

QR Food Ordering System with Data Analytics

Abstract - Imagine entering a restaurant and seamlessly ordering your desired dishes from an intuitive digital menu. Your waiting time, often filled with uncertainty, is now transformed into an informed experience. Develop a web or app-based software solution that allows diners to view the restaurant's entire menu, place their order, and track their food's preparation progress in real-time. This system should provide estimations on serving time, inform the diner of their queue position, and offer an in-app payment feature. The goal is to enhance the dining experience by offering a transparent and efficient ordering process while still enjoying the ambiance of the restaurant.

I. INTRODUCTION

In order to fulfill the rising demand in the restaurant industry, staffing issues can be addressed through process automation and data analytics. A web-based QR Food Ordering System incorporates QR codes, which are recognized for their sophisticated information transfer capabilities. To view the digital menu, place orders, and create automatic bills, customers scan the QR code on a table. The system's data analytics provide insights for forecasting and decision-making that are well-informed. By using data to improve customer experiences, menus, and operational efficiency, this system goes above and beyond standard platforms and ushers in a new era of technologically improved eating experiences.

II. LITERATURE REVIEW

A literature analysis offers a thorough overview of current research and industry practices, which is essential when designing a QR code meal ordering system with data analytics. During the development stage, it can learn about the opportunities, risks, and best practices associated with integrating data analytics, food ordering systems, and QR codes by performing a literature review. The review aids in determining the state of the art at the moment, new developments in technology, and any knowledge gaps that could require filling. It also makes it possible to analyze the advantages and disadvantages of various approaches, methods, and frameworks used to related systems. Furthermore, the literature study facilitates comprehension of data analytics' effects on the food and beverage sector. The literature research is the basis for developing and putting into practice a successful QR code meal ordering system that makes use of data analytics by combining the results of pertinent studies.

A. Digital Food Ordering System

Nowadays, everyone just about everywhere uses the internet. Every day, people benefit from being able to carry out tasks like searching for information, chatting with friends and family, and communicating with colleagues. Since practically anything can be done online, the internet is incredibly practical for individuals. The internet and telecommunications have expanded quickly. Some industries have begun to use this technology in their operations. This move has made the company to be operated more effectively and efficiently.

Customers can access services and information from a distant server, giving them access to databases over a network or through the internet. Nowadays, people can work on or retrieve information and data via mobile devices, and they are more affordable and compact in current technologies. Most of these devices support this wireless technology, which also means they can get information and data from remote areas. The technology can be shown in Figure 1 to have a clearer concept.

A. QR Code Mechanism

The use of QR codes in mobile tagging is crucial. To decode and extract information from them, a QR code scanner

is needed, which is frequently included in smartphones. These codes can include many types of data, which improves user experiences. In multiple processes, the QR code reader finds, interprets, and fixes faults to provide the original contents. Count indications. Decoding the data character based on one or more modes will provide the original data.

B. . Data Analytics with Machine Learning in Food & Beverage Industry

The food and beverage business gains from data analytics because it offers insightful information. Businesses may now gather and analyze data to enhance customer experiences, operations, and sustainability thanks to technological improvements. It is normal practice to use both descriptive and predictive analytics, with machine learning supporting data-driven decision-making. For instance, linear regression aids in pricing, staffing, inventory management, and inventory optimization by predicting consumer behavior. All things considered, data analytics gives companies the ability to remain competitive and make wise judgments.

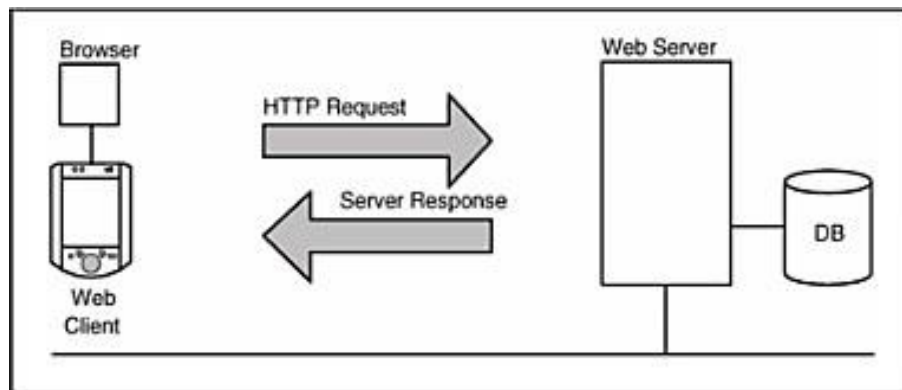


Figure 1. Process of transmitting data from end to end

III. THE PROPOSED SOLUTION

This section defines the architecture, diagram, and data for the proposed system. It is the section where the ideas, strategies, or interventions are outlined to provide a resolution or answer to the problem at hand.

A. System Design

A use case diagram illustrates the relationship between actors and the proposed system. As showed in Figure 2, the actors in the use case diagram involve the customer, staff (waiter and kitchen staff) and admin. Customers browse the menu after scanning the QR code on their dining table and make the food ordering. Meanwhile, staff (waiter and kitchen staff) check any relevant information about customers' orders. Admins of the restaurant create new QR codes for new tables and check QR codes for existing tables in case they need to print out a new QR code sheet to put on tables. They can also modify the menu and access the data analysis features in the proposed system.

An activity diagram showcasing the involvement of customers in the food ordering process which shown in Figure 3. First customer needs to scan the QR code that is available on the dining table, then they can view the menu provided by the restaurant, orders are submitted by customers and the order data are stored in a database

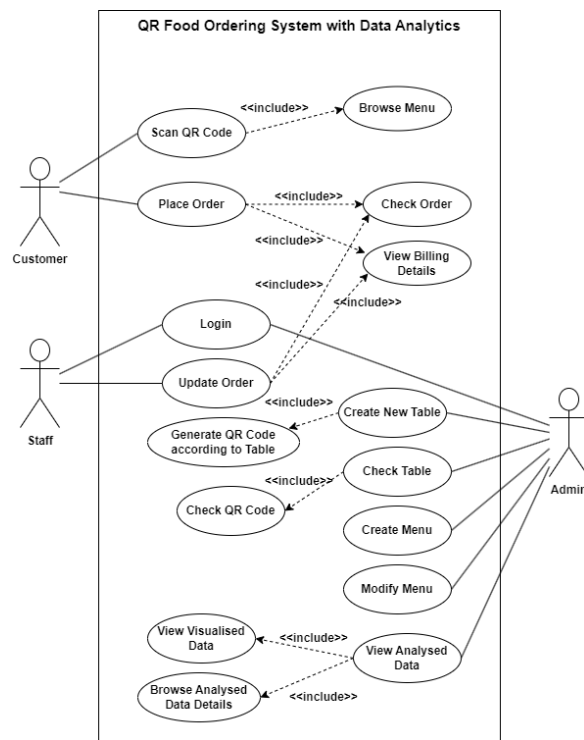


Figure 2. Use case diagram of the proposed system

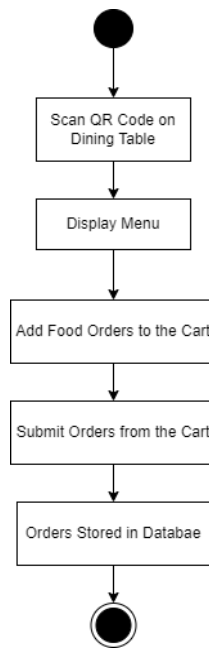
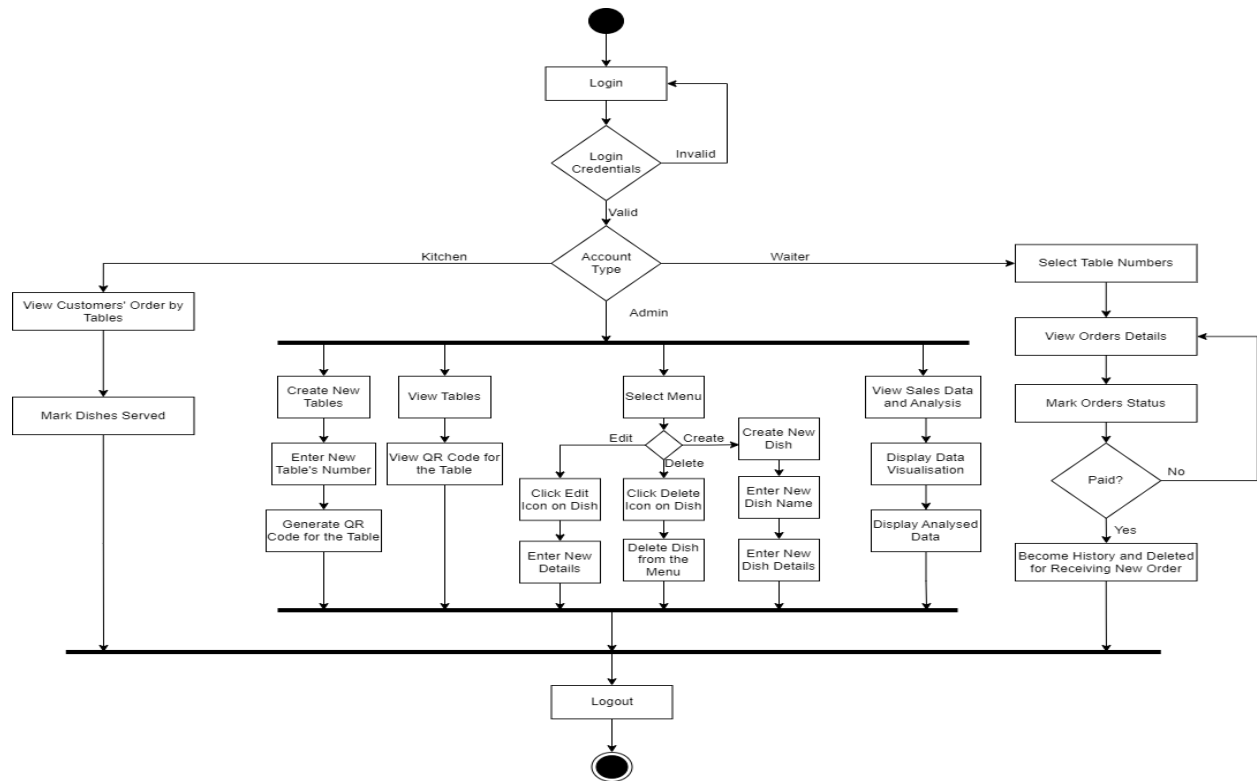


Figure 3. Activity diagram for customer

As illustrated in Figure 4, Customers must log in when accessing the system, and the system verifies their login credentials automatically. Upon logging in, waiters can review order details of customer and update the order status once the customer has completed their meal and made the payment. Kitchen staff can view customer orders and update the status of dishes once they are prepared and taken out of the kitchen. Lastly, admin users can create new tables, view existing tables, modify menus, and access sales analysis upon logging into their accounts.

Figure 4. Activity diagram for staff (waiter and kitchen) and admin



A context diagram of how the customer, staff and admin interact with the system is displayed in Figure 5. Customers can directly scan a QR code to use the system which shows by the activities in the diagram. Still, it is notable that the admin and staff must provide login information to get a different response from the system, which made both of them are separated and has their own activities. The data flow diagram in Figure 6 shows how the data flows between three external entities (customer, staff, and admin) through ten processes and four data sources (Staff, Menu, Order, Table) in the proposed system.

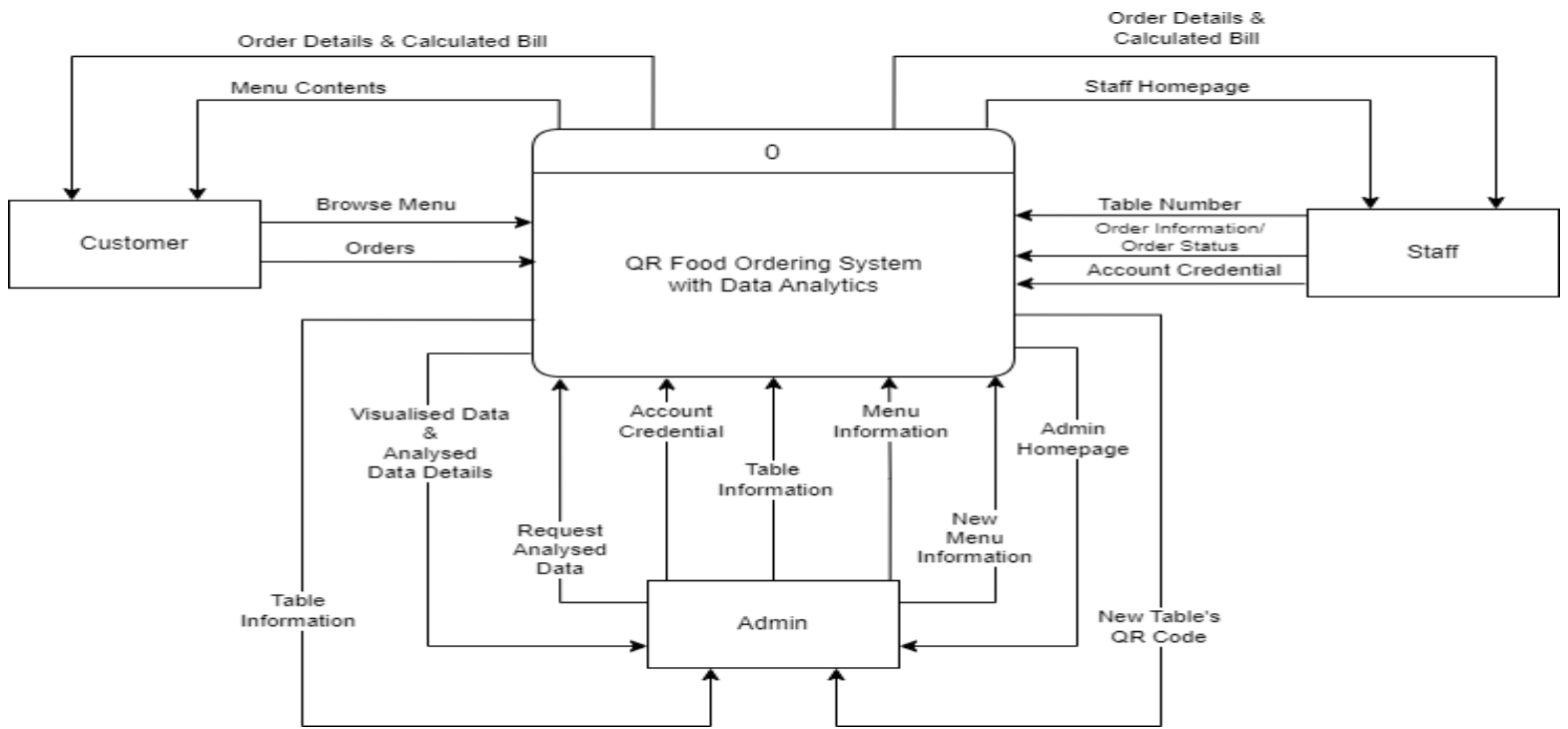


Figure 5. Context diagram of the proposed system

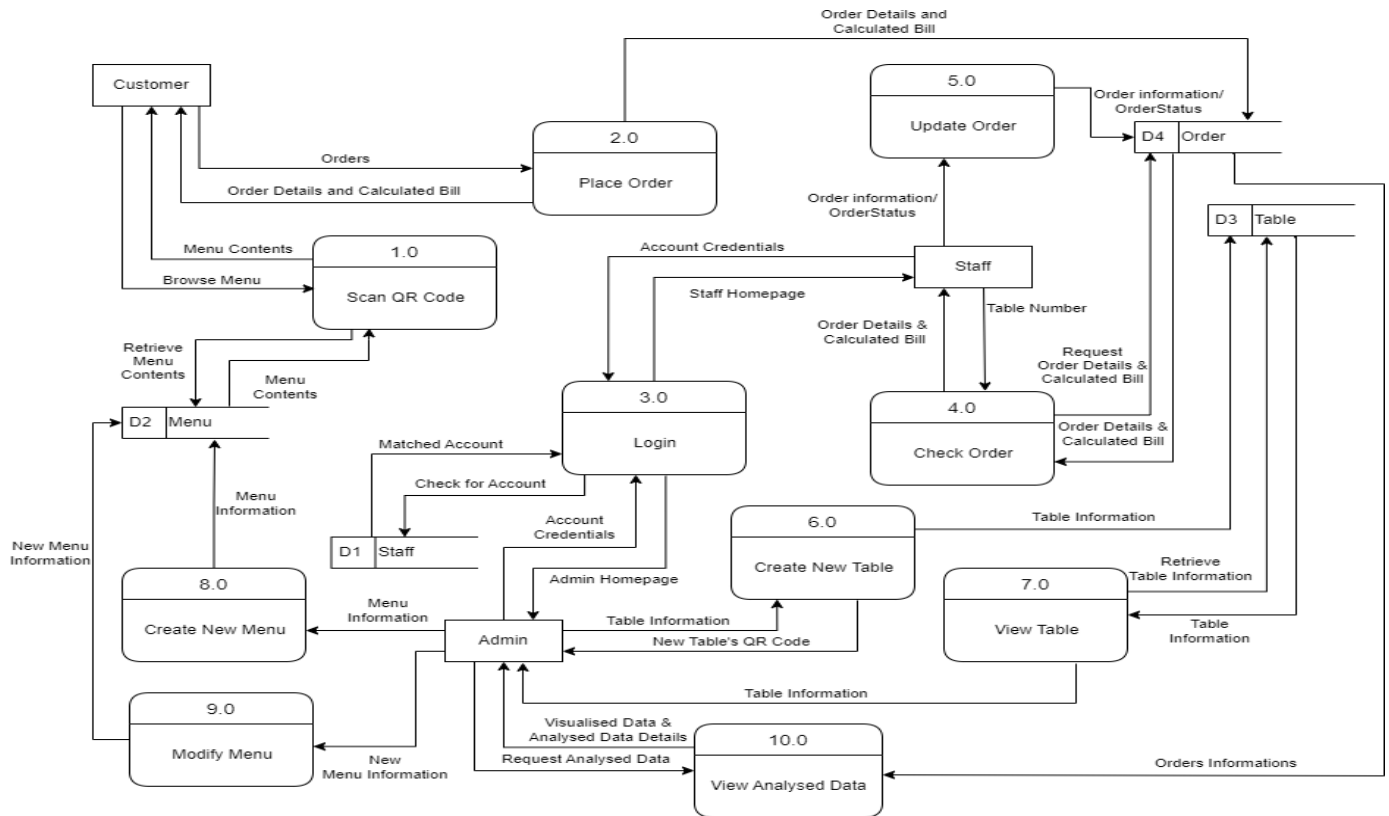


Figure 6. Data flow diagram of the proposed system

B. System Architecture

System architecture contains the front-end and back-end of the proposed system, illustrated in Figure 7. The front-end component handle interaction between users and the proposed system through a web-based user interface, and the back-end components handles all the data operations requested from the front-end components. As shown in Figure 7, front-end components involve the web development tool such as HTML, SCSS, Bootstrap, and JavaScript to create the graphical contents (User Interface), QR code generation and Data Visualization in the proposed system. Meanwhile, back-end components involve server-side scripting PHP that handle the user's request and MySQL that store the content in the database.

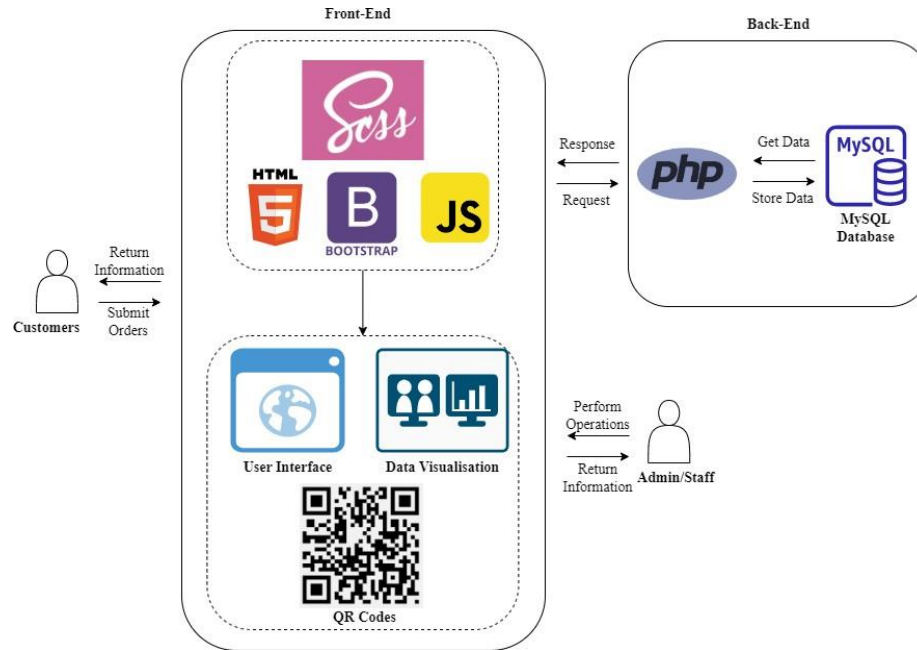


Figure 7. System architecture of the proposed system

C. Generation of QR Code

The proposed system auto-generates a QR code with an embedded URL of the table number to ensure the table number is stated and recorded in the order submitted by the customer later. As shown in Figure 8, jQuery script is needed for simplifying the JavaScript scripts that is required by the API. Google Chart's API is invoked to generate QR Code that contains the table number and URL to the restaurant's menu site [10]. Table number is included to enable the system to recognize the orders submitted by customers from which table. By specifying the chart type (QR code), size for chart, and URL to encode, the Google API create the QR code that is encoded with the URL in the size that is specified by the proposed system.

D. Generation of Visualized Charts

The proposed system allows data visualization based on the past order data. Data visualization helps the admin to improve decision making and forecast future needs. The proposed system imports the library of Fusion Chart and uses the required scripting language, JavaScript, to create various charts [11]. Since past data is required to create the charts, a database connection is required to obtain the past data stored in the database. The involved table is "Order Table", which stores all orders placed by customers. However, since PHP is a server-side scripting, it cannot be integrated with JavaScript, which is a client-side scripting. Therefore, JSON is needed to pass the value received from PHP to JavaScript so that data visualization can be done with past data [12]. Finally, the charts can be displayed on the system pages based on the past data from the database passed by the scripts that run Fusion Chart.

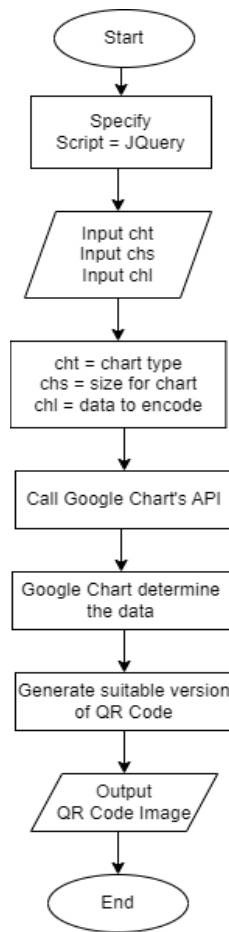


Figure 8. Flowchart of generating QR code

IV. IMPLEMENTATION RESULTS

This section refers to the outcomes obtained during the implementation phase. It presents and discusses the specific results emerged from the practical implementation of the proposed solution.

A. Customer's Interface

The first interface is presented when customers scan the QR code on their phone which illustrated by . The interface is the restaurant's menu that is available at the moment. User is able to view the dishes' name, image and their price, if they wish to order them, they just need to press on the "+ Cart" button on the right side of the dish. Then the bottom-right of the proposed system shows a cart button that indicates the number of dishes added to the cart and the user is able to see the details in a new page by clicking on it. There is also a category filter on the top which allows users to choose the desired category of their food they want to order; it will only show the food that is under the category.

The cart page shows after the customer clicks on the cart button, which is mentioned above, it is illustrated in. It contains a list of items that have been added to cart and along their price. The proposed system automatically sums up the price to show customers their payment amount after having the meal. There is also a remove button to remove the item in the list in case customers change their mind. Lastly, "Submit Order" button allows the customer to send the list

of orders to the system. The system will indicate a successful message if the orders are successfully recorded down in the system

B. Admin Dashboard

The login page of the staff side of the system is illustrated in , where every authorized staff has to enter their own ID and password in order to further interact with the system. Once they enter their ID and password, by clicking login, the system validates and directs them into a web page that matches their role.

The admin's dashboard after the system validates the logged in user is admin, is shown in. The dashboard mainly presents the current analytics of the restaurant based on the order data by customers. By showing their revenue, sales amount, best-selling items based on different scenarios, it allows admin to have overview business situation, by viewing various charts, then can interpret the pattern and analyses to come out a strategy that benefits the restaurant. By the left side of the page, it is a side-navigation bar that can navigate users to pages that they want, it is consistently available on all pages of the system, but it appears different navigate options based on type of users.

After the admin selects the "View More" from the "Best Category" card, it redirects to a page where it shows the best category and worst category, consisting of data at all-time and current month, illustrated. It can show the food inside the category, allowing admin to know which item in the category needs to be aware of, for example, Pepperoni Pizza from the Pizza category is selling slow even though the category is the bestsellingcategory in the restaurant. This allows the admin to find out the problems and deploy strategies to solve them.

V. CONCLUSION

With an emphasis on process automation, QR code ordering, and data analytics, the suggested solution transforms restaurant operations. It improves decision-making and tackles conventional problems. Sales data provides insights on resource allocation, future demand, and trends. This approach rethinks restaurant management and lays the groundwork for future developments in the sector.

In order to improve data integrity and customer experience in the future, POS system integration is essential. This will allow for real-time transactional data and deeper insights for business growth and optimization.