QR Code-Based Smart Food Ordering and Payment System

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Abstract: On the other hand, food ordering through contactless services has impacted the life of a customer more positively in that they no longer need to visit a restaurant or food outlet to place an order. Everything is done from wherever they may be- home or office-to hasten the transactions. This online application allows customers to explore menus, customize their orders, and make payments. While arriving at the premises, customers can scan a unique restaurant QR code to check table availability. In case a table is available, it will get pop-up reserved; in case a table is not available, the customer is put in the waiting list. As soon as the table is confirmed, one can select food, and that order is processed securely. The food ordering system has delivered a better part of security and convenience within the QR code-based encryption system. Customers' food orders are encrypted using AES (Advanced Encryption Standard) to ensure the encryption of data privacy and security to be sent to the restaurant manager. These encrypted orders and secure QR codes are used for payment. The customer makes payment without coming into physical contact with another person. So, this totally provides a smooth, efficient, and most secure experience with fewer human contacts to ensure convenience.

1 INTRODUCTION

In recent years, an increase in contactless food orders has greatly changed how customers interact with restaurants. Thanks to modern web-based platforms, customers can now place orders and carry out transactions swiftly and easily from the convenience of their smartphones or computers. The changeover to contactless technology is thus enhancing customer experience and helping restaurants reach new hygiene standards and operational requirements, especially after the COVID-19 pandemic. These platforms offer a seamless and user-friendly interface that allows customers to view restaurant menus at their own leisure. There is no need for a physical menu, as patrons can browse through an extensive selection of their options right from their devices. This availability of the menus greatly enhances the whole dining experience by saving time for guests and restaurant staff alike. It also helps lessen the operational costs of printing physical menus, thus contributing towards a more sustainable practice. The process starts with QR codes; this has become a staple in numerous restaurants. By simply scanning the QR code using their smartphones, customers will instantly gain access to the restaurant's online ordering system. Because QR codes allow for the minimum physical interaction with wait staff, they also help maintain the safety of dining by minimizing contact. After scanning, the system checks the availability of the table; if a table is free, it gets reserved for the customer right away. Still, if the restaurant has no available tables for them, the customer will go on a waiting list, minimizing the inconvenience of waiting in line or approaching the hostess. If the table is reserved successfully, customers get to customize their orders as per preference. They can add extra toppings, change spice levels, request specific sides, or specify dietary restrictions. This high degree of personalization offered by the platform means the individual tastes and dietary needs of each customer can be catered to without the possible incidental oversight of into lerances or allergens. Patrons can also find detailed information about their dishes, including nutritional facts and lists of their ingredients, thus fostering transparency and trust with the restaurant's offerings. Other features that enhance customer experience

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include the ability to track the customer's order status in real-time, from preparation in the kitchen to delivery at the table. Customers also can rate the meal or provide feedback directly through the system-a veritable goldmine of information for restaurants on how to improve. To complete the experience, customers can also pay through the platform in a secured manner. The total is calculated by the system automatically based on the selected items, eliminating any confusion or error. Payment methods can include traditional ones, like credit cards, or newer and safer options like digital wallets.

1.1 Objective of the Study

The project intents to make things easier for their customers by bringing in an online platform that allows browsing for menus, placing orders, and making payments, thus limiting unnecessary physical interaction between the customer and restaurant staff. It increases operational efficiency by providing a faster means to order and allowing staff to concentrate on preparing food and serving customers. It ensures cleanliness and safety through contactless QR code ordering for safer dining. It provides customization of orders, table reservations in real-time, and secure payments. The project also works with data collection for better insights into customers, hence reducing reliance on physical supplies and providing for an integrated loyalty program to benefit repeat business. Finally, real-time order tracking and customer surveys serve to better the overall dining experience.

1.2 Area of Investigation

The entire project revolves around various investigation areas directing seeding towards an effort for developing contact-less food ordering systems. Some investigations include QR code-based reservation against tables, menu-display, and payment mechanism-all for a better customer journey experience; the other revolves round an interface-focused development of a user-friendly web-based program to support such dimensional services in menu viewing, food ordering, and secure payments, which can run across multiple devices. Further insights concern real-time table reservation and waiting list management systems, which may also add to customer convenience. Payment security is a subject of investigation for the project-that involves encrypted QR code payment-for all possible secure transactions and confidentiality. Other parameters investigated include user experience (UX) and interface design in terms of overall usability improvement in order customization and navigation. Along with all this, the study also examines how the efficiency of restaurants can be increased in terms of easing processes like order-taking and payments-increased productivity of staff in return. Data analytics will be studied for customer insight in preference and ordering habits to improve services and marketing systems. Reducing physical menu and receipt circulation is the other area of investigation in terms of the possible environmental impact and sustainable development-what paper-based material would be saved. Integrated customer feedback mechanisms will be in place to serve the purpose of collecting insights for further systematic improvement of the system and overall experience at the dining table. Finally, the project investigates how the system can adhere to health and safety standards, minimizing physical contact and ensuring a safe environment where both customers and restaurant staff can feel secure. The sum of all these spaces aims at creating a contactless food ordering system that is both secure and efficient as well as customer friendly.

1.3 Problem Statement

In the old-style ordering in restaurants, people have to queue up for long stretches, there would be interaction with waiters when ordering food, and the physical menus are not less prone to inefficiency or error. Besides, in-person transactions also pose health and safety risks, considering recent health concerns across the globe, and there is no accommodation in current. restaurant systems for fast, secure, and personalized ordering experiences. Furthermore, integration between ordering, reservation, and payment processes lacks, thereby complicating the experience both for customers and the restaurant staff. This project seeks to counter these things by making a contactless food ordering system integrated with QR code technology for menu browsing, order customization, table reservation, and payment, creating a more operationally efficient and customer-satisfying environment while safe and less physical contact involved. In-dining food ordering depends on queuing for many hours, ordering through a waiter, and using menus, all of which can be inefficient and highly error prone. In-person transactions can serve a health and safety risk, especially considering recent health issues on the global front. Existing restaurant systems have nothing to do with fast, secure, and personalized orders. It makes finding a solution even more difficult because there is no integration between the ordering process, reservation of the table, and payment system. This project will provide a solution

into these issues by developing a contactless food ordering integrated with QR code options. Menu browsing ordering customization reserpvation of tables and secure payment would increase operational efficiency, improve customer satisfaction, safety, and minimize physical contact. Food ordering in restaurants has a lot to do with standing in queues for hours, ordering via a waiter, or perusing the menu, which is quite inefficient and highly error-prone. Health and safety risks, especially on the global health scale, are possible with in-person transactions. There is nothing about fast, secure, and personalized ordering in the existing restaurant systems. Moreover, there is no integration between the ordering process, reservation of the table, and payment system; this makes the whole experience even more complicated for both customers and restaurant staff. This project would counter these things through the development of a contactless food ordering integrated with QR code options for menu browsing, ordering customization, table reservation, and secure payment which would then create an operationally efficient and customer-satisfying environment while safe and less physical contact is involved.

2 RELATED WORK

Contactless Food Ordering System: This study emphasizes the benefits of QR code-based ordering systems in reducing physical contact, streamlining the ordering process, and enhancing customer satisfaction. (S. Sunanda and Y. Mownika. (2024)). Bytes to Bites: Investigating QR Code Menu Use Behavior and Green Satisfaction: This research explores user behavior towards QR code menus and their impact on customer satisfaction, highlighting the importance of user-friendly interfaces and efficient design. (D. M. Ashrafi et., al. 2025) QR Based Food Ordering System: The paper analyzes how QR code-based systems streamline order management, reduce wait times, minimize errors, and optimize resource allocation in restaurants. (S. Sunanda and Y. Mownika, 2025)

Customer acceptance of QR menu ordering systems in luxury restaurants: This study is concerned with understanding customer acceptance of QR ordering menu systems in luxury restaurants by examining user perception and behavioral intention.(A. A. Alalwan, et al. 2017) Smart Enhancements to QR-based Restaurant Dine-in System and Sales Analysis: The paper identifies the automation process of traditional paper-based menu ordering to a digital and well-formed ordering system through QR codes that will enhance good operational efficiency and improve the customer experience. (R. Singh et., al. 2022) Customer perception about contactless menu in restaurants: The interface perceived by customers is examined, analyzing the benefits of contactless menus such as easy navigation, enhancement of customer service, and reduction of costs for restaurants. There were several factors that were selected to determine customer satisfaction concerning drinking from the floor to the ankle while almost every single person in the house watched, on their phone or TV, pretending not to see.(Shahril et al. 2024) QR Code Based Food Ordering System: This research addresses the challenges of traditional food ordering methods and proposes a QR code-based system to enhance ordering accuracy and efficiency. (V. Venkata Ramanjaneyulu et al.) Application of QR Code for enchancing the satisfaction of customers: The focus of the investigation is the application in the food industry which may lead to greater satisfaction with the end-particular revelations on technological adoption and end-user's engagement. QR Code-Based Mobile Payment System for Restaurants: A Literature Review: This review examines the implementation and adoption of QR code-based mobile payment systems in restaurants, focusing on user acceptance and security concerns.(Sunanda, S., and Mownika, Y. (2024)) Improving the Customer Experience Through QR Code Ordering Food: This review refers to empirical research literature available on QR code-based food ordering systems and customer experience, with an element of use as well as satisfaction levels.(Sunanda, S., and Mownika, Y. (2024)). The pandemic slowed down but many restaurants can operate in full capacity, which becomes a challenge concerning staff. In this paper, a food ordering system proposed is QR code-based. The system automates the order-taking and billing process. Every customer scans the QR code to access the menu and place orders, while the system automatically generates bills; thus, reducing the possibility of human error. The admin interface is accessible to restaurant owners so they can update the menu, manage orders, and gain insights into the business through data visualization. Machine learning is included to forecast demand and provide better insight for decision-making. (C.-C. Wong et al.2023). The increasing coffee consumption in Indonesia has caused the growth of coffee shops, including in Bekasi. With the aim to improve customer satisfaction, a mobile web-based ordering app for food and beverages was developed, which uses QR and RFID technology. The app allows customers to order food and drinks and pay without going to the

cashier, shortening the waiting time and avoiding food delivery mistakes. The development employed the Kanban method, with testing involving 20 respondents who found that 65% said the ordering process was faster and accessible, while 35% thought it was easy to use. Subsequently, User Acceptance Testing demonstrated that 91.4% of the functionality was performed, making the whole process more efficient and userfriendly. (F.A. Hidayat et al. 2024) With the academic performance of students, higher institutions have several dimensions, including physical attendance in classes. Nevertheless, for the greatest part, registration for student attendance is still being done manually, which contributes to its cumbersome nature and consumption of time, especially in large courses. Most of the universities have been managing the manual attendance for years and still do. In contrast to the manual attendance systems, the smart attendance system provided in this paper was proposed and realized in order to pave way for prospective uses of QR code as an attendance management system that tracks and records student attendance in lectures and exercises for all related courses. (M. Anusha et al. 2025) The issue of food safety has always existed, tracing back to ancient times. In this respect, the traditional agri-food systems do not have any systems for tracking the produce in the event of foodborne outbreaks. This issue can be addressed with blockchain-based systems, but current methodologies are not easily accessible or verifiable using mobile devicesFoodSQRBlock, a framework targeting the blockchain digitization of food production data, is discussed in this paper. Through QR codes, consumers and producers can trace and verify such data. The paper discusses appraising the large-scale integration of FoodSQRBlock in the cloud and addresses how the feasibility of this framework meets the requirements of scalability and experimental evaluation. (Dey et al. 2021) As shopping centers are becoming gigantic and sprawling, shoppers are found to be really getting afflicted. A new system is propounded which will aim to improve the shopping experience by bringing to resolve issues regarding standing in long queues, carrying hefty items, as well as limited information storage as with the traditional systems. Using QR code technology, this mobile-based system eases the shopping activities with fast payments, more navigable facilities, and effective customer data mining. The products will generate QR codes and a python program will keep scanning these codes and creating bills based on what is purchased. Applied Artificial Intelligence and Computing International Conference in 2022. (K. Kaarthik et al. 2022) It enables the customer to place an order online along with payment processing with the help of contactless ordering, which has simply changed the interaction between customers and restaurants. Customers can explore menus of choice, place orders, and pay without breaking a sweat via these online applications. By scanning the restaurant's QR code, customers may reserve tables, which will automatically reserve if that specific table is available. If occupied, it adds the customer to a Wait List. After selecting the required food, customers can make secure payments depending on food items ordered. The order will be served directly to the customer. Contactless food ordering has made a convenience revolution and makes the dining experience so much easier for all. (R. K. Goli, 2023) Nevertheless, the restaurant business in developing countries has been confronted by challenges due to inefficiencies in order handling, resource management, and food quality. Hence, this paper proposes what is believed to be the best solution, i.e. an IoT-based automated order-handling system, into which has been incorporated many improvements in the dining experience. The system enhances operational efficiency apart from ensuring validity in food orders and privacy for customers. Through advanced technology adoption, it offers a sustainable solution towards improving satisfaction and profitable operation in restaurants, especially in developing countries. Moreover, the paper reveals the economic and operational advantages that accrue from such implementation. (A. Sultana et al. 2024) With the tracking and billing of orders done manually, it becomes very difficult to manage a large dining crowd in a restaurant. The computerized menu ordering system, proposed here, is all about improving the internal processes of the restaurants, lightening the load of staff, and increasing customer satisfaction. Now, showing the menu, ordering, updating, and confirming orders becomes possible with this system, making it reliable, easy to maintain, and faster. At the same time, it will handle multiple orders coming into the system efficiently, thus solving a majority of the problems faced by traditional restaurants. (S. Deivanayagi et al. 2024) This paper intelligent centralized IoT billing system such as RFID technology for automatic tracking of product location and billing in malls. To take a shopping assistant, a mobile application that is developed in Java and Python will assist customers to find products. The ESP8266 Wi-Fi act as a medium for transmitting billing information to the cloud. Every product gets RFID tagged, and the product data is stored in EEPROM. The living calculates the total of

purchases by cloud database accessing. The system has been designed in such a way that it would eliminate searching for products and waiting in long queues in malls or supermarkets. This paper presents a contactless food ordering system that utilizes holograms to minimize the risk of virus transmission in restaurants. Based on the light source wavelength distribution, the hologram-based menu ordering system operates in both virtual and physical environments, thus minimizing direct contact points and creating a consequence of reduced virus spreading. Furthermore, the paper analyzes the features of various operational modes, which will serve as a very important reference for researchers working on operations and management in food supply chains. (R. Vinifa et al. 2024)

3 PROPOSED SYSTEM

The proposed system for contactless food ordering is a web-based platform designed for easy meal ordering. Through the platform, Customers can study the menu, choose items they want to send in, get to know the menu better in order to enrich it according to their choice, and pay for the stuff they want. Also incorporated is a QR code system whereby customers can scan a restaurant's QR code. Scanning an appropriate QR code will redirect the customer to detailed information about the restaurant, such as available tables and the full food menu. If a table is free, it is automatically reserved for that customer; if not, the customer will be placed on a waiting list. This ordering process greatly streamlines and enhances the customer experience while minimizing the physical interaction between customers and staff.

3.1 Overview of Our Work

The project objective aims to create a contactless food ordering mechanism, enhancing the experience of dining using a web-based and QR-coded technology. Customers explore restaurant menus, choose food items, customize orders based on their preference, and pay for them securely through their smartphones or other devices. When it comes to entering the premises, customers are able to scan a restaurant QR code, which will be able to display the details of the restaurant, including the information about the available tables and a full menu. When there's an available table, it will reserve for the customer automatically. If there's none, the customer will be put in a waiting list. Once a table confirms the availability, customers can proceed and place their orders, which can be electronically settled. The primary features of the system include the management of the reservation of tables, updates on the food availability in real-time, customization of the orders, and secure payment through encrypted QR codes. The vision is to provide seamless, more straightforward, efficient, and safe dining by minimizing physical contacts of the customers with their attendants. Not only does this illustrate better operational efficiency in restaurants, but also maximizes the personalized experience of the customers, which means improved quality as far as the potential level of service comes from, hence maximized customer satisfaction. Figure 1 shows the Project Flow.

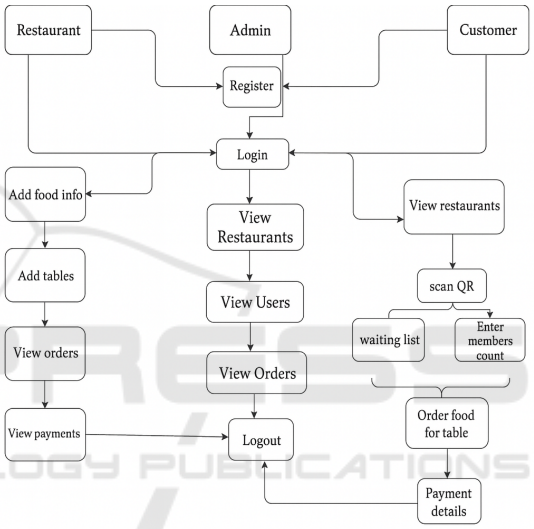

Figure 1: Project Flow.

Restaurant

- Registration: For registration, the restaurant must provide their initial, last email, password, and anaesthesiology, also must have a restaurant name.
- Login: Restaurant will Login using Email, Password.
- Add Food Info: Restaurant will add dishes and its price in Add Food info (Dish name, price).
- Add Table's: Restaurant will add dishes and count of members for table in Add Tables (Members count, Tables count).
- View Order's: Restaurant will view the all Table orders.
- View Payments: Restaurant will view the all Table orders.
- Logout: Finally, Logout.

Customer:

- Registration: Customer will register with details like First Name, Last Name, Email, password, confirm password.
- Login: Login with details (Email, Password)
- View Restaurants: Customer view all the restaurants by selecting the restaurant qr code will be displayed, user has to scan the QR code
- Enter Members: After that Input field will be displayed. In that customer has to give members count then table will be reserved randomly.
- Waiting List: Incase table is not available that request will be added in waiting list and he can order food for the table. When it comes to his time that table will be registered for the next person
- Food Order: Customer can order the food for that table.
- Payment: Customer will pay the bill for the ordered food by giving his card details Logout: Finally, logout.

4 METHODOLOGY

Advanced Encryption Standard:
AES stands for "Advanced Encryption Standard," and it is a symmetric encryption algorithm. This is the encryption standard selected by the U.S. government, and there is a near-universal consensus that AES is one of the very most secure of all the encryption methods. AES works on data in blocks of fixed size (128 bits), and this process uses key lengths of 128, 192, or 256 bits depending on the level of security required. AES is a running series of rapid encrypt/decrypt processes based on a pre-place number of rounds depending on the size.

- 128-bit key: 10 rounds of encryption
- 192-bit key: 12 rounds of encryption
- 256-bit key: 14 rounds of encryption

AES functions by executing data encryption through a series of steps, each of which entails the manipulation of a 4x4 matrix representing an individual data block. Within this matrix, each cell contains one byte of data. Considering that a block comprises 16 bytes, the matrix comprehensively encapsulates the entirety of the block's data. Figure 2 shows the Indexing of a 4x4 Grid.

0	1	2	3
4	5	6	7
8	9	10	11
12	13	14	15

Figure 2: Indexing of a 4X4 Grid.

The state array, Figure 3 illustrated in the accompanying diagram, plays a pivotal role in the AES (Advanced Encryption Standard) algorithm. In addition to that, the primary key will be expanded into a total of (n + 1Plant ont ves towards AES encryption, which is specifying their number n for the rounds in the encryption. For instance, in case of using 128 bits Key and for 16 rounds then maximum of 11 keys will be generated (i.e. 10+1,). AES Encryption Stages consist of processes like Sub Bytes, Shift Rows, Mix Columns, and finally Apply Add Round Key. iteration state appropriate for the number of rounds. The aforementioned discussed steps change the input plaintext into ciphertext using the keys generated from them. This article briefly introduces the constituents of the AES algorithm as well as the steps through which it processes encryption.

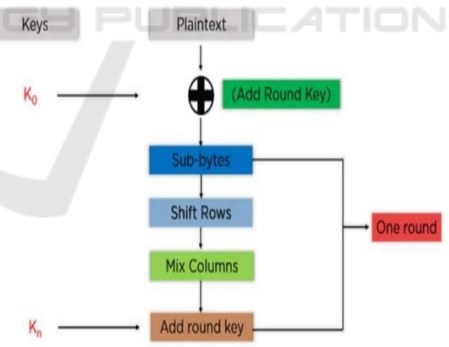

Figure 3: Simplified Block Diagram of One Round of the Advanced Encryption Standard (AES).

This Figure 4 necessarily follows an orderly set of operations for each block and then combines them into the address for one ultimate ciphertext. Stages would follow in the order: Adding a round key: This amounts to a XOR operation on the block data in the stated array and the first generated key (K0). This is followed by feeding the output state array to the next operation.

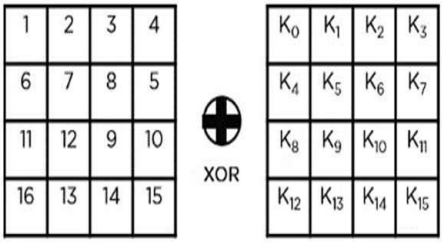

Figure 4: Example of the Add Round Key Operation in AES.

State-by-state State-substitution on each byte indicates the process whereby a substitution is applied to each byte in the state array with every byte being changed to 2 segments indicating rows and columns in hex format, replaced by new values from an S-Box-by-picture or contesting state array. Illustration of the SubBytes Transformation in AES Shown in the Figure 5.

Figure 5: Illustration of the Sub Bytes Transformation in AES.

Shift Rows is an operation of data modification entailing the interchange of row elements. It usually leaves the first row intact and shifts the elements of the other rows left by a certain number of places. For example, in a four-row matrix, the two-row elements can shift an amount of one point on the left. The three-row elements could shift an amount of two points on the left. Likewise, the elements in the last row can shift by three left points. This kind of operation is an integral part of the security enhancement and ease of distribution of several encryption methodologies, including the Advanced Encryption Standard (AES).

Shift Rows is really an operation pertaining to data manipulation in which they can interchange row elements. Normally, it keeps the first-row static and moves other's components in subsequent rows after a certain number of places to the left. For example, elements present in row two of four-row matrix would be shifted one place to the left; while those present in the third row would displace two positions left. Likewise, the final row's elements could shift three positions to the left. Such an operation, important for security improvement and ease of distribution in several encryption methods including the advanced encryption standard (AES), is the basis of some encryption methods. Figure 6 Shows the Example of the ShiftRows Transformation in AES.

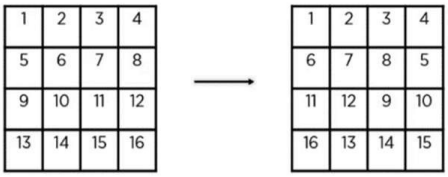

Figure 6: Example of the ShiftRows Transformation in AES.

The mixing columns stage is correspondence in the AES encryption method. This stage multiplies all the columns in the state array by a fixed matrix to create an entirely new column for the next state array. This process continues for all the columns of the state array into state arrays for the next step. This is to be underscored as it is performed in all rounds of encryption, except in the last round.

From the Figure 7 SubBytes operation followed by ShiftRows, and MixColumns of the data of the first round, the round key is then added. The round function's state array is XORed with the roundspecific key. If the state array is from the last round, it will produce the ciphertext of the block.

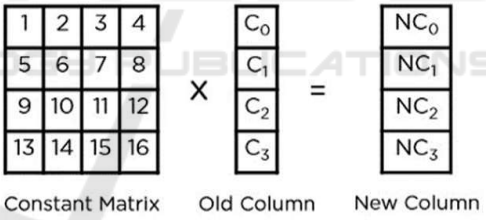

Figure 7: Illustration of the MixColumns Transformation in AES.

Otherwise, it serves as the new input state array for the subsequent round. Detailed View of the AddRoundKey Operation Shown in Figure 8.

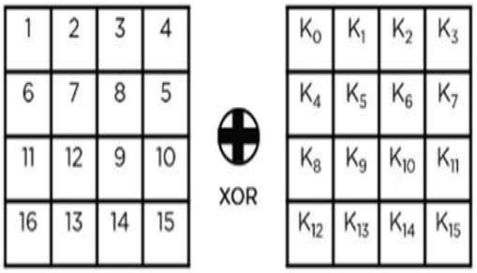

Figure 8: Detailed View of the AddRoundKey Operation.

The extracted State array must be passed on as input to the subsequent round, observing the similar operating of the same as heretofore discussed. Here is what you should do for that:
Round Key Addition:

Figure 9 shows the Numerical Example of the AddRoundKey Operation in AES.

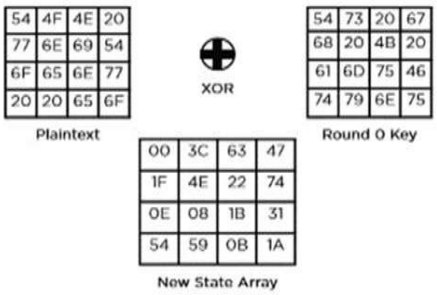

Figure 9: Numerical Example of the AddRoundKey Operation in AES.

Sub-Bytes: To obtain a whole new state array, the elements are passed through a 16x16 S-Box. Resulting State Array After A Round of AES Operations Shown in the Figure 10.

Figure 10: Resulting State Array After a Round of AES Operations.

Shift Rows:
The process of the Numerical Example of the ShiftRows Transformation, using specific hexadecimal values, is demonstrated in Figure 11.

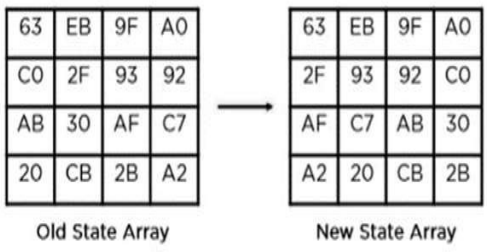

Figure 11: Numerical Example of the ShiftRows Transformation.

Mix Columns:
Figure 12 provides a numerical example illustrating the MixColumns transformation.

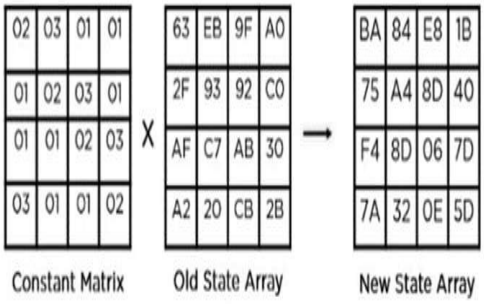

Figure 12: Numerical Example of the MixColumns Transformation.

Add Round Key:
Figure 13 provides a numerical example of the AddRoundKey operation specifically for the first round of the process.

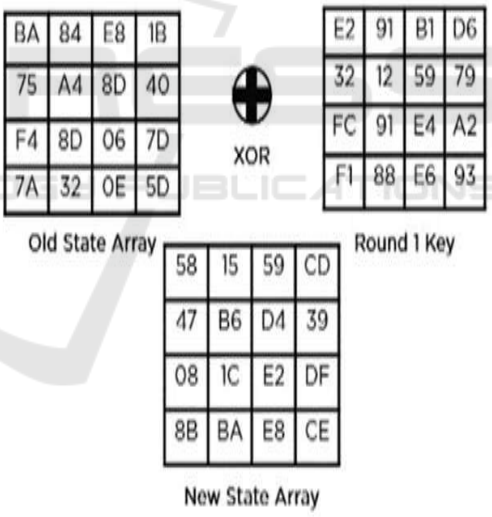

Figure 13: Numerical Example of the AddRoundKey Operation for Round 1.

The past round-final ciphertext is now that state array. For this round, this state array serves as input to round number two. Repeat steps one through ten until round 10 is achieved; at that point, you'll have the final cipher text, subject to length of the key. Figure 14 illustrates the final state of the data after undergoing 10 rounds of the AES algorithm, along with the resulting ciphertext output.

Figure 14: Final State Array and Ciphertext Output After 10 Rounds of AES.

The architecture for cloud data access, along with a visual representation of a possible security threat, is outlined in Figure 15.

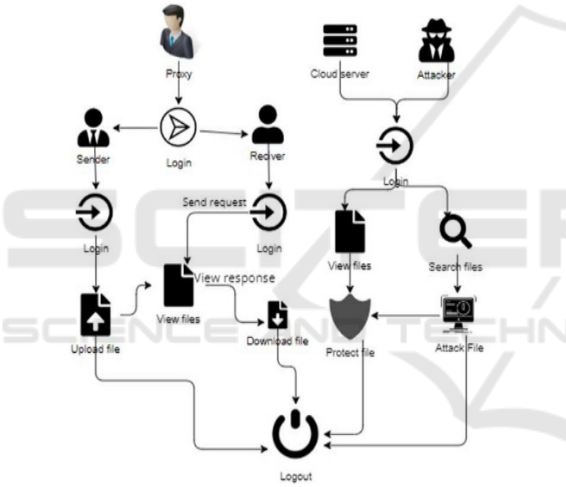

Figure 15: Cloud Data Access and Potential Attack Scenario.

4.1 Working

The contactless food ordering system operates by initiating the view of the restaurant order portal with a unique QR code scanned by customers found on their tables or at the entrance. Information regarding the restaurant, such as its location, opening hours, and promotions is displayed on the platform along with a menu available for browsing by customers. Once within the menu, customers customize their orders by selecting food items while indicating preferences such as toppings or spice levels and nutrition details. The system checks table availability, reserving tables for customers if available; otherwise, customers are placed on the waiting list.

Once the table is confirmed, then from this juncture onwards, they make payment through secured payment methods available on the platform like credit cards or mobile wireless wallets. The transactions protect the customer's payment information through encryption of data, which further adds to the security of transactions by AES (Advanced Encryption Standard). After the payment, the restaurant staff receives the order for preparation and real-time status updates for customers on their orders via the platform, with food delivery to the reserved table as soon as it is ready. In addition, after the meal, customers have the opportunity to rate the service and provide feedback through the system, which the restaurant can review for service improvement. Overall, the convenience of the system reduces contact for the comfort of the customers in terms of payments with security and, in fact, a pleasant experience from order to payment.

5 RESULTS AND DISCUSSION

The implementation of the contactless food ordering system has brought forth remarkable improvements in customer experience, as well as the overall restaurant's operations. The contactless system embedded QR code technology into table reservation, menu browsing, and secure payment processing, providing a smooth and efficient experience to customers. Customers could simply scan the QR code fixed in the restaurant to view the menu, check the real-time availability of tables, and order with ease. This eliminated not only the need for the physical menu but also the time during which the customers were made to wait for the waiters to come and take their orders. Thus, wait times were considerably reduced, and customer satisfaction was enhanced. The real-time feature for table reservation could enter customers into the system from which the tables are assigned automatically if available or put on the waiting list should the restaurant be fully booked. This implied that long queues for seating arrangements and misleading table availability were avoided. The very customizable ordering process has thus been of paramount benefit to customers, giving them a greater say in their meal selection to suit their own dietary needs and tastes. In the context of security, the payment AES encryption was quite effective in ensuring that sensitive financial information remained uncompromised. Customers felt comfortable and secure using the platform for their payments because they were assured that no one could trace their transaction details as these were all

encrypted and kept private. The payment interface of the system was user-friendly, thus further enhancing customer experience by allowing customers an easy and efficient way to make the transaction without facing direct interaction with the waiters. There was also an improvement in the restaurant staff's operational efficiency. Eliminating manual order-taking allowed staff to work more on food preparation and customer service, thus increasing service speed and decreasing human error. Additionally, customer preferences and ordering trends were captured as rich data by the platform, granting the restaurant insight into popular menu items and customer behaviors, thereby helping to reorient marketing and improve the entire dining experience. However, challenges arose, mainly with keeping the QR code system running on different devices, especially with regard to availability and maintenance. Some customers faced small challenges accessing the platform mainly due to compatibility issues of their devices or limited internet connectivity. Continuous updates and troubleshooting protocols have been put in place to solve these issues and keep the system operational. In addition, quite a few customers have had initial difficulties using the platform, indicating that instead of an improvement in UI design and guidance; greater attention may also need to be channeled towards usability. Consequently, it can be drawn that, through enhanced security, convenience, and operational utility, the contactless food ordering system has dramatically improved the dining experience.

6 CONCLUSIONS AND FUTURE WORK

Conclusively, the contactless food ordering system has successfully altered the conventional dining experience by taking advantage of modern technology to help enhance client satisfaction and operational efficiency. Customers can easily access restaurant services with little physical interaction thanks to QR codes for table reservations, menu viewing, and secure payments. The use of AES to encrypt transactions ensures that the customers feel confident about the personal and payment data safety. It has real-time table reservation and waiting list management functions to Ensure Simplification of The Whole Process by Cutting Down on Waiting Time and Improving the Entire Dining Experience.

This system has also enabled restaurants to compile valuable customer data that informs business decisions for improving services catered to customer preferences. In sum, it provides a seamless and secure solution for customers and restaurant personnel alike, thereby ushering in a new standard for the restaurant industry.

For future development, there are other enhancements to be added to further improve the system. Making it multi-language will accommodate a diverse clientele, thus widening the platform's accessibility to an even larger international audience. Loyalty and reward offerings would generate repeat customers by offering discounts, free items, or exclusive deals in accordance with their order history. Such personalized recommendations suggested items that genuinely improve the dining experience, truly based on something the customer is likely to enjoy. The program could allow ordering for takeaway or delivery through popular food delivery services. This would result in a more advanced analytics dashboard that could give restaurant owners greater insight into understanding customer behavior while managing operational issues such as popular items and peak bachelor evening dining. Truly, a voice ordering feature should be considered for a more convenient and hassle-free experience, especially for impaired customers. It would also help increase restaurant visibility if social media sharing options were integrated. AI chatbots could steer customers through the menu and questions. Adding these enhancements would make the contactless ordering system much friendlier for users and increase the efficiency and versatility of operational dynamics for the restaurants.

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