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Towards Assimilating and Reconciling Customer Pain Points of Food Delivery and Logistics Industry: A Design Science Approach

Sugun Segu
Dept. of Mechatronics and Robotics, SRM University, Tamil Nadu, 603203, India

Krutarth Manish Bhatt
Dept. of Computer Science, Nirma University, Ahmedabad, 382481, India

Harshmeet Singh Chandhok
Dept. of Computer Science, Shivaji University, Ichalkaranji, 416115, India

Sayanta Paul
Dept. of Computer Science, IIT Patna, Bihar, 801106, India

Hitesh Hinduja
Dept. of Computer Engineering, Mumbai University, Mumbai, 400071, India

* Corresponding author, Email address: hitesh.hinduja@ves.ac.in

Abstract - The fundamental objective of this paper is to contribute to the strain of research for understanding the customer pain points experienced in the food and logistics industry and come up with possible. Artificial Intelligence based solutions. Primarily, we have focused on three crucial aspects to improve the entire process of the online food delivery and logistics industry, i.e., uncovering customer pain points, comprehending business obstacles, and achieving an overall synchronization of the end-to-end process. This paper addresses such concerns by using state-of-the-art advanced technologies like Artificial Intelligence, Block chain, and more. Every potential method mentioned in this paper also describes the features used to build this technology with a detailed understanding of every feature proposed. The article also discusses the future challenges faced after incorporating state-of-the-art techniques to improve processes and systems further.

Keywords- Artificial intelligence, Block chain, Covid-19, Food delivery, Inventory management, Variable neighborhood search (VNS).

I. INTRODUCTION

We, as a customer, always look forward to getting well served, which will be a convenient and hassle-free experience. Before the online food delivery services emerged, only a few options were available, e.g., dine-in and take away from selective restaurants. Today, technology as a pivotal player upraised the prior defination of food delivery to the customers' doorstep with ever-changing demands.

It notes that several concerns are associated with online food delivery services and logistics industries, e.g., seasonal influences, hygiene, quality checking before delivering the products, and more. It has been observed in the literature that there exists a strong Correlation between different entities involved in end-to-end doorstep delivery services, ranging from availability of a particular product to selection of a product and finally on-time delivery [1].

In 2020, Anjani et al. presented a study to illustrate that watching others eat something delicious creates a craving for the food [2]. Authors also have shown that watching eating broadcasts helps to gain an appetite. As online food delivery services emerge, there is an ongoing concern about food safety and healthy food.

In 2013, Lau et al. proposed a functional food concept, which contains bioactive components beneficial to health and can reduce risks of chronic diseases, leading to a rigorous food quality checking starting from food producers to restaurants [3]. In the scenario of online food delivery services,

projecting appropriate food images plays a vital role in placing orders. In 2013, Sakurai et al. constructed a tabletop system that projects virtual dishes around the food to interactively change the assessed apparent food volume. Authors have drawn a direct relationship between the sizes of virtual dishes the perception of satiety, and the amount of food consumption [4]. This doorstep delivery system has always been driven by customer demands, customer experience, and customer satisfaction.

Therefore, undertaking customer insights provide better service quality. Clark et al. introduced a study considering the increased need for pre-packaged food-to-go products. Authors have shown how customer behaviour studies made the overall delivery system better [5].

The history of goods delivery dates back to 400 BC when Prince Cyrus used pigeons and men on horseback to deliver messages and goods within his kingdom and beyond. Since then, courier services have undergone a massive transformation with large companies like Pony Express, Wells Fargo, and Blue Dart. However, goods delivery has never been an easy task as it comes with inherent problems like delivering the goods timely and in the same condition as dispatched. Also, deciding the location of the warehouse needs to be done, taking multiple factors into account.

In 2017, Zhang et al. presented a study to minimize the warehouse's total cost of production and operations. To do this minimization, the Authors have developed a mixed-integer linear programming model [6]. In 2015, Zhi-HuaHu highlighted a dynamic vehicle routing problem for a closed-loop vehicle for incompatible goods. Authors solve this problem with VNS (Variable Neighbourhood Search)-based algorithm [7].

All these studies have specific challenges which can be solved efficiently using data-driven approaches. Section 3 presents several such challenges and their possible solutions by utilizing AI-empowered systems.

With the exponential growth of technical advancements, the definition of online food delivery services has changed dramatically, including in the logistics industry. Unfolding technology and innovations, increasing competitors, and expanding demand of the emerging customers, forcing the organizations to improve their existing services to retain their customer base and gain new customers. To achieve customer satisfaction, both food delivery services and logistics industries have undertaken specific strategies and adopted cutting-edge technologies that are potential and significant. Data is the new oil in this era, so taking advantage of artificial intelligence is undoubtedly an intelligent move.

Organizations already have undertaken cutting-edge technologies like explainable AI, scalable ML, blockchain to ensure better market reach, customer retention, and product quality in the online food delivery and logistics industries. Data-driven AI-enabled systems have already demonstrated their ability to forecast the demand of any particular product, predict the dynamic routes of delivery, real-time tracking, and other attributes. The potential applications of AI have been observed across domains to solve numerous downstream problems.

In particular, online food delivery industries utilize these AI-empowered systems to estimate the delivery time of order arrival and recommend items to users based on different aspects like placing orders, order history, and bestseller items of a particular restaurant.

Similarly, AI has been employed in the logistics industry to minimize human efforts and efficient planning like analyzing existing routes, route optimization, scheduling and tracking, back-office automation, sales and marketing analytics, and others. It notes that this paper focuses on understanding and identifying customer pain points based on expectations before purchase and post-purchase experience.

We then come up with quite a few possible AI-driven solutions to address these emerging challenges, discussed in the subsequent section.

While we tried to address the identified customer pain points, we have also considered and analyzed its business impacts, ensuring that organizations achieve better customer satisfaction with optimized costs. The rest of the ideation paper represents various aspects of problems experienced by customers and AI-empowered solutions that attains both the business impact and USP.

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The organization of the paper is as follows. Section 2 and its subsections explain our materials and methods, followed by Section 3, which concludes this study and its future scope.

II. MATERIALS AND METHODS

This section exhibits the customer pain points experienced in the food and logistics industry. Furthermore, we address these issues by leveraging AI to provide a better customer experience.

1. Food search and discovery system through ingredient search:

The world consists of a diverse set of people, and each one of them has its personal food preferences. People have ingredient preferences based on their likings and allergies. According to a report3, 6% to 8% of children under the age of 3 and up to 3% of adults suffer from food allergies. Finding food online with preferred ingredients is challenging. To overcome this, we propose an ingredient-based search system. This system allows the user to create lists of ingredients that should not be in the food.

Our proposed AI system considers 20+ features; some include the type and cost of previous orders, restaurants from past orders, user location, time of order placed, etc., and recommends food those fits customer preferences. This system generates a unique ID for each ingredient and maps that to a list of food items containing that ingredient. This system will significantly impact places where people's choices are highly diverse.

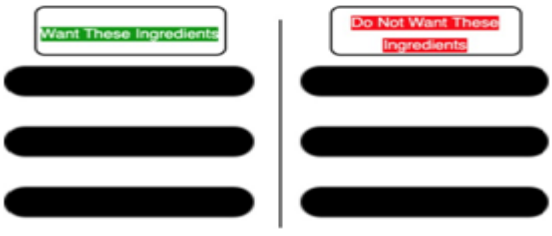

Fig 1. List of ingredients that user requires.

2. Health-conscious system:

According to the survey4 in 2013, over 95% of the world's population had health issues, with over one-third of them having more than five ailments [8].
A healthy diet with proper proportions contributes towards an increase in life expectancy.

Having an option to comply with the dietary preferences, there would be an increase in demand for healthy food. In such a scenario, the online food ordering platforms must recommend healthy food to such users and help them maintain their health.

Hence, we propose a Health Conscious Food Recommendation System, wherein users enter the ailments or allergies they are suffering [3] [9]. The recommendation system considers 15+ features, including the user's illnesses, the severity of diseases, time since diagnosis, order history, etc.

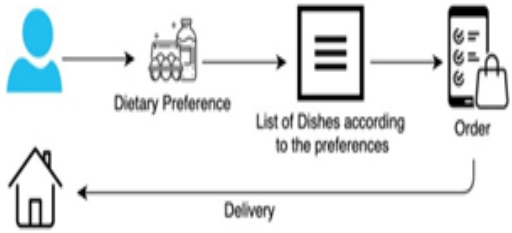

Fig 2. Health-conscious food recommendation system.

3. Self-Cooking System:

Today, numerous restaurants, food joints, and online food ordering platforms provide ready-to-eat food items to their customers. However, they are not able to serve the consumers who want to cook by themselves. Statistics5 show that there are around 36% of Americans cook at home daily. Also, those who want to learn cooking will have to buy all the raw materials needed and start everything from scratch, which is a long and tiresome process.

Fig 3. Users can get personalized items for self-cooking.

Hence, we propose a self-cooking system, where the user selects food items and the quantity of those items that they want to self-cook. Raw materials for the dish are sent to the customer with a cooking manual or a tutorial video. Additionally, an extra charge will be taken from the user to pre-processed raw materials, e.g., providing an option to get

chopped vegetables. This will work as a tutor for people trying to learn cooking.

4. A system to quantify food items/dishes through visualization:

In the present scenario, online food ordering platforms mention the weight of the dish, which gives an idea of the quantity of the food. However, this method doesn't work in all cases [4]. Consumers won't understand the quantity of food just from the weight and might order less or more food than needed. There would be cases where there is a difference in quantity even if the weight is the same. We propose a feature where the dish is displayed using Augmented Reality (AR) to resolve this. This feature helps achieve a better customer experience [10] and increases transparency as the users get a clear idea of the quantity before placing the order.

5. A system to identify warehouse hotspots on strategic locations:

The establishment of warehouses at optimal and strategic locations paves the path of better customer retention, new customer addition, and above all, enriched customer experience. A perceptive location of the warehouse ensures a well-balanced distribution of goods to both urban and rural areas, maximizing the overall profitability of the respective business organization. Choosing the site for setting up warehouses, with particular attention to the rural customers, comes with four-fold advantages, i.e., cost reduction, faster delivery, better reachability, and more area coverage [11].

However, most existing strategies [6] for setting up warehouses have few demerits, including less attention to the customer residing in rural areas, inefficient deliveries, and suboptimal cost efficiency. This has a significant impact on the overall warehouse management system. This problem is alleviated by making use of Artificial Intelligence and advanced analytics. As Clive Humby said [12], "Data is the new oil," we will leverage data while determining a strategic location for setting up a warehouse. The attributes to be considered include but are not limited to the following: number of orders placed from a specific geographic region, waiting time to receive an order, availability of land in the targeted location, analysis of the local market and environmental factors, review of highway connectivity with airport, railways, and ports, transportation connectivity, traffic conditions, availability of various supportive resources, availability of workforce.

This enriched AI-empowered solution effectively tackles all the demerits of existing strategies for warehouse location selection with minimized cost, maximized profit, and customer retention.

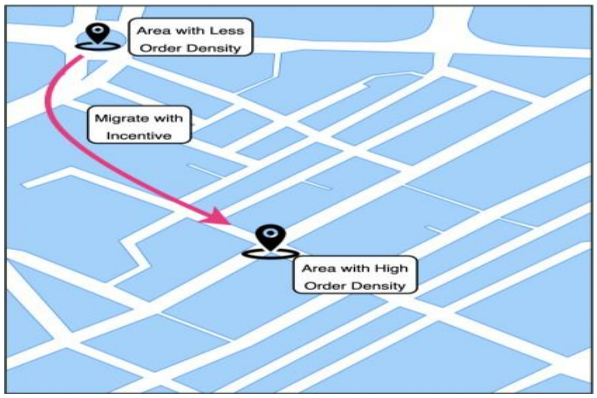

Fig 4. Delivery partner relocation from less order density area to an area with high order density.

6. A fair and explainable solution for waiting time payment to delivery partners:

Companies pay extra charges every minute to the delivery partner who reaches the restaurants before the food is prepared. Usually, the waiting time for delivery partners ranges from 10-15 mins.

Companies should assign a predicted pickup time to the delivery partner. We propose that if the delivery partner arrives after the pickup time or the restaurant exceeds the allotted food preparation time, the responsible entity will be penalized accordingly. The system will also provide buffer time above the estimated time given to delivery partners and restaurants.

By this, we are efficiently minimizing the cost borne by the company, keeping the restaurant's goodwill, and optimizing the overall time from placing the order to delivery. To develop a solution to optimize the waiting time, the proposed AI system considers 20+ features. Some are the order placement time, order quantity, order type, restaurants' location, number of orders queued, order history, restaurant workforce, forecasted demand, etc.

Following the above approach, we effectively avoid overhead costs incurred by companies. If we can estimate the pickup time based on the attributes

considered, companies will not have to bear delivery partners' waiting for costs.

This system encourages the restaurants and delivery partners to work as competitors because they will have to pay for the other if they fail. Hence, both of them will try to perform better, reducing the loss incurred by the company. This will result in a reduced delivery time leading to enhanced customer satisfaction.

7. Incentive driven innovative and dynamic recommendation system for food delivery partner:

There are certain areas in any city or town where the order frequency is relatively high at a specific time. Consequently, the shortage of delivery partners in the dense order frequency areas results in undesired delivery delays, leading to suboptimal customer experience. On the contrary, delivery partners have to stay idle in regions where the order density is low.
To achieve a trade-off, we propose an incentive-driven dynamic recommendations system. It solves the problem by recommending delivery partners to move from common order density areas to high order density areas.

The proposed AI-enabled system considers 20+ features. Some include ordering time, area cluster, delivery partner count, delivery partner ratings, delivery time, the distance between the delivery partner's current location and the area of high order density, delivery partner status in the low order density area, etc.

This proposed solution ensures a better customer experience as the orders will be accepted and delivered on time. Also, delivery partner (from low order density area) satisfaction will be attained as everyone will get more work. Companies get competitive advantages by paying a convenience fee to the delivery partners for duty if they do not get any orders.

8. Smart hygiene and safety delivery through a video packaging system:

Hygiene of food and safe doorstep delivery are the two most important and prioritized aspects ensured by any food delivery service provider. Several cases have been found where the customers have complained about the quality and quantity of the received food. It harms both the restaurants and delivery executives, leading to a negative impact on the goodwill of the service providers. After the food gets prepared, a small video is shared with the customer through the app [5]. This video is further analyzed using AI-empowered techniques, which effectively analyze and evaluate customer concerns.

We propose the following attributes to strengthen the system by including a video feature before and after packing. The video is finally shared with the customer through the app, and this allows the customer to understand the quantity and quality of packing and whether proper government protocols were followed before packing (e.g., adequate sanitization (following COVID norms) or using gloves, the body temperature of packing person, etc.).

This system will benefit customers, restaurants, delivery executives, and also delivery service providers.

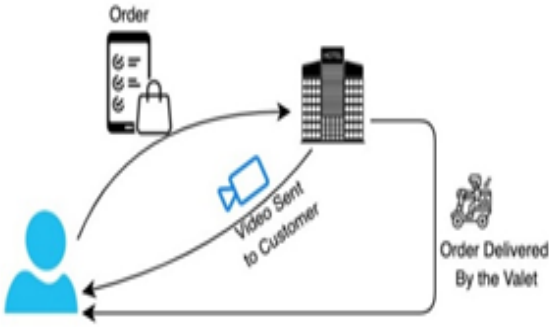

Fig 5. Packaging video sent to the customer.

9. Long-distance delivery system through multiple delivery partners:

Restaurants deliver only up to a certain radius, and delivery executives have a predefined area to serve or deliver foods. It has been observed often that a customer wants to order from a particular restaurant that does not fall under the radius of service. Consequently, service is not available for the customers who wish to order from a specific restaurant [15]. The use of multiple delivery partners is employed for delivering longer distances.
This increases the range of items delivered by any service platform and increases the delivery partner footprints while improving the availability of the items delivered in any part of the city.

To achieve a smooth, hassle-free, and long-distance delivery with the help of multiple delivery partners, we have considered the following attributes to develop an AI-driven system: shortest distance from

the restaurant to destination, number of delivery partners in the current locality, number of delivery partners in next locality, expected orders in the present locality, expected orders in next locality, number of orders assigned to the current delivery partner, number of orders given to the next delivery partner and more.

This system will increase the number of sales in remote areas keeping a constant density of delivery partners.

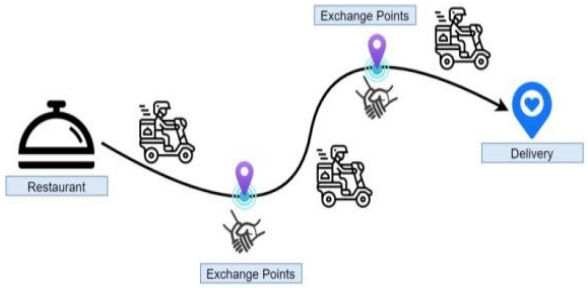

Fig 6. Long-distance deliveries by multiple delivery partners.

10. Add-on recommendation system:

The best solution to maximize the value per order is the add-on recommendation system. It is powerful enough to enhance the luxury and experience of dining by allowing customers to choose add-ons from tailored recommendations. Add-ons, sides will support the main dish and help to improve overall customer satisfaction.

Having said this, finding the item that complements the main course is the real problem. The recommendation system provides both customizable and pragmatic suggestions to the customer. AI-powered recommendation systems enhance the value proportion and help improve customer experience.

Our proposed AI system considers 30+ contributing factors like customer preferences, order price, order type, previous pair-ups, the quantity of last main courses and respective complements ordered, partner availability, restaurant vicinity, restaurant load, climatic conditions, festivals, cultural events, etc.

Carefully crafted recommendations make the product offering diverse for the variety-seeking customer without changing the menu. Studies7 show that the large segments of sales contributors to the food delivery industry include millennials and high-income households. More than 70% of online food delivery services comprise customers of age group 21 to 36 years. For these segments of customers, with add-ons and sides, the product offerings become distinct.

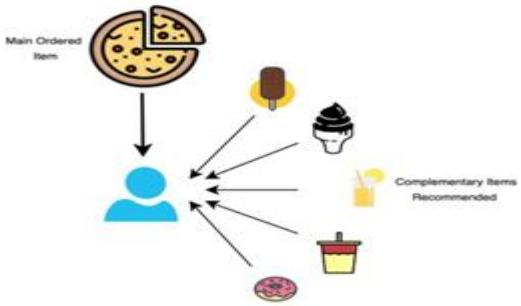

Fig 7. Complementary items recommended to the user.

11. Multi-order delivery system through a single order:

The above-proposed recommendation system enables users to choose sides and add-ons along with the selected food items, but this idea hinders while ordering the food. The suitable food item might not be available in the same restaurant, or the customer prefers another restaurant.

Ordering from multiple restaurants resolves these issues and allows customers to get a complete meal in one go. However, suggesting items from various restaurants might disturb delivery timing and destroy the central idea of providing a full meal. The proposed AI-powered system recommends dishes from different restaurants to achieve synchronized delivery and satisfy customer preferences.

This ordering strategy enables the eligibility of customers to avail offers from different restaurants and reduces the overall price of the order. Therefore, we propose an AI-based system that accounts for 20+ features to provide solutions to these issues. Some considered features are the number of parallel orders for a delivery partner, the density of the demand, restaurant location, partner availability, expected delivery time, etc.

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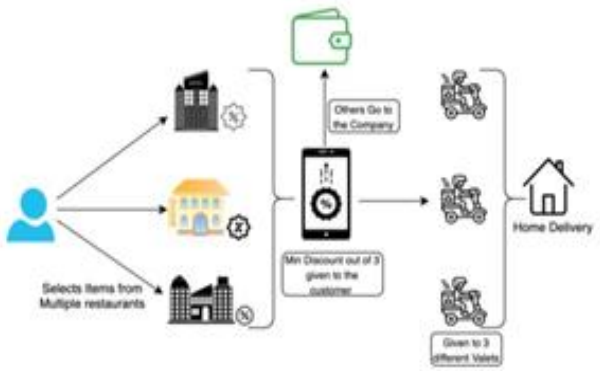

Fig 8. Food order from multiple restaurants in a single order.

12. Crypto-currency for food payment:

In the process of ordering food, payment is the only phase that lacks excitement. Many companies have tried to elate customers by providing coupons and offers. However, as an effect, the food prices were boosted up to compensate for coupons and offers. A better solution to resolve this issue is to provide rewards for the payments.

Crypto is a digital currency that uses block chain technology, created as a new way of payment that is decentralized without any financial institution behind it. It has touched 60X its original value in just three years. Increasing the flow of crypto in the food industry will ramp the price of crypto and stabilize crypto. As a reward, AI Systems will award crypto coins to the customer. Customers are allowed to reuse the crypto coins to pay their other bills.

Awarding tips make the payment fun and also project a better customer experience than standard cash back. Adding creativity, there are multiple levels, and each payment will help the customer pass levels, therefore getting more coins.

The proposed AI-enabled system considers 20+ features. These are order count, order cost, total money spent, discount proportion, customer rating, type of customer, referrals, amount of received coins, crypto circulation in the market, etc.

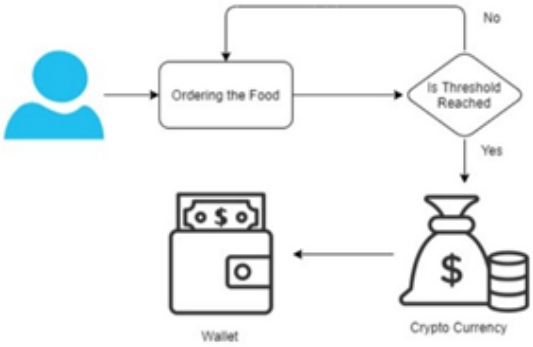

Fig 9. Crypto ecosystem for the food.

13. Food wastage and remains reduction system:

According to the Food Agriculture Organization (FAO) of the United Nations, approximately 1.3 billion tons of food is wasted, which amounts to one-third of the food produced in the world9. Studies10 estimate that 20 million people die every year due to hunger and related causes [19]. There are two primary sources of food wastage: food leftovers and peel-offs.

Wastage of food is significantly reduced if the food is produced by considering forecasted demand [20]. Restaurants predict the quantity of food to be prepared beforehand by leveraging our proposed data-driven AI system. To build such an intelligent system, we consider 15+ important features: weather forecast, festive season, attrition in customer orders, customer demographics, etc.

However, in unavoidable circumstances, there still would be a significant amount of food wastage. Thus, to deal with these inevitable situations, restaurants should tie up with NGOs to distribute the leftover edible food to the needy [21].

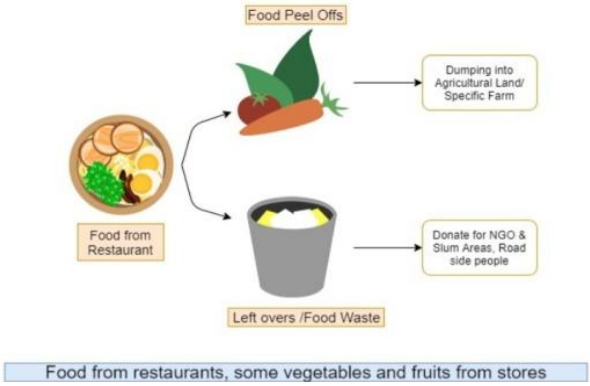

Fig 10. Food waste utilization process.

Furthermore, wastes from restaurants will be used in the waste-to-energy plants. Depending on the usage,

these plants will help convert the rotten food into heat or electric energy. Finally, the restaurants could also provide peel-offs to the farms, which will help to nourish the land. These peel-offs can also be fed to the cattle as fodder. This overall strategy would achieve significant reduction and utilization of wastage.

III. CONCLUSION

This study aims to find the customer pain points in the present online food delivery and logistics industry scenario. Their possible solutions are driven by advanced technologies such as Artificial Intelligence. It is noteworthy that the ideas presented in the paper resolve any customer pain points to a certain extent and provide wholesome customer satisfaction, providing the organization's competitive advantages.

Our propositions can achieve better customer retention, gain a new customer base, provide overall customer satisfaction and cost optimization for the organizations. Each of the recommendations presented in the paper can be implemented in real-life scenarios, subject to the availability of appropriate and sufficient data. We have also noted some limitations associated with a few ideas. Cravings creations-sometimes customers can be annoyed due to excess notifications.

For food search based on ingredients - there can be a dish in which some ingredients said by the user are not present or are difficult to add, for dynamic routing for delicate goods-significantly more delivery time in some cases and others. We plan to get subjective data to develop a proof of concept, eventually, an end-to-end framework to extend this work.

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