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Survey Paper on QR based menu system for Restaurants

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Abstract: *This paper introduces an innovative web application aimed at modernizing the restaurant dining experience by combining QR code-based ordering with Augmented Reality (AR) technology. The platform enables customers to easily access the restaurant's menu by scanning a QR code placed on their table, allowing them to browse and place orders directly from their mobile devices. A standout feature of the application is its AR capability, which provides a 3D view of dishes, helping customers visualize meals before making a selection. This enhances the dining experience by offering a clear representation of the food's appearance, portion size, and presentation. The system also eliminates language barriers by enabling a seamless, self-guided ordering process, removing the need for waitstaff intervention. Once an order is placed, it is instantly transmitted to the kitchen, where staff can update the order status in real time. Customers can track their meal's progress and choose to pay either online or in cash. The application improves restaurant operations by reducing reliance on physical menus and minimizing communication errors, ultimately enhancing both customer satisfaction and operational efficiency. By integrating AR visualization, digital ordering, and real-time updates, this platform offers a more interactive, efficient, and satisfying dining experience for both customers and restaurants.*

Keywords *–Augmented Reality (AR), Customer satisfaction, Digital ordering, QR code-based ordering*

1. INTRODUCTION

This paper presents an innovative web application that leverages QR code-based ordering in conjunction with Augmented Reality (AR) technology to significantly enhance the dining experience in restaurants. The core concept behind this platform is to provide a seamless and hygienic way for customers to interact with restaurant menus by simply scanning a QR code placed on their table. This eliminates the need for physical menus, creating a contactless, modern solution that enhances both customer convenience and restaurant efficiency. Once scanned, the customer can access the full menu directly on their mobile device, where they can browse detailed descriptions of each dish, view photos, and easily place their order. This digital system supports multiple languages, ensuring that diners from various cultural backgrounds can comfortably navigate the menu without requiring assistance from waitstaff, which is especially valuable in diverse or tourist-heavy areas. By removing communication barriers, this platform streamlines the entire ordering process, making it more intuitive and accessible for everyone.

The integration of Augmented Reality (AR) technology into dining experiences has been highlighted in various studies as a unique feature that can significantly enhance customer satisfaction. According to several survey papers, AR enables customers to visualize potential meals in 3D before making a selection, offering an accurate and lifelike representation of dishes, including details such as portion size, presentation, and overall appearance. This ability to preview meals has been shown to reduce the gap between idealized menu photos and the actual dishes served, which in turn decreases customer dissatisfaction and increases the likelihood of a positive dining experience. Research has also shown that this technology not only improves customer engagement by making the ordering process interactive and visually appealing but also streamlines restaurant operations. Studies indicate that once an order is placed, it is automatically transmitted to the kitchen, where staff can update the order status in real-time, leading to fewer communication errors, improved order accuracy, and faster service. These advancements in operational efficiency are backed by findings from various sources, which emphasize that such systems contribute to a smoother and more efficient dining experience. In summary, the combination of QR code-based ordering and AR technology, as evidenced by research from multiple survey papers, offers significant improvements in customer satisfaction, operational efficiency, and the overall restaurant experience, ultimately setting a new standard for the foodservice industry.

2. LITRATURE REVIEW

A survey was done on the existing literature and products to find out their shortcomings and research gaps in their systems. This survey consisted of more than 15 literature papers wherein the most relevant ones are listed below.

Amin, Sadia Nur, Palaiahnakote Shivakumara, Tang Xue Jun, and Kai Yang Chong. “An Augmented Reality-Based Approach for Designing Interactive Food Menu of Restaurant Using Android.” [1]
This paper highlights food industry is increasingly competitive, and introducing new cuisines hasn't significantly improved performance due to customer dissatisfaction from limited dish descriptions by waiters. To address this, an Android app using augmented reality (AR) overlays 3D food models onto a QR code on the menu, allowing customers to visualize their orders.

Gupta, Hrithik, Sandhya Avasthi, and Divya “Scan Karo: An QR Code-Based Menu Application for Restaurants.”[2]
This paper explores the usage of information technology is increasing nowadays, people have become dependent on their mobile phones. In this covid pandemic if we go to hotel we get every order from same paper menu card which everyone touches and do not even update from time to time. The menu card is one of the most important forms of communication tool.

Al-Ansi, Abdullah M., and Mohammed Jaboob “Developing and Evaluating AR for Food Ordering System based on Technological Acceptance Evaluation Approach.”. [3]
The authors present a study on dining experiences increasingly focus on service quality, AR technology in restaurant ordering is still limited. This study developed "MenuAR," an AR-based system that uses a marker-based technique to display 3D food models on traditional menus, enhancing the ordering process.

Suryantari, Putu Anggi, and Rendi Panca Wijanarko “Online Food Ordering System.” [4]
This review examines Online Food Ordering App is designed for the food delivery industry, helping restaurants, hotels, and food courts expand their business while reducing labor costs. It allows customers to browse menus and place orders with ease, improving convenience and boosting takeout services. Restaurants can manage orders, track them, and maintain customer databases efficiently.

Patel, Sapna, Ayushi Panchal, and Vishwa Motawar “QR Based Food Ordering System including Sentimental Analysis.” [5]
This paper examines the importance of all-in-one QR Menu solution simplifies the food ordering process for customers and streamlines operations for quick-service restaurants, kiosks, and food delivery services. It supports online ordering through websites and social media, with a backend CRM for managing special requests. The platform integrates with POS systems and supports credit card payments, eliminating the need for additional mobile apps. It uses sentiment analysis to personalize menu suggestions and enhance customer experiences.
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Styliaras, Georgios D. “QR Based Online Food Ordering System.” [6]
This system addresses modern dine-out priorities, especially safety, by minimizing human interaction in restaurants. Traditionally, orders are placed through waiters, but due to the pandemic, there's discomfort with this contact. The web-based solution streamlines the entire ordering process, including interactions between customers, waiters, kitchens, and cashiers. It replaces manual ordering with a contactless system using QR code menus, reducing staff-customer interaction

Muhamad Nazmi, Nurul AMERA, and Wan Mohd Rizhan Wan Idris. “Smart QR-based Restaurant Dine-in System with Sales Analysis.” [7]
The authors explore system is designed to streamline the restaurant ordering process by minimizing human interaction, especially in light of the pandemic. It replaces the traditional manual ordering system by allowing customers to place orders directly through a web application, reducing the need for face-to-face interaction with

staff. The system integrates the customer, waiter, kitchen, and cashier, making the order process more efficient and safer.

Haudhari, Sarthak, Prasad Bhot, Aniket Nehe, and Nilesh Savkar "Smart Menu Card Using QR Code." [8]
This project introduces a digital menu system that replaces traditional paper menus, offering a modern and efficient way for customers to order food. The mobile application provides a user friendly interface, allowing customers to browse updated menus, choose dishes, and pay through a mobile API.

Batat, Wided "Application of Augmented Reality In Food Ordering System." [9]
This study aims to modernize the ordering process at Dapoer Widya Restaurant by developing an innovative system using PHP, UML models, and Augmented Reality (AR) technology. The ordering system is designed with the SDLC method and integrates AR-based menu innovations through Vuforia and Unity3D, allowing customers to view 3D representations of menu items. The system also handles table assignments and generates integrated transaction reports for restaurant staff.

Khosasih, Mikhael Ming, and Lisana Lisana "Augmented Reality Food Menu." [10]
This paper examines the use of Augmented Reality (AR) technology to enhance customer engagement and accessibility in the food industry. AR food menus offer customers an interactive experience by allowing them to visualize meals, access nutritional information, and place orders directly from their mobile devices. The study highlights benefit like increased customer satisfaction, reduced wait times, and improved accessibility for individuals with disabilities.

Dhiman, Karan, and Mayuresh Phansikar "Augmented Reality in Food Promotion and Analysis: Review and Potentials." [11]
This paper reviews the current use of Augmented Reality (AR) in food analysis and promotion, focusing on 34 AR applications for various purposes, audiences, and implementations. These applications are categorized as research-based, commercial, or entertainment-focused, and are evaluated using eight classification criteria, including content, context, execution, markers, and devices.

Latha, B. Sushma, G. Manish, Shaik Sami, and Syed Nurja "Hotel Food Ordering System Using QR Code." [12]
This paper reviews smart restaurant system using QR codes enhances efficiency and customer satisfaction by automating key tasks like table booking, menu selection, and order placement without waiter intervention. By scanning a QR code, customers can log in, reserve tables, and place orders directly. Managers can update table and menu statuses, while chefs receive detailed order information, including table numbers, for accurate food preparation and delivery.

Dhanawade, Aishwarya, Chinmayee Khavale, Darshana Bhayde, and Poonam Sankpal "Intention to Adopt Online Food Delivery Using Augmented Reality Mobile Apps." [13]
The COVID-19 pandemic shifted customer behavior from dine-in services to online food delivery (OFD), driving the need for enhanced decision-making tools like Augmented Reality (AR). This study assesses factors influencing consumer adoption of AR in OFD apps, using the stimulus organism-response (SOR) framework. A sample of 52 AR OFD users was analyzed through Partial Least Square-Structural Equation Modeling (PLS-SEM).

Singh, Riteshkumar, Rupal Sonje, Soham Salkar, and Ashish Jadhav. "How Augmented reality (AR) is transforming the restaurant sector." [14]
This study explores how Augmented Reality (AR) technology affects the dining experience, using the case of Le Petit Chef AR dining experience. Through a qualitative multi-method approach, the research identifies five key dimensions influenced by AR: sensory (intensity of the five senses), affective (pleasantness), behavioral, social, and intellectual. AR can enhance or diminish these aspects, shaping customer perceptions. The findings suggest AR can improve the overall food well being and lead to positive post-consumption behaviors.

Styliaras, Georgios D. "Analyzing augmented reality (AR) and virtual reality (VR) recent development." [15]
This review examines the development of Augmented Reality (AR) and Virtual Reality (VR) technologies in education over the past 12 years, analyzing 1,536 articles from the Scopus database using text mining and topic analysis. AR and VR are transforming learning through immersive, interactive experiences, but their widespread adoption requires significant investment and customization. The study highlights the exponential growth of AR and VR in education, especially in wearable devices, but also identifies gaps in rapid implementation and

customization. As these technologies mature, researchers are encouraged to explore ways to improve their adaptability for educational institutions and maximize their potential benefits.

2.2 Analysis Table:

Table 2.2: Analysis Table

Title of paper	Technology Used	Advantages	Disadvantages	Open challenge
An Augmented Reality-Based Approach for Designing Interactive Food Menu of Restaurant Using Android (2023) [1]	1) AR (Augmented Reality) 2) QR codes 3) Unity 3D	1) Improved customer experience 2) Increased customer satisfaction 3) Language barrier reduction	1) Dependency on technology 2) Potential for technical issues 3) Limited applicabilit	1) Accessibility 2) Model Performance 3) Dynamic Menu Updates
Scan Karo: An QR Code-Based Menu Application for Restaurants. (2023) [2]	1) QR codes 2) Interactive mobile application 3) Database	1) Increased efficiency 2) Improved customer satisfaction 3) Enhanced management	1) Dependency on technology 2) Potential for technical issues 3) Limited applicability	1) Digital Transformation and Accessibility 2) Hygiene and Safety 3) Real-time Updates
Developing and Evaluating AR for Food Ordering System based on Technological Acceptance Evaluation Approach. (2023) [3]	1) AR (Augmented Reality) 2) Vuforia	1) Enhanced user experience 2) Increased engagement 3) Improved brand identity	1) Dependency on technology 2) Limited applicability 3) Potential for technical issues	1) Technical Infrastructure 2) Implementation Costs 3) 3D Model Creation
Online Food Ordering System. (2023) [4]	1) Real-time menu updates 2) Advanced search and filters 3) Geolocation	1) Increased user convenience2) Reduced errors3) Improved efficiency	1) Privacy concerns 2) Technical issues 3) Dependency on technology	1) Handling Large Traffic Volumes 2) Server Load Management 3) Managing Multiple Deliveries
QR Based Food Ordering System including Sentimental Analysis. (2024) [5]	1) Wireless technology 2) Mobile devices 3) Bluetooth technology 4) QR codes	1) Increased efficiency2) Reduced costs3) Improved customer experience	1) Dependency on technology 2) Limited applicability	1) Real-Time Sync Issues 2) Data Privacy Concerns 3) Handling Peak Load
QR Based Online Food Ordering System. (2023) [6]	1) Web application 2) QR codes	1) Reduced contact2) Improved restaurant management	1) Dependency on technology 2) Technical issues	1) Internet Connectivity. 2) Payment Security 3) Implementation Costs
Smart QR-based Restaurant Dine-in System with Sales Analysis. (2022) [7]	1) QR codes 2) Touch screen technology 3) Speech recognition technology	1) Increased efficiency 2) Improved restaurant management	1) Limited applicability	1) Dependence on Smartphones and Connectivity. 2) System Integration Across Functions 3) Order Queueing
Smart Menu Card	1) Digital menu card	1) Contactless	1) User resistance	1) Real-Time

Using QR Code. (2023) [8]	2) Mobile API 3) Mobile application 4) QR codes	ordering 2) Increased efficiency 3) Easy to update	2) Security concerns	Updates 2) Menu Complexity 3) Menu Complexity 4) Handling System Failures
Application Of Augmented Reality In Food Ordering System. (2021) [9]	1) Augmented reality (AR) 2) Information system	1) Increased efficiency 2) Better decision-making 3) Enhanced competitiveness	1) Limited accessibility 2) Initial investment 3) Technical challenges	1) Integration of AR Technology with Ordering System 2) Maintenance and Updating of AR Content
Augmented Reality Food Menu. (2022) [10]	1) Machine learning 2) QR codes 3) Augmented reality (AR	1) Enhanced customer experience 2) Increased sales 3) Improved staff training	1) Initial investment 2) Visual Overload 3) Hardware Costs	1) Device Compatibility and Access 2) Technological Limitations 3) Cost and Resources for Development and Maintenance
Augmented Reality in Food Promotion and Analysis: Review and Potentials. (2022) [11]	1) Quick Response (QR) codes 2) Sensors 3) Augmented reality (AR)	1) New business models 2) Enhanced customer experience 3) Improved decision-making	1) Maintenance 2) Accessibility Concerns 3) Device Compatibility	1) Content Development for AR Applications 2) Accuracy and Reliability of Food Information 3) User Experience and Interaction Design
Hotel Food Ordering System Using QR Code. (2022) [12]	1) Cloud computing 2) Wi-Fi 3) NFC sensors 4) Bluetooth	1) Reduced costs 2) Integration with other systems 3) Enhanced management	1) Complexity 2) Cost	1) Network Reliability and System Downtime 2) Customer Engagement During Delays
Intention to Adopt Online Food Delivery Using Augmented Reality Mobile Apps. (2023) [13]	1) Stimulus-organism-response (SOR) model 2) Mobile application 3) QR codes	1) Improved customer satisfaction 2) Personalized Experience 3) Increased Social Sharing	1) Accessibility 2) User Experience	1) User Experience Consistency Across Diverse Food Types 2) Cultural and Regional Preferences 3) Cost of Implementation for Restaurants
How augmented reality (AR) is transforming the restaurant sector. (2023) [14]	1) Interactive tables 2) Smart plates 3) VR (Virtual Reality)	1) Data-Driven Decision Making 2) Increased Efficiency	1) Job Displacement 2) Data Privacy Concerns 3) Complexity	1) Maintaining the Authenticity of the Dining Experience 2) Social Dynamics and Group Experiences 3) Technical Challenges and Integration with Fine Dining
Analyzing augmented reality (AR) and virtual	1) AR (Augmented Reality) 2) VR (Virtual	1) Flexible learning 2) Improved	1) Initial investment 2) Technical	1) High Investment Costs for Implementation

reality (VR) recent development. (2022) [15]	Reality) 3) M-learning	student performance	challenges 3) Limited accessibility	2) Content Development and Accessibility

3. METHODOLOGY

A user-friendly mobile Web application will be developed, allowing customers to scan QR codes on tables to access the digital menu. The app will incorporate AR technology to display 3D visualizations of dishes directly on the table, enhancing the customer's ordering experience. Once a customer selects a dish, the order will be transmitted directly to the kitchen management system in real-time, ensuring timely preparation. Additionally, the system will allow kitchen staff to receive updates on order status, enabling efficient workflow management. Finally, user feedback will be collected to continuously improve the system.

4. CONCLUSION

In conclusion, the integration of Augmented Reality (AR) technology and a smart ordering system revolutionizes the dining experience by enhancing customer engagement and streamlining operations. By allowing customers to scan a QR code to access an interactive menu and visualize dishes in AR before ordering, the system minimizes uncertainties and improves decision-making. The seamless process of adding selected dishes to the cart, facilitating payment, and directing orders to the kitchen ensures efficiency and accuracy. Moreover, timely notifications upon order completion enhance customer satisfaction. This innovative approach not only elevates the dining experience but also optimizes restaurant management, leading to improved service quality.

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