



The Benefits of Utilizing the Automated System at the Restaurant

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DOI: 10.5281/zenodo.15132178

Submission Date: 23 Feb. 2025 | Published Date: 03 April 2025

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Abstract

The use of tools and technology to decrease human labor, optimize procedures, and boost overall restaurant management effectiveness is known as restaurant automation. It entails combining hardware, software, and other tools to automate a number of formerly manual operations. The idea of automating dining establishments is not new; it has existed for some time. However, restaurant management are using automation tactics more than ever before because of technological improvements and the growing demand from customers for faster and more convenient service. The benefits and drawbacks of utilizing the automated system at the restaurant are discussed.

Keywords: Advantages, Drawbacks, Automation, Radio Frequency Identification (RFID), Internet of Things (IoT), Services.

I. INTRODUCTION

The implementation of process automation in business nowadays is increasing, as it enables specific actions to be performed more efficiently, faster, or using fewer resources [1-3]. Digitization of business processes allows executing specific processes digitally using informational technologies and creating control mechanisms, monitoring, and increasing data and information transparency in order to analyze business processes more efficiently and detect weak points. Customer support in the restaurant industry, digitalization is a step toward more effective service. Overall system automation that enables patrons to put orders straight from the table while informing chefs is currently uncommon. When a waiter provides manual customer service in a restaurant, there are multiple times when a customer must wait while specific tasks are completed.

II. LITERATURE REVIEW

Combining kitchen and management maintenance systems with touchscreen devices on restaurant tables that allow patrons to digitally peruse the menu and place their orders is a practical method of automating restaurant operations and making them more efficient, adaptable, and economical [5]. Use of suitable equipment that is very durable, less susceptible to filth, and scratch-resistant is required. In addition to having a fast response time and general reliability, the screen must be sufficiently transparent to display the menu [4]. The system includes all aspect of restaurant ordering in the research publications the authors analyzed, from waiter and client orders to kitchen and cashier applications [4]–[7], [8]–[12]. It is typically advised that customers utilize tablet applications running the Android operating system to place orders at the table [4], [6], [10]–[12]. Primarily designed for mobile and tablet devices, the Android operating system is the most widely used Linux-based operating system. From the perspective of the developer, it is less expensive than iOS. The characteristics of the system vary depending on the literary source. One option, for instance, is to use two Android operating system applications: a restaurant application and a customer application. The restaurant application is designed for restaurant employees and has three user types (Customer, Cashier, and Kitchen) with the previously mentioned functions, while the customer application contains information about the precise location of the table to trace it when the

customer is placing the order [4]. A different approach uses four types of applications: customer and waiter applications, restaurant web applications, and management applications [6]. In this case, the waiter application is defined separately and contains several functions, for example, additional information about the order, grouping of the payments, as well as order confirmation before it is transferred to the kitchen. The waiter application is also used to receive information about ready orders from the kitchen, unlike the approach described above, in which this function is intended only for the manager. A similar system is also described in papers [11], [12]. The choice of system application user types depends on the specific restaurant business and its customer service. In restaurants where the cashier's and ordering duties are performed only by waiters, it would be more convenient to use a system that provides more functions in the waiter application, though in cases where the service process is organized with the involvement of the manager, a system can be used in which the manager also acts as a middleman between the kitchen and waiters. Based on one of the research approaches in restaurant automation, the GSM layer is used for data transmission. The authors conclude that it has lower costs, improved quality performance, a large transmission range (1000+ meters), and a high level of reliability. If a GSM module is used, several modules can be used in the same range, unlike RF modules that do not work if there are more than three modules in one area. GSM bandwidth is 900 MHz, and the communication format does not require a large channel bandwidth. As a result, the number of channels increases significantly and, thus, the efficiency. It is possible to add additional channels using CDMA technology [4]. The Liquid Crystal Display (LCD) screen is most often used for better review of orders in the kitchen area. To connect the Android app used by the chef with the LCD screen, it is possible to use the Arduino tool, which uses a Bluetooth connection to mirror application information on the LCD monitor. Arduino is an open-source physical computing platform, which is based on a simple microcontroller board and is used as an environment for adding software. Likewise, there is a logical queuing system that allows chefs to see orders in a specific order. Arduino uses a wireless Bluetooth connection to transmit order information to the LCD monitor [4]. Radio Frequency Identification RFID-based technology integrated with WLAN and database technology is also used for data transfer in the automated system of restaurant processes. It is used to develop an e-restaurant system for customer-oriented services. In this case, RFID-tagged customer cards can be used that allow waiters to immediately identify customers and then provide customized services [6]. The architecture of restaurant customer service systems is usually created using a centralized database. Such a system contains a database server with restaurant menus and all of the information regarding ordering logic. Devices can be connected using a secure and private WLAN network [5]–[7], [9]–[12]. It is also possible to use real-time data reading when the customer application is connected to a database server and downloads restaurant menus in real time [6]. Another approach to send customer order data to the server is to use the already described wireless GSM connection [4]. In addition to the existing functionality, it is possible to add video cameras in the kitchen in order to let customers see how their order is being prepared in real time [9]. Customers can retrieve information directly from the database using touchscreen devices in the comprehensive restaurant service system. The menu list can be designed to call PHP functions to extract information from the database and save it to an XML file. The order information selected by the customers can then be stored as data objects in the database [5]. Zend Framework is one of the frameworks that can be used to develop a comprehensive automated restaurant service system. It provides wide component libraries for the functional web management system development. The Zend framework provides many modules and classes developed over the years by the open-source community, and it is easily extensible [5]. Using the framework, it is possible to develop the required controllers with individual methods—login authentication and user type classification, menu updating, display daily messages, database retrieval operations, and order generation according to received requests, as well as order accounting and queuing to display in the kitchen [5]. Extending the architecture of the considered automated system with Internet of Things (IoT) devices, or, in other words, sensors, it is possible to achieve additional system functionality in the case of long queues, where customers are waiting for the available table. Use of the sensors can significantly improve customers' experience, promote the restaurant brand value, increase the overall level of service quality, as well as improve effectiveness and decrease the expenses. Sensors can serve as a basis for a smart queuing and reservation system. An existing WeChat application with sub-software can be used, which can also serve as a website where, for example, with the help of a QR code developed by a restaurant, a customer can occupy the queue and come to the restaurant only when the table is available. Besides, it is possible to use a sub-software of the WeChat application in order to develop the restaurant menu environment, which can be used by customers through touchscreen tablets installed in the restaurant [8]. Extending automation to restaurant warehouse processes makes it possible to use RFID technology in order to label goods in the restaurant warehouse in order to make the management of raw materials more efficient and ease the purchase process by digitalizing information about expiry dates of goods [8]. Robots equipped with various necessary sensors, as well as RFID readers, can be used for kitchen warehouse service management, as well as for waiter functions [8]. Robotic systems of IoT technologies are used to replace the traditional workforce, to make various activities more efficient, and to reduce the mistakes made by employees, which are often caused by long working hours of waiters. Using robots to accept and deliver orders to customers is another possible approach to automating the overall restaurant service system. Specialized robots with laser scanners and ultrasound sensors can be developed in order to recognize their location in the restaurant. When the restaurant is being scanned by sensors, it is possible to give a voice command to move the robot to a previously defined place in a restaurant. Likewise, it is possible to teach the robot different types of voice commands. Voice commands can also be used to move the robot or interact with another robot's software. By adding a serving tray to a robot, it can also be used to deliver orders to a

customer [6]. In this case, a robot can partially replace the waiter's job responsibilities while not losing the usual restaurant concept in accepting customer orders. However, the use of such robots is not common worldwide, and they do require full digitization of the customer service system. It is important not only to digitize the customer service process but also to implement automatic inventory and control of raw materials in restaurants with high turnover and demand. A specialized order management system for this function is able to determine the necessary raw materials for the dishes ordered by customers, thus facilitating the work not only for the cook but also for the manager [13]. The most widely used device for processing customer orders in restaurants is the personal digital assistant (PDA). It is used to automate part of the overall service process, as this device is usually designed for waiters who accept orders from customers. Afterwards, data can be transferred to the cash register system and the kitchen [7]. Such systems allow speeding up service time, increasing service efficiency and the accuracy level of orders. PDA systems typically use a wireless network for data transmission [7]. However, it does not offer separate customer and overall management applications, which means all of the processes cannot be automated. The potential reduction in customer waiting times will be less than using a comprehensive digital restaurant system. The strengths of the PDA system are the reduction of the waiter's service time, the reduction of errors, and others that focus directly on the waiter's duties. The weakness is its inability to support and to be integrated into other business processes [7]. In order to identify potential benefits for restaurants, the study suggests a smart restaurant system and evaluates its merits. One of the primary factors that may be changed to improve customer service speed and draw in more customers to a restaurant is service time. The system is developed by analyzing solutions from software, scientific literature, and their various architectures. The average restaurant service load time can be reduced by 52.76%, according to research. To ascertain how a smart restaurant service system might boost a chef's productivity and how the application of various algorithms can lessen a chef's workload during peak hours, two hypotheses have been put out for additional study [15]. In this study, robotics in food processing is thoroughly reviewed, and its analysis is examined in relation to the degree of automation used in different food processing industries. In the food industry, food robots are expected to retrieve different materials and form them into a finished product using an efficient protocol [16]. This study proposes an automated meal ordering system that will intelligently track user orders. In essence, we will put in place a system that will allow customers to place orders or create custom meals with just a single click for a variety of restaurant kinds. An Android application for tablet PCs will be used to build this system. A MySQL database will be used at the backend, while Java and Android will be used to construct the front end [17].

III. THE ADVANTAGES OF RUNNING AN AUTOMATED RESTAURANT SYSTEM

1. Improve accuracy

Automated restaurants provide a high level of accuracy because customers can take their time to review their order. A busy fast-food restaurant with long lines can place pressure on the customer and the cashier. This environment can lead to mistakes being made. Automation can also improve the accuracy in back of house restaurant functions. Where robots prepare food, meals are cooked to a predetermined specification every time. The quality of the food is not determined by how many orders are waiting. There is an increased chance of chefs making mistakes with orders during busy and stressful restaurant times.

2. Make savings

Paying for labor is one of the highest costs when running a restaurant. With the increase in minimum wage in different states, automation could be a way to save on costs. Automated restaurants can take advantage in the decreasing cost of technology to offset the rise in paying employee wages.

Automation also addresses the unpredictability associated with working with people. When running an automated restaurant, you don't have to be concerned about employee absenteeism due to sickness and unauthorized leave. Another aspect of running a traditional restaurant that could be costly is making mistakes when scheduling employees. Restaurateurs in some states are subject to predictive scheduling legislation that penalizes them if they do not stick to certain conditions when scheduling employees. Automated chefs and servers can continue to work 24 hours a day if necessary. The threat of financial penalties for violating predictive scheduling legislation is decreased when running an automated restaurant.

3. Drive efficiency

Another benefit of running an automated restaurant is the added level of efficiency that it provides. As seen above, automation removes the possibility of misinterpreting food orders. Additionally, an automated restaurant will ensure the right amount of ingredients is used in food preparation every time. Therefore, you'll be able to produce a more accurate forecast when predicting your inventory needs. Allocating the right amount of ingredients every time to every meal also prevents wastage, therefore will keep your costs low.

There has been an increase in fast-casual restaurants that aim to offer convenient food, served quickly, and at a fair price. Automation enables restaurateurs to deliver these three aspects in a cost-effective way.

4. Improve customer service

If your automated restaurant is a fast food or fast-casual concept, automation can improve customer service. As more people are time-poor, they welcome the opportunity to reduce waiting times for their meals. Automation that reduces waiting is not just for restaurants. Bars can also take advantage of using automation to improve

customer service. For example, Pour My Beer allows customers to pour their own beer if they do not want to wait to be served by a bartender. To remain legally compliant, Pour My Beer requires customers to buy a radio-frequency identification-enabled card (or wristband) to get access to the beer machine [18].

IV. The disadvantages of running an automated restaurant

1. Lack of emotional connection

Eating is historically a social event and meeting up for lunch and dinner is one of the ways that people connect. Automated restaurants remove this connection because of the reduced human contact. There have been many studies that show that technology contributes to loneliness. Automation has seeped through every aspect of our lives and it remains to be seen whether this will extend to the widespread adoption of fully-automated restaurants. Customers cannot form an emotional connection with machines, therefore they may prefer to be served by a human being, even if it means waiting in line for longer. Being served by a human being gives the customer the chance to engage in small talk. The importance of these small interactions should not be underestimated in terms of making customers feel valued.

2. Hard to use

Not every customer who wants to eat at an automated restaurant will be familiar or comfortable with using technology which can make the experience daunting and intimidating. If a customer is having difficulty using any part of the automated restaurant, they may feel embarrassed to ask for help. This is especially the case if they see everyone else around them experiencing no difficulties.

Using automation in restaurants can turn into a frustrating experience, which is a direct contrast of what the service should represent. As a result, automated restaurants should always have support staff to assist customers.

3. Inability to solve complicated problems

Automated restaurants may provide a reliable service within set parameters and boundaries. However, one disadvantage is that customers with complex problems are unlikely to get the right assistance. For example, a customer may want to remove an ingredient from their meal, but that particular customization option is unavailable. In this situation, traditional waiting staff would communicate the special requirements to the kitchen. However, an automated restaurant's options are limited to only what has been pre-programmed. This lack of flexibility can lead to a reduced customer experience.

4. High costs

The cost of opening and running a restaurant varies depending on the type of establishment you choose. Although you can make savings on aspects like labor costs, starting and running an automated restaurant can be costly. For instance, Spyce founders have raised \$25.9 million to fund their automated restaurant. It's unlikely that most automated restaurants will require such a significant amount of funds. However, the technology to operate a fully-automated restaurant is fairly new and still expensive. It's likely that you'll need specialist maintenance and repair of your automation technology which could increase costs.

V. With the help of this detailed guide, you can successfully integrate automation into your business and enjoy its advantages for many years to come

Step 1: Identify Areas for Automation

Determine which parts of your restaurant require automation the most before implementing it. Order taking, payment processing, and inventory management are a few examples of such duties. Identifying pain points and doing an analysis of your present operations can help you determine which procedures should be automated first.

Step 2: Choose the Right Technology

It's time to choose the best technology for your restaurant's requirements after you've determined which areas need automation. There are many software programs and WordPress plugins on the market made especially for restaurants. Popular choices include inventory management software, point-of-sale (POS) systems for processing orders and payments, kitchen display systems (KDS) for expediting food preparation and delivery, and the WPCafe, Five Star, or Orderable plugin for automated restaurant management.

Step 3: Integrate Your Systems

All of your systems must work together harmoniously if you want automation to maximize efficiency. For instance, in order to deliver orders in real time via tableside tablets or mobile devices, your POS system and your KDS system should be able to connect. Wait times are decreased and inaccuracies in human data entry are eliminated through system integration.

Step 4: Train Your Staff

Training is crucial when introducing any new technology in a restaurant. Ensure that every employee is aware of the new systems' operation and their specific responsibilities for maintaining them. This will minimize interruptions during service hours and guarantee a seamless rollout.

Step 5: Monitor Performance & Make Adjustments

Automation is a process that needs to be continuously monitored and adjusted in order to maximize its performance. To find areas that could have more improvement, monitor performance indicators like inventory levels, table rotation rate, and order processing time.

Step 6: Embrace Customer Feedback

Remember to ask your patrons for their opinions on the automated procedures in your restaurant. To guarantee their general pleasure with the eating experience, use their feedback to make any necessary adjustments or enhancements [14].

VI. Depending on the unique requirements and objectives of a given establishment, a variety of restaurant automation strategies might be used. These consist of

1. Online Ordering & Delivery Automation

The process of receiving and processing orders from various online platforms is streamlined by online ordering and delivery automation. By integrating with delivery services, it guarantees that orders are precisely recorded, monitored, and delivered on schedule.

Benefits include improved customer satisfaction through seamless service, lower labor expenses, and increased order accuracy and efficiency.

2. Customer-Facing Display

Digital screens that offer customers promotions, order data, and other pertinent information are known as customer-facing displays. These can be set up at the counter or at self-service kiosks.

Benefit: By offering real-time order updates, cutting down on perceived wait times, and encouraging upsell chances, it improves the customer experience.

3. QR Code Menu Automation

Without using paper menus or interacting with employees, clients can see and place orders using QR code menus by scanning a code with their cellphones.

Benefits include fewer points of contact, better hygiene, and an easy-to-use, interactive ordering system that may boost sales.

4. Reservation System

Through customer confirmations and reminders, automated reservation systems optimize table distribution, handle reservations, and lower no-show rates.

Benefits include expediting the reservation process, optimizing table usage, and raising customer satisfaction through shorter wait times.

5. Kitchen Display System

Digital screens in the kitchen are used by Kitchen Display Systems (KDS) to prioritize chores and display order details in place of conventional paper tickets.

Benefits include improved communication between the front and back of the house, decreased errors, and increased kitchen efficiency, all of which result in quicker service.

6. Geo-location Food Menu

Local specialties and limited-time deals are among the personalized menu selections that geo-location food menus offer based on the customer's location.

Benefit: By offering individualized menu selections, it improves the consumer experience and may boost sales and loyalty.

7. Inventory Automation System

Real-time stock level tracking, automated reordering, and low-stock item alerts are all features of inventory automation systems.

Benefits include waste reduction, ingredient supply assurance, and time savings on manual inventory checks, all of which improve cost control.

8. Point-of-Sale (POS) Systems

In order to manage sales, inventory, and customer data from a single platform, modern point-of-sale (POS) systems integrate with a variety of additional automation technologies.

Benefits include streamlining processes, accelerating transactions, and offering insightful data on consumer preferences and sales patterns.

9. Customer Relationship Management (CRM) Software

CRM software gathers and examines consumer information to enhance customer connections and tailor marketing campaigns.

By enabling users to bookmark their favorite products, a WooCommerce Wishlist enables companies to monitor client preferences. In addition to improving customer satisfaction, this function offers insightful data for focused marketing initiatives.

Benefit: Increases revenue and repeat business by strengthening client loyalty through tailored experiences and targeted incentives.

10. Restaurant Robots

A variety of automated devices that can greet customers, bring food to tables, and even prepare meals are referred to as restaurant robots. The overall efficiency of services can be enhanced by these robots' ability to work either alone or under human supervision.

Benefit: It boosts productivity and offers a distinctive, cutting-edge dining experience that may draw clients. Automated robots can also do monotonous duties and ensure constant quality, freeing up human employees to work on more intricate and engaging roles [14].

VII. CONCLUSION

We have read a lot of restaurant automation system literature for our project. In the current technological era, we have witnessed a number of developments. Also discussed are factors to be taken into account when putting the current restaurant automation system into place [19]. The automated restaurant system's drawbacks are discussed [20].

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CITATION

Amina I., Aisha S. S., Abubakar A. U., Jamilu Y A., & Muhammad A. B. (2025). The Benefits of Utilizing the Automated System at the Restaurant. *Global Journal of Research in Engineering & Computer Sciences*, 5(2), 48–54. <https://doi.org/10.5281/zenodo.15132178>