Restaurant Information System (RIS) with QR Code to Improve Service Operations of Casual Fine Dining Restaurant

Grace Lorraine Intal
School of Information Technology,
Mapua University Muralla St., Intramuros Manila,
Philippines
e-mail: gldintal@mapua.edu.ph

Jan Daryll Payas
School of Information Technology,
Mapua University Muralla St., Intramuros Manila,
Philippines
e-mail: payas.jandaryll@gmail.com

Louise Mae Fernandez
School of Information Technology,
Mapua University Muralla St., Intramuros Manila,
Philippines
e-mail: lmmvfer@gmail.com

Blanca Marie Domingo
School of Information Technology,
Mapua University Muralla St., Intramuros Manila,
Philippines
e-mail: biancamdd@gmail.com

***Abstract*—The rapid growth of technology makes people look forward for innovation that makes transactions faster and easier. For the food industry, a search for techniques that would improve their business functions for the customers would mean an increase in revenue and customer satisfaction. The study highlights on the business process improvements of casual dining restaurant in the Philippines thru the application of Restaurant information system (RIS). Analysis of the current business processes was conducted through interviews and observations. The level of customer satisfaction was evaluated through SERVPERF questionnaires using five (5) dimensions: Tangibles, Reliability, Responsiveness, Assurance, and Empathy. The results show that customer satisfaction levels in ordering, billing and payment processes require improvements. To address these issues, the researchers proposed a web-based system with Quick Response (QR) code functionality which is easy to use for mobile users. A prototype was made and comparison of service times between current and proposed processes was considered.**

Keywords-RIS; QRCode; service time

I. INTRODUCTION

A casual-dining restaurant serves a higher quality of food that offers less table service with the consistency of a casual-dining ambiance. Since customers may become demanding, casual-dining offers healthier food choices, good ambiance, and better customer service. The casual-dining falls to the "quick and full service" that has been a trend in food service industry [1]The authors conducted the study in a casual dining restaurant that has 12 tables with 4 maximum seating capacity, 1 cashier staff, 2 waiters and 1 kitchen staff. The waiters have direct interface with the customers from the time they arrive until payment of their bills. During peak hours, waiters could not attend to the customers immediately in getting the orders so clients tend to wait. Mistakes in orders as well as not informing the customers about unavailable menu also happen. Due to the booming tourism of the Philippines, more foreigners are visiting the country and some foreigners may not be from an English-speaking country or do not have an understandable English accent for a Filipino thus, may most likely cause communication problem. Ordering through a restaurant app will save time, money and effort both for the customers and the restaurant. [2]. The study aims to develop a web based application that will facilitate the ordering process using QR code, easy issuance of bill and fast processing of payment.

II. LITERATURE REVIEW

The internet is widely used today and plays a vital role in the business sector. One big advantage is that internet can be used to help companies communicate with each other or determine if the customer is satisfied with their current process. Self-service technologies or systems are one of the advantages of internet. According to the article entitled "Self-Service Technologies: Understanding Customer Satisfaction with Technology-Based Service Encounters", it increases the way of the customers interaction on how to react and to create service outcomes. [3] Self-service is a business strategy that can automate customers need or services by providing a tool for their needs to serve themselves. Some examples of self-service technologies are bank machines, vending machines, mobile applications and websites and other application that offers customer services. Self-service technologies have its own potential value to the business itself and to the customer's satisfaction, it can deduct the cost, it can prolong its service hours and can cause more functionality, it can reduce its waiting time and increase security. [4] According to the restaurant La Frame Blanche d'Asie owner named Ding Zhong Zhang, self-service application enhances customer's satisfaction. It allows his customers' to view pictures of the food prior to ordering. The application also helps the customer makes the right decision and choose the right order for them. It can

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also display attractive imagery to certain foods that can tempt the customer to buy that food. The self-ordering menu also enables the restaurant service much faster than usual. He proved that using the self-service application that he doesn't need to add more waiter to the floor to offer greater services.[5]

One of the most common restaurant mistakes is getting or being served by the food that the customer did not order. According to the article entitled "Most common restaurant complaints" it pointed out that among 1,003 people they surveyed about their common complaints on restaurant services. The highest percentages was the category on "Meals are not what you order" which has 62%. [6] Inaccuracy of orders often delays the serving process. It will also affect the integrity of sales report, which can also affect the accounting management of the restaurant.

Manual ordering by restaurant guests can also be time consuming as the customers tend to call waiters while still deciding on orders. Some guests tend to change their decision last minute. In manual ordering, waiters are required to repeat all the guest's orders in order to make sure that the waiter got everything correctly. Manual ordering can be vulnerable to errors due to taking down of orders by hand. Management of orders will be easier with ordering through the restaurant application since the coming in of orders in the kitchen is automated. [7]

Ordering through a restaurant app will save time, money and effort both for the customers and the restaurant. [8]. With this, a Quick Response (QR) code is embedded in the system developed by the researchers. QR Code is a technology that is easy to use that even first-time users will easily learn how to use it. The process of scanning a QR Code to access information can be engaging to customers. Scanning a QR Code of the guest's table can be an easier way to access the restaurant menu rather than typing it down through the phone's browser. Majority of the smartphones today have built in QR Code scanners that can direct them to the website. Although, the application is not limited to only those with smartphones that has a QR Code scanner. Those who cannot access the menu can be assisted by a waiter and have the waiter order it for them. As stated in the International Journal of Business, Humanities and Technology, in the topic named "Extent of QR Code adoption by Consumers", QR Code is a favorable gateway used by consumers to request for certain information that can be accessed with just a click of a button. On the report of their research, they have therefore concluded that consumers find QR Code easy to use. [9]

Waiters take a huge part of the ordering process in manual ordering. In some cases that the restaurant waiters cannot attend to a large number of guests, ordering of food can be slower. Waiters tend to attend to the table they are closer to and the rest will follow. This can cause disappointment to some guests and can affect the restaurant's review and reputation. According to the article "Ordering method and system for restaurants", the price of labor of restaurants take up 30% of operating costs. This means that, with a restaurant system that is technologically self-service, restaurants can lessen their labor costs with what the system can do. Guests can now place their orders straight to the kitchen with the restaurant's application. Their requests will also be on queue so that waiters can attend to their tables properly. [10]

Restaurant owners need to provide guests with something fresh and innovative ideas. Restaurant owners must have something out of ordinary that cannot be found in majority of the restaurants in the market. Owners must have something unique to offer to the customers to make their restaurant stand out from the others. As stated in the European Journal of Applied Economics, in the topic named "Restaurant Innovativeness: A Case Study of Vojvodina", Restaurant owners should transform what to offer. It is because innovations in the business segment are considered important for the wealth and success of a business and to help enhance it. [11].

III. METHOD

A. Business Process Analysis and SERVPERF Model

In order to assess the current business processes of the Filipino Casual Dining Restaurant, the researchers conducted actual observations. The process begins with the arrival of the customers. If there are available seats, the waiter will assist the customers to the available table. But if not the customer will have to wait until seats become available. When seated, waiter will hand the menu and ask for their orders The customers will then choose their orders from the menu and the waiter will give them to the kitchen staff and to the cashier, so that the cashier will be able to initially process the customer's bill. The kitchen staff will prepare the orders that the waiter will serve. Once finished, the customer will ask for the bill from the waiter, and the waiter will get it form the cashier. After receiving the bill, the customer will then pay the bill.

The researchers also conducted a survey to the customers regarding their experiences and to identify the weaknesses of the processes. The SERVPERF Model is the tool used to measure the perceived service performance of the restaurant as it relates to service quality. The model consists of five service dimensions namely: Tangibles, Reliability, Responsiveness, Assurance, and Empathy. These helped the researchers point out which part of the service offered is perceived by the employees as problematic or unsatisfactory [12]. The first dimension is Tangible. This dimension measures the physical appearance such as the facilities, equipment, materials, and employees. Reliability measures the ability of an organization to perform and comply with what is promised accurately and without error. Responsiveness measures the promptness of service of employees, and willingness to serve customers. Safety or Assurance is a dimension that measures the knowledge and courtesy of employees and their ability to convey trust to customers. The last dimension is Empathy. This dimension measures the attention provided by the employees to customers, and willingness to listen and understand the need of customers. [13]

The results show some areas for improvement in the quality of their service and Responsiveness maybe

considered as critical factor. Table I shows the results of the survey covering the failure points of the current business processes.

TABLE I: FAILURE POINTS OF THE RESTAURANT'S BUSINESS PROCESS

Failure Points	Issue	Dimension
1. Wait for available seat	Customer sometimes has towait before being seated	Responsiveness
2. Ask for Menu	Waiter is unable to respond promptly	Responsiveness
		Empathy
3. Delivery of order	Waiter sometimes is unable to deliver the correct order	Reliability
4. Ask for bill	Waiter is unable to respond promptly	Responsiveness
		Empathy
5. Wait for bill	Processing of bill takes time	Responsiveness
6. Receive receipt and change	Waiter is unable to give receipt and change right away	Responsiveness
	Processing of customer's payment takes time	

B. *Time Study*

The researchers were able to get the service times of the current processes done by the waiter to validate the issues on Responsiveness and so that it can be compared with the processing times upon using the RIS.

TABLE II. SERVICE TIME FOR WAITERS' ACTIVITY (CURRENT PROCESS)

Summary of Average Service Time of Waiter's Activity	
Activity	**Mins.**
Assist customer to table	0.83
Give Menu to Customer	0.97
Get Customer's Order	4.42
Give Customer's Order to Kitchen Staff	2.04
Give Customer's Order to Cashier	0.96
Give Customer's Order	6.13
Get Customer's Bill from Cashier	1.56
Give Bill to Customer	1.04
Get Customer's Payment	2.16
Give Receipt to Customer	1.63
TOTAL AVERAGE SERVICE TIME	**21.73**

C. *Proposed Business Process Using RIS*

The proposed process flow when the RIS will be incorporated will be as follows;

Once the customer picked a table, they can start ordering for their menu via scanning the QR code. Once the customer is done ordering, the orders will be saved in the system where the pending orders will be redirected to the kitchen. If the customer doesn't have a smartphone with QR code scanner, the waiter will be the one ordering for the customer. When confirmed, waiter/ customer sends the order which will be received by the kitchen for preparation. The kitchen screen will display the orders. Once the kitchen is done with a table order, they can click complete and it will be sent to the waiter's screen. The waiter will see all the completed orders with its respective table numbers. The customer can still order again if they already sent their existing orders to the kitchen. The customer will request the bill from the waiter by pressing "Proceed to Checkout" then the cashier will issue the receipt and will be given to the customer. The customer will be shown the summary and total orders and press checkout. Customer's cash payment will be given to the waiter then to the cashier. The cashier will record the payment in the system and the table number will be available again. Customers can use the app for payment thru card,

D. *System Architecture*

Figure 1 below shows how the customers, manager, cashier, kitchen, and waiter are connected. The proposed system would have its server running in a cloud (Microsoft Azure) and employees of the restaurant can access the website in their mobile phones via internet while customers can access the website by scanning a QR code which will redirect them to the website. Employees can access the system as long as they are authorized. Any menu changes made by the manager will be seen by the others. Customers account orders will not be deleted as long as the cashier does not clear their table orders, allowing the customers to connect and disconnect.

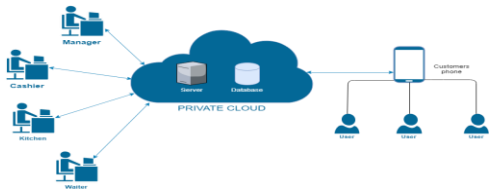

Figure 1. System architecture of RIS.

E. *Technical Tools*

QR Code

A QR code or Quick Response code is a symbol type of matrix barcode or two-dimensional barcode. It was first designed for automated transaction in Japan. QR codes are initially are intended for use in production to control automotive parts, but years passed, it has become very popular in other fields. Now, QR codes is used in other transactions and it is very useful and suitable in Japan and with other countries. The QR code became popular outside the countries because of its quick readability and wide storage capacity compared to other barcodes. Since it is popular and useful in Japan, most of their mobile phones can be able to read QR codes and can access the internet automatic by simply scanning the URL encoded in the QR code.

SQL

Structured Query Language or SQL is a tool for organizing data, managing data and retrieving data that is stored in a computer's database. Since the proposed system is in need of storing sales, menus and other important restaurant's data, SQL is fitted for the proponents' proposed system. SQL provides data definition that will let the user

define the structure of the stored data, another is data retrieval it allows the user to retrieve data from the database, data manipulation for the user to add, remove or modify data. Another function that will help the proposed system is the access control, the user might restrict other user for retrieving, adding or removing a data from the database and most important function is data integrity it will protect the data from the computer's database. [14]

Bootstrap 4

Bootstrap was said to be " the most popular HTML,CSS, and JavaScript framework for developing responsive, mobile first project on the web.[15] Bootstrap is an open source JavaScript meaning there is no need to pay for license to use the software. Bootstrap is a combination of HTML, CSS and JavaScript code designed to help build the user interface components and Bootstrap was also made to support both HTML5 and CSS3.[16]

C#

The C# Programming Language is a modern object oriented created by Microsoft together with the .Net platform. Nowadays C# is one of the most popular programming languages since it was used by millions of programmers around the world. C# Programming Language enables programmers/developers to build a secure and durable application. It also can develop a Windows client application, client service application, XML Web services, databases applications and many more. One of the advantage of using C# programming language is that it can provide an advanced code editor a convenient user interface, a fixed debugger and other tools that can make the developer develop an application. C# programming language as an object oriented language, it can support the concepts of inheritance, encapsulation and polymorphism.[17] The proponents will use Microsoft visual studio software to create the visual, structure and layout of the desktop application needed to our system.

Angular 6

Angular 6 was a version released from Google. Angular 6 was focused on tool chain and it is easier for the users to create different types of application. Angular 6 will be used as one of the front end of the system. Angular is a framework that works for single page applications. The system's design and layout will also cover by angular 6. Also, this framework will help the system since the system's website is responsive it can develop across all platforms for mobile, desktop and tablets.[18]

PayPal

PayPal is used for the proposed system's payment gateway. PayPal allow people to make financial transfer between computers. PayPal is one of the world's primary method of online payment based on an article. PayPal's service is to allow individuals or any businesses to transfer or pay electronically. Paypal will be used as a payment method for the foods that customer ordered and will be received by the restaurant's bank account.[19]

IV. Results and Discussions

A. RIS Modules and User Interface

Ordering Module

The customer will scan the QR Code (Figure 2) which is placed on the table. Then the customer will be redirected to the ordering site (Figure 3) and may choose the order from the menu. The menu indicates the quantity of the customer's order and the customer must click the "add to cart" option to complete the order. The app will show if the order is successfully added to the cart. If the notification of the successful ordering does not pop up, then the order is not added to the cart. When the customer accesses their cart, it will show the summary of their order. When a customer is ready to submit order, he then clicks "Submit Additional Order". System will ask for confirmation (Figure 4) since customer is not allowed to cancel their order once submitted. These orders will be received by kitchen staff.

Figure 2. QR code

Figure 3. Ordering site.

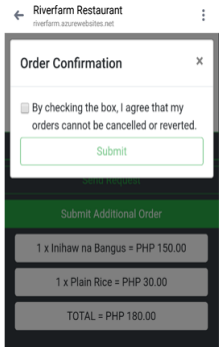

Figure 4. Order confirmation.

Kitchen Module

Upon sending of customer orders, the kitchen staff can be notified by the system as to the table number, order quality and descriptions. Once the orders are completed, the kitchen staff will notify the waiter thru the app.

Payment Module

The customer may use the app in viewing his bill for payment. The cashier can print an Official Receipt if the customer wants a copy. Below is the screenshot of the Payment Module

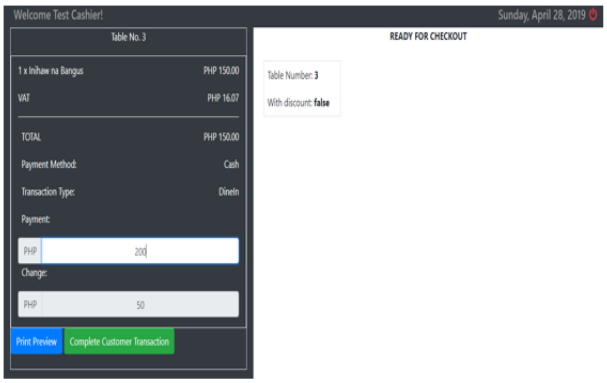

Figure 5. Payment module.

Reports/ Dashboards Module

The system can generate reports/ graphs that will be beneficial to the management such as Daily Sales Report, Most Saleable item etc.

B. Time Study of the Waiter's Activity using RIS

In the implementation of RIS with QR code, some of the waiter's activities will be eliminated such as giving menu to customers, getting customer's orders, giving customer's orders to kitchen, giving orders to cashier, getting bill for cashier and giving bill to the customers, To determine if the proposed system had a positive effect in the service delivery thru reduction of waiter's service times, the authors observed service time per activity.

TABLE III. SERVICE TIME FOR WAITERS' ACTIVITY WITH RIS

Summary of Average Service Time of Waiter's Activity (mins) with RIS	
Activity	**Mins**
1. Assist customer to table	0.83
2. Give Customer's Order	6.13
3. Give Receipt to Customer	**1.63**
TOTAL AVERAGE SERVICE TIME	**8.58**

Table IV below shows the percentage difference in service time of waiter's activities. The reduction in time will help to address the concerns of the customers about serving time and promptness of waiter to respond to customer request since the waiter will have more time to accommodate customers.

TABLE IV. COMPARISON OF SERVICE TIME (CURRENT AND PROPOSED)

Comparison of the Average service time of Waiter's activities	
CURRENT	21.73
PROPOSED	8.58
% Difference	**87%**

C. Cost-Benefit Analysis

Cost	
System Implementation Costs	
• System Development	Php 40,000
Ongoing Costs	
• System maintenance and/or upgrades	Php 30,000
• Cloud support	Php 5,000
• Training for new users	Php 15,000
Total Costs	Php 90,000
Benefits	
• Enhanced customer service and customer experience • Decision support for restaurant owners	

V. CONCLUSION

The researchers were able to develop a Restaurant Information System with QR Code to improve the service quality of a casual fine dining restaurant in terms of fast ordering and payment. Issues on Responsiveness will therefore be addressed. Errors in order taking maybe prevented. The reports that the system will generate will also aid the management in decision making as and plan for sales and marketing strategies.

VI. RECOMMENDATIONS

The researchers recommend setting an ordering system containing delivery option to cater to increasing demand. Customers prefer their food being delivered to avoid travelling and falling in long queues. There should also be a function to monitor inventories to avoid over/under stock. The researchers also recommend a function that can monitor the employees' payroll and tips. This function will definitely help to automate the manual recording of payroll every month. This can lessen the errors and make sure that the recording and computation of absences and leaves can be easily generated. On the tips, since the restaurant has a centralized tipping policy, this function will help compute the tips based on the days and time they work to have a fair division of tips. Moreover, for further improvements, data visualization techniques to allow analysts to more easily derive insights about data and make wise decisions must be incorporated [20]. Thus, charts/ graphs about fast selling or slow moving items,

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