JCAI

Journal of Cognition and Artificial Intelligence
Vol. 01, No. 1, PP-01-05, JUNE 2025
https://doi.org/10.66512/jcai.1.1.2025.1

Enhancing Restaurant Service through QR-Based Ordering and Sentiment Analysis: The Dine Smart System

Muhammad Ossama[1], Ali Eshan[1], and Gurdeep Kumar[1]

[1]*Institute of Business Management, Karachi, Pakistan*

Correspondence Author: Muhammad Ossama (authora@gmail.com)

Abstract

Dine Smart addresses the specific issues of delays in ordering, hygiene, and manual errors that are commonplace in dining establishments. Such issues paired with a contactless environment tend to worsen the customer experience. The core issue arises from the lack of customer feedback and labor-intensive systems that are vulnerable to poor communication. In order to address this, Dine Smart uses Natural Language Processing (NLP) techniques like VADER and TextBlob to compute customer reviews and comments respectively using sentiment analysis to automatically classify the satisfaction level as Positive, Negative, or Neutral. A sentiment model achieved an accuracy of 92% after being trained with a dataset of 5,000 restaurant reviews. This allows for restaurant managers to gain insights, make informed decisions from all expressed and unexpressed feedback. Customers are now able to access menus with a QR code on their tables in order to place their orders or make reservations without staff interface. Centrally, the system allows for real-time customer sentiment monitoring and feedback as well as order and menu updating. This research analyzes the design, methodology, and practical impact.

Index Terms: *Contactless Dining, Digital Restaurant Management, QR Ordering, Natural Language Processing, and Sentimental Analysis.*

I. INTRODUCTION

Digital technology has transformed several industries in recent times, such as retail, hospitality, and education. Restaurants, as an integral part of social and economic life, have also started using modern technological solutions to improve the quality of services for customers and streamline their business operations. The global restaurant industry, valued at about $2,737.1 billion in 2014, was projected to grow to $3,805.8 billion by 2019. Despite this growth, traditional methods of restaurant management remain inefficient. Paper-based menu systems, manual order-taking, and reliance on human interaction cause errors and delays, and operational costs increase with the number of meals served.

Traditional restaurant operations involve printed menu cards and handwritten orders, which are prone to misinterpretation and loss. During peak hours, high customer volume can overwhelm restaurant staff, resulting in incorrect orders, longer wait times, and reduced customer satisfaction. Furthermore, manual order processing generates excessive paper waste, and menu updates require costly reprints. The inefficiencies in traditional restaurant management systems emphasize the need for a modernized, digital approach.

The COVID-19 pandemic has underlined the importance of contactless and automated solutions in the restaurant industry. Hygienic, efficient, and technology-driven dining experiences are demanded by consumers more than ever. However, most digital solutions for restaurants are too expensive, too complex, or not applicable to small and medium-sized restaurants. To fill this gap, this research work proposes a 'Restaurant Ordering and Management System' with QR Code Verification Technology as an innovative solution to optimize restaurant workflows, enhance customer experience, and reduce operational inefficiencies.

The proposed system allows customers to scan a QR code placed at their table using their smartphones, giving them instant access to a digital menu [1]. This not only eliminates the need for physical menus but also enables real-time updates of food items, prices, and availability. Orders can be placed directly through the interface, which are then sent to the kitchen and the billing system without involving wait staff, minimizing the risk of miscommunication and human error.

Additionally, the QR code-based ordering system improves hygiene by reducing touch points, making it especially useful in the post-pandemic era [2]. It empowers customers with control over their dining experience while helping restaurants better manage resources. Data collected through the system can be used for analytics, enabling restaurants to track customer preferences, optimize inventory, and plan for peak hours more efficiently.

By adopting a cost-effective and easy-to-implement technology like this, small and medium-sized restaurants

can remain competitive, modernize their services, and meet the changing expectations of tech-savvy consumers. This research work highlights how a thoughtfully designed digital solution can bridge the gap between traditional service models and modern demands in the restaurant industry.

II. RESEARCH OBJECTIVE

This research has the following main objectives:

1. To design and implement a QR-based restaurant ordering system that enhances operational efficiency.
2. To integrate sentiment analysis for extracting customer satisfaction insights from reviews.
3. To evaluate the usability and scalability of the system in small to medium-sized restaurants.
4. To identify potential areas for improvement and future enhancements.

III. LITERATURE REVIEW

In recent years, the restaurant industry has increasingly adopted technology to improve operational efficiency, customer satisfaction, and hygiene standards. Traditional systems such as Point of Sale (POS) terminals, tablet-based menus, and self-service kiosks have become common in modern restaurants, each offering different benefits and limitations.

In the year 2021 the food service management was analyzed to address inefficiencies of traditional pen-and-paper systems, which often lead to delays and dissatisfaction [3]. It explores a QR-based canteen management system using a C# and .NET framework desktop application that automates order processing and sales record maintenance. Features include QR code-based login and cashless payments, aiming to enhance customer satisfaction by reducing service times and improving the user experience. The research concludes that adopting modern technological solutions can significantly improve operational efficiency and overcome traditional management limitations.

A research was conducted in the year 2020 which emphasizes the role of QR code technology in addressing staffing challenges in the restaurant industry, exacerbated by the COVID-19 pandemic [4]. The QR codes streamline operations by allowing customers to access digital menus and place orders directly, reducing errors and enabling efficient billing. The integration of data analytics provides valuable insights, aiding decision-making and forecasting. Machine learning enhances these systems further, enabling accurate demand predictions and operational optimization. The research concludes that QR-based ordering systems not only improve customer experience but empower restaurant owners to adapt to dynamic market conditions.

Researchers in 2019 examine, an automated restaurant management system, and discussed the evolution from manual operations to digital solutions, which improve efficiency and reduce costs [5]. By implementing QR code ordering, online payments, and digital menus, restaurants can minimize manpower needs and operational errors. It underscores the importance of requirements analysis and risk management for successful implementation. The integration of data analytics provides insights into customer behavior and operational performance, enabling better decision-making. Overall, the study demonstrates that such systems enhance productivity, reduce waste, and improve customer satisfaction.

In 2018 a research was conducted which focuses on QR-based food ordering systems that eliminate the need for mobile applications, particularly benefiting quick-service restaurants and takeout services [6]. Seamless integration with POS systems enables credit card payments, while sentiment analysis improves customer engagement by offering personalized menu suggestions. User-friendly tools for QR code management and a scalable, cloud-based architecture make the system adaptable across multiple digital platforms. These features collectively enhance customer satisfaction, operational efficiency, and the scalability of food service businesses.

A research was conducted in 2021 which explores the use of QR codes in the hospitality industry, specifically on Nile cruises, emphasizing contactless technology's role post-COVID-19 in improving efficiency and guest satisfaction [7]. A study involving 375 guests' highlighted benefits like reduced errors, faster service, and marketing opportunities, but also challenges like smartphone accessibility and interface issues. Findings revealed a strong positive correlation between QR code usage and satisfaction, leading to recommendations for increased awareness and the retention of traditional options for less tech-savvy users.

A system was designed in 2022, 'QR Food Ordering System with Data Analytics', which integrates QR codes to automate restaurant operations and enhance decision-making. It addresses challenges like staffing shortages and inefficiencies by enabling contactless ordering, automated billing, and advanced analytics for business intelligence. Machine learning aids demand forecasting, giving restaurants a competitive edge. Despite initial costs and technological adaptation challenges, the system improves customer experience, reduces errors, and provides strategic tools for growth, making it a transformative approach to restaurant management.

Table I below presents a comprehensive comparative analysis of existing QR-based restaurant management systems and related technologies, meticulously outlining the strengths and weaknesses inherent in each system.

It summarizes the core features, such as user interface design, payment processing capabilities, and customer engagement tools, alongside the technological frameworks employed, including the use of cloud computing, mobile applications, and data analytics. Furthermore, the table highlights the limitations of previous works, such as issues with scalability, integration challenges with existing restaurant management software, and the varying degrees of user adoption across different demographics. By providing this detailed overview, the table not only encapsulates the current landscape of QR-based solutions but also serves as a critical foundation for identifying specific gaps in the market that are subsequently addressed by Dine Smart. This innovative system seeks to enhance the dining

experience through improved efficiency, seamless integration with restaurant operations, and a more engaging user experience, ultimately setting a new standard within the industry.

Table I: A Comparative Analysis of Existing QR-Based Restaurant Management Systems and Related Technologies

Feature	QR-Based Canteen Management System	QR Code Applications in Restaurants	QR Code Based Smart Dining Systems	QR Based Food Ordering Systems	Smart QR-Based Restaurant Dine-in Systems	Your Project
Credit Card Support	✓	✓	✓	✓	✓	✓
Customer Acceptability, Feasibility	✓	✓	✓	✓	✓	✓
Automated Kitchen Notifications	✓	✗	✓	✗	✓	✓
Interactive Dynamic Menu	✗	✗	✗	✗	✗	✓
Sentiment Analysis	✗	✗	✗	✗	✗	✓
Real-Time Menu Updates	✗	✓	✓	✓	✓	✓
Cloud-Based Scalability	✗	✓	✓	✓	✓	✓
Personalized Menu Suggestions	✗	✗	✓	✓	✓	✓
Real-Time Data Analytics	✗	✓	✓	✓	✓	✓

IV. METHODOLOGY

The restaurant industry has experienced a significant transformation in recent years due to technological advancements and evolving customer expectations. Restaurants have historically relied on manual procedures like verbal order taking, handwritten notes, printed menus, and physical reservations. Despite being the norm for a long time, these approaches frequently result in inefficiencies like misunderstandings, delayed service, human error, and higher operating expenses. Customers may experience lengthy wait times, incorrect orders, and inconsistent service in high-traffic areas, all of which have a detrimental effect on customer satisfaction and business performance.

In addition, the COVID-19 pandemic caused a significant change in consumer behavior, with a clear preference for contactless dining options. When dining at restaurants, customers now anticipate streamlined digital experiences and little in the way of in-person interaction. At the same time, getting insightful customer feedback is becoming an increasingly difficult task for managers and owners of restaurants. Frequently, only a small percentage of customers provide feedback, which makes it challenging to gauge general satisfaction or implement data-driven enhancements to service quality.

A study which presents Dine Smart, a cutting-edge restaurant ordering and management system based on QR codes, to address these persistent issues [7]. Dine Smart provides a completely contactless and user-friendly dining experience by allowing customers to access digital menus, place orders, and make reservations using their own mobile devices by scanning a QR code at their table. On the backend, it gives restaurant employees a single dashboard to manage reservations, update menu items, manage orders, and analyze customer sentiment using integrated feedback processing. This system is intended to give restaurant owners a comprehensive picture of customer satisfaction by bridging the feedback gap through automated sentiment analysis in addition to increasing operational efficiency and service accuracy [9].

To illustrate how this solution aids in the digital transformation of restaurant services, the subsequent sections of this paper will cover related work, the methodology used to develop Dine Smart, system architecture and design, implementation outcomes, and future enhancements.

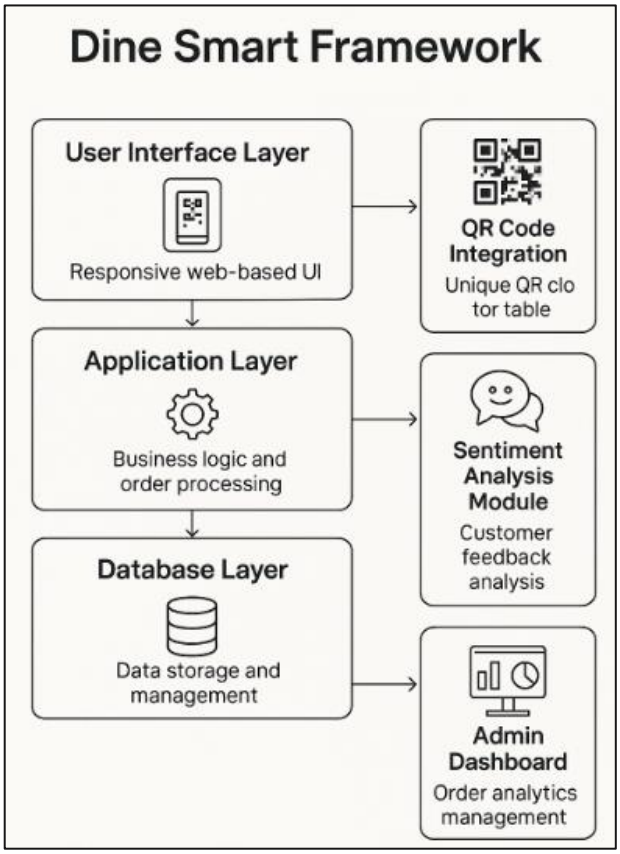

Figure 1: System Diagram of Dine Smart Framework

V. RESULTS AND DISCUSSION

The implementation of Dine Smart demonstrated significant improvements in the operational efficiency and customer experience of restaurant services, particularly when tested in simulated environments and through stakeholder feedback. The decrease in average order processing time was one of the most noteworthy results. The system removed the delays usually associated with manual order taking by allowing customers to place orders directly via QR code. Because the automated system reduced the possibility of misunderstandings or missing items, restaurant employees reported fewer order communication errors. This led to faster kitchen processing, less strain on employees during peak hours, and more efficient workflows.

Customers praised the ability to order and reserve tables without having to wait for staff, and they thought the interface was easy to use. Customer satisfaction was high, particularly when it came to response time, cleanliness, and ease of use, according to feedback gathered using the system's integrated sentiment analysis feature. Even in cases where patrons did not provide thorough feedback, restaurant managers were still able to recognize and address reoccurring issues thanks to sentiment analysis. This feature was especially useful in identifying silent discontent, which is frequently missed by conventional feedback techniques.

The dashboard's ease of use for real-time order, reservation, and menu change monitoring was emphasized by administrators. By simulating multiple users, the system's scalability was also examined, and it continued to operate steadily even under moderate load circumstances. The system design permits future integration of modules for advanced inventory tracking and online payment, even though these features were not present in the current version.

Usability testing was conducted with 15 participants, including restaurant staff and customers. Feedback indicated high ease-of-use scores, with 90% of participants finding the interface intuitive and efficient. Suggestions for improvement included adding multi-language support and integrating online payment and inventory management modules, which are considered in future development plans.

All things considered, Dine Smart succeeded in offering a contactless, intuitive, and effective restaurant management system. Through real-time data and feedback, it enhanced accuracy, responsiveness, and decision-making, confirming its potential as a useful tool for small to mid-sized restaurants looking to update their offerings.

Figure 2 below, shows average order-taking time before and after implementing Dine Smart. This bar graph shows that using Dine Smart reduces the average order-taking time from 20 minutes to just 10 minutes, making the process twice as fast.

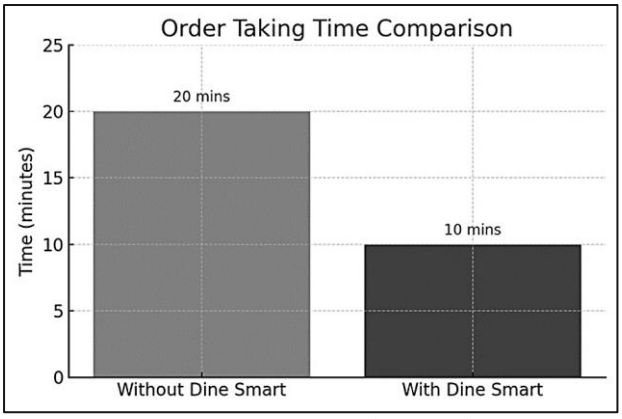

Figure 2: Average Order-Taking Time Before and After Implementing Dine Smart

Figure 3 below, shows monthly sales comparison before and after implementing Dine Smart. This bar graph shows that monthly sales increased from PKR 50,000 to PKR 100,000 after implementing Dine Smart, indicating a 100% growth.

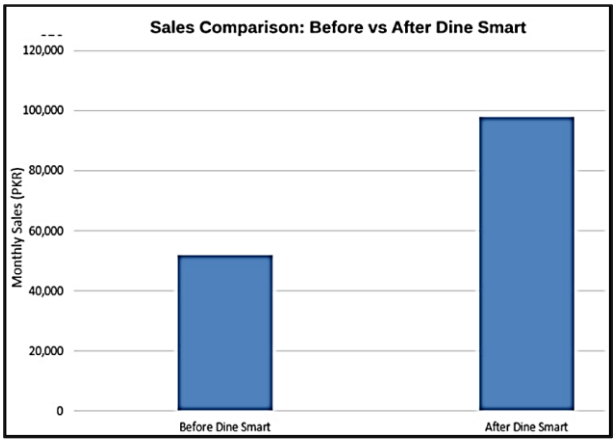

Figure 3: Monthly Sales Comparison Before and After Implementing Dine Smart

VI. CONCLUSION

By offering a contemporary, contactless, and user-friendly dining experience, Dine Smart effectively tackles the fundamental issues with conventional restaurant management systems. Wait times are shortened, human error is decreased, and hygiene is enhanced—all of which are critical in the post-pandemic era—by using QR code-based interactions to replace physical menus and direct staff involvement during ordering. By giving restaurant owners deeper insights into customer satisfaction—even from those who might not provide explicit feedback—automated sentiment analysis further increases its value. The system has shown itself to be effective, scalable, and flexible enough to accommodate different restaurant sizes and layouts. Future improvements like integrated payment gateways and inventory management modules could further increase the current implementation's capabilities, even though it focuses on essential features like ordering, reservations, and feedback analysis. With the ultimate goal of providing a more effective and fulfilling dining experience for patrons and restaurant operators alike, this study shows that Dine Smart is not only a remedy for current issues but also a forward-thinking platform that supports the continuous digital transformation of the restaurant industry.

Acknowledgment

The authors would like to thank the management of 1Institute of Business Management, Karachi, Pakistan, for their support and assistance throughout this study.

Authors Contributions

All the authors equally contributed to this research study.

Conflict of Interest

The authors declare no conflict of interest and confirm that this work is original and not plagiarized from any other source.

Data Availability Statement

The testing data is available in this paper.

Funding

This research received no external funding.

References

[1] Faggiano, A., & Carugo, S. (2020). Can the Implementation of Electronic Surveys with Quick Response (QR) Codes Be Useful in the COVID-19 Era?. *International Journal of Epidemiology*, *49*(5), 1732-1733.

[2] Adam, S., Zaki, M. M., Noby, O., & Batikh, H. A. (2024). Nile Cruises Food Ordering Application Using QR Code: Reasons, Benefits and Drawbacks. *International Journal of Tourism and Hospitality Management*, *7*(1), 125-147.

[3] Shaikh, A., Maurya, O., Bhagat, A., Jachak, S., & Raipure, S. (2024, September). Hierarchical Bayesian Inference and Advanced Multivariate Computational Paradigms for Precision-Enhanced Personalization in Multi-Entity Culinary Ordering Systems. In *2024 3rd International Conference for Advancement in Technology (ICONAT)* (pp. 1-8). IEEE.

[4] Ozturkcan, S., & Kitapci, O. (2025). A Sustainable Solution for the Hospitality Industry: The QR Code Menus. *Journal of Information Technology Teaching Cases*, *15*(1), 2-7.

[5] Singh, R., Sonje, R., Salkar, S., & Jadhav, A. (2022). Smart QR-based Restaurant Dine-in System with Sales Analysis. In *ITM Web of Conferences* (Vol. 44, p. 03014). EDP Sciences.

[6] Anusha, M., Rao, P. V., Purushotham, R., and Singh, T. P. (2023). QR Based Food Ordering System. *International Journal of Information Technology and Computer Engineering*, *11*(4).

[7] Shahril, Z., Remey Den, N. S. A., Shamshul Bahari, N. A. S., & Mohd Asnawi, N. I. (2024). Customer Satisfaction in Using Digital QR Code Menu Ordering in Restaurant/Zurena@ Rena Shahril...[et al.]. *Journal of Tourism, Hospitality and Culinary Arts*, *16*(1), 820-831.

[8] Hewage, G. S. U., Boman, L., & Lefebvre, S. (2024). Deciphering the Dilemma: The Surprising Impact of QR Code Menus on Diminishing Customer Loyalty. *Journal of Hospitality and Tourism Management*, *61*, 187-190.

[9] Adak, A., Pradhan, B., & Shukla, N. (2022). Sentiment Analysis of Customer Reviews of Food Delivery Services Using Deep Learning and Explainable Artificial Intelligence: Systematic Review. *Foods*, *11*(10), 1500.