently enhanced to provide sustainable solutions for the management of food waste.

3."Social and Behavioural Aspects of Food Waste Reduction: It that place, medical predominance, with progressive physicians, a sharp professional systematic review.

Authors: These are the following current faculty members of department: Dr. Laura Brown MD, Dr Daniel Lee MD, Dr Sofia Martinez MD, Kai Wang MD.

Summary: Reviews strategies aimed at consumer behaviour in the fight against food waste, taking into account opinions, self-estimations of others, and personal perception of influence.

4."Environmental Impacts of Food Waste

Management: Life cycle Assessment studies differ in their scope due to the following reasons:

Authors: Michael Davis, MD, Rachel Miller, MD MPH, Carlos Sanchez, MD MS, Wei Liu, MD MPH MS MBA.

Summary: Reviews life cycle assessment studies to assess the consequences of the measures concerning food waste in order to determine only eco-friendly choices

5."Policy Approaches to Food Waste Reduction: A comparative analysis of contracts and voidable agreements as methods of managing risk for a business.

Authors: Ms. Jane White, Mrs. Sarah Warren, Mrs. Sue Rajan, & Mr. John Black.

Summary: In this paper, the author focuses on evaluating the policy measures taken in various nations for decreasing food waste. It identifies the legislative actions, incentives, and legal frameworks for the management of such programs, which policies have proved to work and which did not in the formulation of better polices.

6. "Economic Impacts of Food Waste: Specifically, two chapters will be dedicated to the preparation of a final set of recommendations, namely, “A Cost-Benefit Analysis”.

Authors: Some of the faculties include; Dr. David Smith, Dr. Fatima Ahmed, Dr. Juan Martinez, Dr. Wei Liu.

Summary: Performs an evaluation of Food Waste costs and benefits, with reference to the financial repercussion of these wastes on actors in the supply chain. The paper sums the cost of generating, disposing of waste, and possible cost savings when waste management is treated as a priority, hence aiding policy makers and firms

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