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Trends and Challenges in Smart Inventory Management

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***Abstract*—This literature review discusses the development of smart restaurant inventory management systems based on technological innovation and its probable benefits. The discussion ranges from food safety tracing to QR code usage, tracking expiration dates, recipe management, ingredient management, temperature and humidity monitoring, and supplier management. Food safety surveillance is also enabled by machine learning technologies like Vision Transformer (ViT), which detect spoilage at high recall and precision rates, although it still has device compatibility problems and no internet connection. QR codes are also highlighted for order accuracy, automated inventory keeping, and improved operational efficiency but also have cost integration into the system and compliance issues. Barcode and QR code monitoring systems of expiration dates are compared, and a combination system is proposed as effective. Improvements in managing recipes involve interactive step-by-step instructions to ensure greater accuracy and efficiency, particularly with bulk quantities of ingredients. Management systems of ingredients using pocket scanners are compared under the constraints of space and the environment of the fridge. Temperature and humidity monitoring technology, i.e., cloud-based or predictive modeling, is promising to enhance food safety and reduce waste. Supplier selection practices and their impact on restaurant performance are also touched upon, where the importance of ingredient quality comes to the fore. The literature review provides insight into the present trends, problems, and remedies in inventory management systems on which the design of the StockMate system is based to optimize inventory processes and enhance operational efficiency.**

***Keywords*—Food Safety Monitoring, QR Code, Inventory Management, Predictive Modeling, Supplier Integration.**

I. INTRODUCTION

Today, inventory management systems play a major role in the operation of numerous companies and restaurants. With the desire of restaurants to enhance customer loyalty and gain customer satisfaction while reducing costs, inventory management systems have become an important thing because they integrate many technologies such as artificial intelligence, automation, and the Internet of Things to achieve the best results. Inventory systems allow restaurants to be managed professionally, as well as contributing to making the right decisions, minimizing manual work prone to many errors, forecasting more accurately, and assisting in making automatic decisions. Despite everything, there are many obstacles and challenges that hinder the process of adopting these systems by restaurants. In addition to the challenges existing in the systems themselves, which require further improvement, there are many issues related to these problems, such as information security issues, the costs that the adoption of such systems will add to restaurants, labor training, etc. In this literature review, we will highlight the most recent trends in smart inventory management systems, as well as problems and impediments, along with solutions to these issues. This literature review will provide an overview that will help to grasp the newest trends and challenges, as well as novel elements available for further studies.

II. LITERATURE REVIEW

A. Survey Analysis

In this section, the survey results are displayed and analyzed.

1) Introduction: The most crucial aspect of running successful restaurants, bakeries, and cafe businesses is inventory management. It helps the business maintain the right levels of stock, avoid waste, and meet its customers' demands without interruption. However, many establishments are challenged by outdated and limited features of their prevailing systems or simply not being integrated with their suppliers in meeting the inventory processes.

We reached out to restaurants and café owners and managers in survey mode to gain insight into their practice patterns, the tools they use, and the issues that they face in their inventory management. The survey was intended to identify how effective the current systems were and what additional elements enhanced efficiency and decision-making in such vital areas.

The responses collected through the survey were from a diversified range of businesses from small cafes to large restaurants, whose numbers of employees range from less than 10 to above 45. Businesses participated in sharing the present inventory management methods employed, and the features they

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preferred in the system, and their suggestions for improvement to have in a smart solution for inventory management.
The data collected is well-examined as to what significant trends and insights it may reveal. In particular, many of the surveyed rely on software or specially designed spreadsheets to control and manage their inventories, where real-time tracking and stock alerts are considered vital features. Again, the calls for requisite additional features include integration with the supplier's systems, mobile access, and advanced alert systems for stock monitoring. StockMate will serve to fill this gap by developing a smart inventory solution specifically to the needs of the food business.

2) Methods:

- The study site: Saudi Arabia.
- The number of cases: the dataset includes (21) responses.
- Objective: Identify current inventory management practices and the required solutions and improvements.

3) Collecting Data:

- Voluntary response sample: By spreading the survey via WhatsApp, Instagram, and in person to the restaurants.
- Survey Link: click here.

TABLE I. VARIABLES TABLE

NO.	Variable	Type	Values
1	What kinds of food are you providing?	Qualitative	Restaurant, Café, Fast Food, Bakery
2	How many staff work at your restaurant?	Qualitative	36 to 45, 26 to 35, 5 to 15, 16 to 25, 46 to 55, More than 56.
3	How are you currently managing your inventory?	Qualitative	Specialized software, Excel/Spreadsheets, Paper-based
4	How many times do you restock and change your menu?	Qualitative	Monthly, Daily, weekly, others
5	Who is responsible for managing inventory?	Qualitative	Owner/Manager, Dedicated inventory manager, Chef/ Kitchen staff
6	Do you currently use any software to manage your inventory?	Qualitative	Yes, No.
7	If you answered the previous question yes, please provide the name of the software currently utilized for inventory management	Qualitative	Text
8	What features are most useful in your current inventory management process	Qualitative	Real-time tracking, Automated reordering, Alerts for low stock/expiring items, Integration with the supplier system
9	What features would you like to see in an inventory management system that you currently don't have	Qualitative	Supplier system management, Mobile App access specialized for inventory, QR/Barcode scanning, Temperature and humidity monitoring
10	How important is your inventory system to integrate with your restaurant's supplier system?	ordinal	1 to 5
11	Would you invest in a new inventory management system if it addressed your needs more effectively?	Qualitative	Yeas, Maybe, No
12	If you are using an inventory management system, how user-friendly is your current one?	Qualitative	Very user-friendly, somewhat user-friendly, Not user-friendly, Not using any system
13	Would you prefer an inventory management system that is?	Qualitative	Desktop-based, Mobile App-based, Web-based, Hybrid (Desktop and Mobile)
14	What additional features or improvements would you like to see in an inventory management system?	Qualitative	Text
15	Any other comments or suggestions?	Qualitative	Text

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4) Explanatory and Dependent Variables:

a) Explanatory variables: All variables except "Would you invest in a new inventory management system if it addressed your needs more effectively?"

b) Dependent variables: Would you invest in a new inventory management system if it addressed your needs more effectively?

5) Variable Analysis: In this section, we provided an overview of the key variable in our survey.

a) Software usage in inventory management: The pie chart shows the variation of participant's answers on the question "Do you currently use any software to manage your inventory?", we can notice that the majority use software to manage their inventory and their percentage was 61.9%. In contrast, the percentage of those who do not use any software to

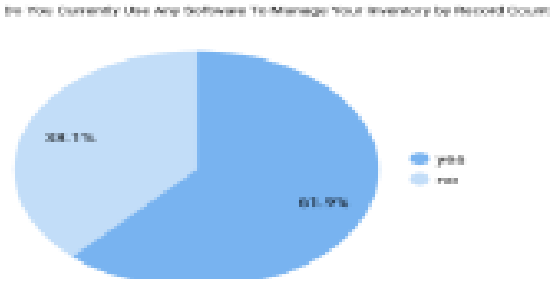

Fig. 1. Pie Chart for Software usage in inventory management

b) Software used by restaurants for inventory management: The chart shows different software that restaurants used to manage their inventory. In addition, this chart. provides insights on the most used software by participants, where "Foodics" software occupy the first place followed by Excel.

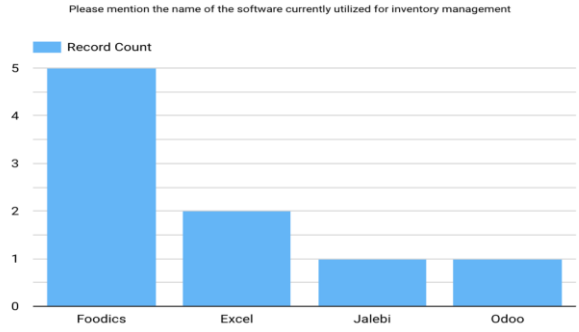

Fig. 2. Bar Chart for most software used by restaurants

c) Most useful features in inventory management: The Bar Chart shows the most useful features in inventory management according to the participants. It shows that the most participants vote for "Real-time tracking" and the least favorable or important feature is "integration with the supplier system". This analysis highlights the priorities of inventory management features according to participants.

d) "Would you invest in a new inventory management system if it addressed your needs more effectively?":

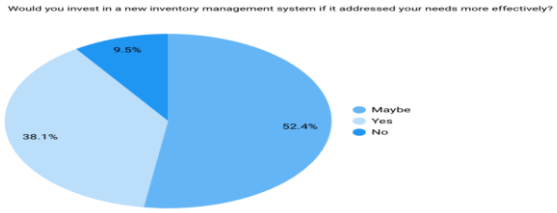

Fig. 3. Bar Chart for most useful feature in inventory management

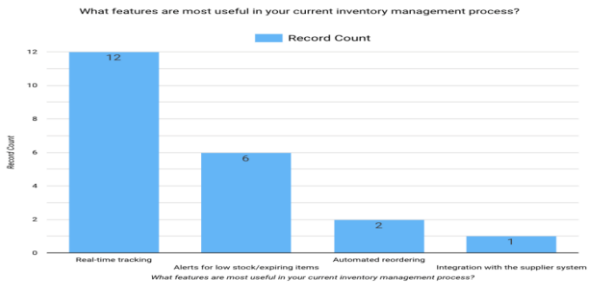

Fig. 4. Willingness to invest in a new inventory management system

The above chart shows the desire of participants to invest in a new system to manage their inventory if the new system provides bett

responses expressed uncertainty about this decision, with the majority voting for "maybe." The rest voted for "yes" by 38.1% and "no" for 9.5%.

e) "Would you prefer an inventory management system that is?":

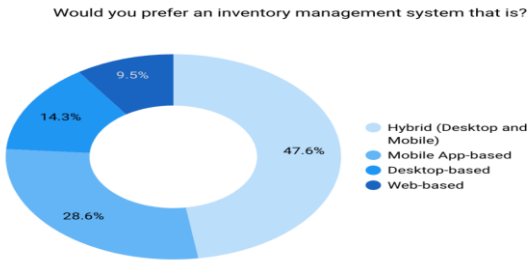

Fig. 5. Pie Chart for the most preferred system type

The chart above shows the most preferred system types among the participants, where the "Hybrid" took the first place, followed

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by “mobile app-based”. And the least preferred is the web-based system according to the participants.

f) Inventory management responsibility: This bar chart explains the distribution of responsibility in restaurants/café/bakery. The information shows that in most cases owners or managers or both together with dedicated professionals are the first to be at the forefront. A relatively lesser number of respondents indicated the chef/kitchen staff have that responsibility.

Fig. 6. Bar Chart of inventory management responsibility

g) What additional features or improvements would you like to see in an inventory management system?”: In this table we have presented the suggestions made by the respondents regarding the developments and improvements they would like to see in the inventory management system.

Table II. Participants suggestions for improvement

Comment no.	Comment
1	Add smart alerts that notify you when your stock is about to run out.
2	Live update of stock and barcode.
3	Application.
4	Importance of having the appropriate temperature sensors for food storage.

h) “What features would you like to see in an inventory management system that you currently don’t have?”: This pie chart shows the preference of users for various features in an inventory management system is presented, as reported by the survey respondents. The percentages reflect the part of respondents who gave priority to each or any combination of the features. The most generally chosen facility is Mobile App access (28.6%), followed by Supplier system management (23.8%). Further notable choices are a temperature and humidity monitor (14.3%) and combinations of advanced features like QR/barcode scanning. The results indicate the demand for mobility, supplier integration, and environment monitoring in inventory solutions.

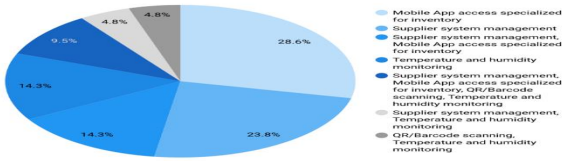

Fig. 7. Pie Chart of the most wanted improvements

6) Relationship Analysis:

a) Importance of Supplier Integration vs. Interest in New Systems:

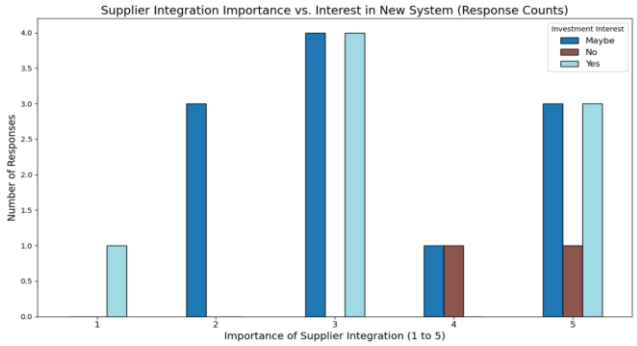

Fig. 8. Clustered Bar Chart - Relationship analysis#1

The x-axis gives different levels of supplier integration importance from 1 (considerably less important) to 5 (very much important). Each level has three distinct bars representing answers regarding the adoption of a new system: accommodates "Yes," "Maybe," or "No." The Y-axis shows the number of responses for each category.

Table III. Relationship Analysis #1

Supplier Integration Importance	Yes	Maybe	No
1	1	0	0
2	0	3	0
3	4	4	0
4	0	1	1
5	3	3	1

From the table above, businesses that prioritize supplier integration (3 and 5) are most likely to adopt a new inventory management system. We can see that the integration of suppliers with the system may make restaurants more willing to adopt the system.

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b) User-Friendliness vs. Interest in Switching Systems:

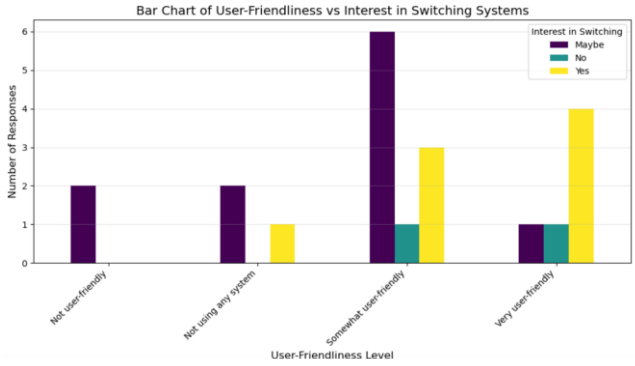

Fig. 9. Bar Chart - Relationship analysis#2

We have asked users about how easy it is to use their existing systems, and we have asked another question about their desire to adopt a new system if it provides them with better features in the chart above, we have clarified the relationship between these two questions.

Switching Interest Does Not Correlate Directly to User-Friendliness one would expect that higher dissatisfaction ("Not friendly") should increase interest in switching, but it is less reflected here. The chart shows that Those who are satisfied with their current systems ("Very user-friendly") have still shown a willingness to switch.

It can be concluded that simplicity alone is not a criterion through which users can be stopped from switching the system; insights obtained in that StockMate could assist in averting probable churn by constantly innovating features.

c) Restocking Frequency vs. Low Stock/Expiration Alerts:

Fig. 10. Bar Chart - Relationship analysis#3

- Daily Restocking: 0 businesses found low stock/expiration alerts useful.
- Weekly Restocking: 3 businesses found the alerts useful.
- Monthly Restocking: 3 businesses found the alerts useful.
- Depends on the type of product: 0 businesses found the alerts useful.

From the chart above we can note that restaurants that restock inventory monthly or weekly are the ones that benefit most from the Low Stock/Expiration Alerts feature.

In StockMate we can route our marketing strategy towards businesses with weekly or monthly restock cycles. These are the ones that stand to gain the most from low-stock or expiration alerts and are likely to be more receptive to using them.

B. Background and Literature Review:

This section is an overview of the basis on which inventory management becomes so critical for the entire restaurant industry to bring efficiency, cost control, and customer satisfaction. We will review the current literature on inventory management systems and recent developments in information technology relevant to the problem. In this section, the rationale is established for developing a smart inventory solution StockMate to address the deficiencies in the existing systems.

C. Background:

Since food service is such a high turnover business, restaurants must keep their stocks fresh and products safe, but it can be difficult to order the right amount of inventory. Manual inventory control and ordering methods from the past can push errors such as out-of-date products or too many shortages of basic supplies during peak times. You have a direct impact on both operations and customer satisfaction. Introducing an example of a smart system, StockMate, by our team. By combining inventory management, expiration date monitoring supplier optimization technologies, and other functionalities StockMate help restaurants reduce waste, provide food safety also focus on serving exceptional customers. The need for such systems is seen when food poisoning, for example the case at Hamburgini restaurant left several customers hospitalized in critical condition after incorrect ingredient handling. StockMate is strategically positioned to address and prevent the circumstances listed above by offering food safety alerts, and track inventory (real-time) both maintaining client safety and ensuring continued company expansion.

D. Literature Review:

Today, inventory management systems play a major role in the operation of numerous companies and restaurants. With the desire of restaurants to enhance customer loyalty and gain customer satisfaction while reducing costs, inventory management systems have become an important thing because they integrate many technologies such as artificial intelligence, automation, and the Internet of Things to achieve the best results. Inventory systems allow restaurants to be managed professionally, as well as contributing to making the right decisions, minimizing manual work prone to many errors, forecasting more accurately, and assisting in making automatic decisions. Despite everything, there are many obstacles and challenges that hinder the process of adopting these systems by restaurants. In addition to the challenges existing in the systems themselves, which require

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further improvement, there are many issues related to these problems, such as information security issues, the costs that the adoption of such systems will add to restaurants, labor training, etc. In this literature review, we will highlight the most recent trends in smart inventory management systems, as well as problems and impediments, along with solutions to these issues. This literature review will provide an overview that will help to grasp the newest trends and challenges, as well as novel elements available for further studies.

1) Food safety monitoring:

The food safety monitoring process aims to use and employ modern technology to ensure the safety and security of food products by identifying the risks present in foodstuffs. Examples of these risks are mold, and restaurants can take advantage of this process to improve the quality and safety of food.

2) The latest technologies in monitoring food safety:

The ViT (Vision Transformer) algorithm is now- a-days applied to food safety monitoring. Using transformer models, ViT analyzes food images to detect spoilage, mold, and contaminants almost perfectly. Because ViT considers long-range dependencies in images unlike traditional CNN architecture, it is more efficient in reflecting minuscule changes regarding food decay. It has been established that those ViT-based models are trained in huge datasets of food images to attain quite high accuracies in detecting food safety challenges[1][2].

3) The positive aspect of ViT algorithm:

- A Stunning Accuracy: A ViT, for instance, treats its imagery in a holistic fashion, hence improving detection accuracy for food spoilage.
- Scaleable: The model can be adapted to a variety of foods for spoilage types, thus enhancing reliability in detection.
- Cloud Incorporation: ViT allows for large-scale processing of food safety monitoring, thus allows cloud-based processing.
- ws 0 Cross-Platform: It can run on many operating systems, increasing user-friendliness[3][4].

4) The negative aspect of ViT algorithm and the solution for it:

- Computational power needed: Requires high processing thus not performing on lesser devices. Here the optimization of the model for edge devices or hybrid processing on cloud and local could solve the problems.
- Energy Drainage: Probably drains the battery on mobile platforms. Adopting an energy saving mode should relieve the battery.
- Internet Dependency: A cloud setup requires stable internet. The offline mode with a light version of ViT should be implemented for basic operation without internet connectivity[5][6].
- The Cost of Cloud Services: Financing the running expenses of ViT on cloud platforms may become a burden for smaller companies. This can eventually solve facilitating dedicated budgets for subscription plans and allowing local processing.

5) QR Code in Restaurants Management System:

The QR code automates a lot of tasks, it allows you to enter orders, in addition to tracking inventory, and performs a variety of other functions, which allows for reducing human errors, increasing accuracy and speed, enhancing customer satisfaction, as well as improving operational efficiency. Employees also become more committed to providing excellent customer service and other duties that require a personalized touch. This move enables restaurants to prioritize innovation and growth, resulting in more dynamic and responsive management. The QR code can be used in inventory tracking to gain better inventory management and decrease the need for manual management, which has many faults. It can also be used to gather and analyze data, which helps restaurant management make decisions.

6) Employ a QR code in customer services:

QR codes allow people to seek information with just one press of a button. So, customers find QR codes straightforward to use [7]. It is possible that traditional methods can be replaced by more modern methods, for example, a QR code can be used to display the menu instead of the printed menu or instead of asking the consumer to download the restaurant application or search for its website online. The QR code can be used to transfer customers' orders to the kitchen directly, especially when the restaurant is crowded with visitors, and it becomes impossible for the waiters to serve everyone at an acceptable time.

7) The positive aspects of using QR codes in a restaurant management system:

The most important feature of dealing with the quick response code and integrating it into the restaurant system is to minimize manual work, which is likely to cause a lot of errors, which becomes much less with the automation system. In addition, one of the other advantages is to improve customer experience, as the waiting time is reduced, the quality of service is improved, and the speed of arrival of orders. As previously said, the Quick Response Code provides various services to restaurant management and customers; it is also straightforward to use and does not require any specific skills or training before using [8].

8) The negative aspects of using QR codes in the restaurant management system and the solution:

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The integration of Quick Response Code services may be costly for small and emerging establishments and restaurants, and this problem can be managed by appropriate management by assigning a portion of revenues to be invested in this area following a feasibility study and returns. Some customers may not prefer to use this modern technology and prefer to continue with traditional methods so the restaurant should not rely on them completely and provide all the traditional and modern methods together. Some technical problems may affect the system, as is the case with any other system, so traditional alternatives should be maintained, in addition to the presence of specialists to address these problems as soon as possible.

9) Tracking expiration date in the inventory management system:

This is why companies now need to maintain inventory management systems so that they can track the stock level, replenish them on time, and reduce waste. For businesses that deal with food and medicine, this is especially important to keep track of expiration dates. Traditionally, businesses have managed expiration dates with barcode-based systems or human keying. The alternative is with Quick Response (QR) codes, which might kick in opportunities to simplify inventory systems by improving admin and data storage.

10) The most used way of expiration date tracking:

Since barcodes are so easy and such an inexpensive technology, they get used all over the place. It allows businesses to quickly check any basic product information like prices and stock-keeping units (SKUs) possibly resulting from human error. Barcodes are easy to break and contain fixed information that the tracking issue can occur [4][5]. Regarding information storage (like batch numbers and expiration dates), QR codes are superior to barcodes. They are functional and available since cell phones can scan them. QR codes enhance efficient processes by providing better data and automatic, real-time updates, thus making the form more functional than pen-based forms [9].

11) Challenges:

However, barcodes are not good at storing information and it is less practical to make use of them to track expiry dates. They are also more susceptible to breakage, which may lead to inventory control issues [3][4]. While using QR codes will incur a printing and system integration fee (QR has higher data capacity though), In addition, organizations may require re-configuring their existing system to support QR code tracking which results in extra expenses [10][11].

12) Solutions:

The adaptation for businesses could be to adopt a hybrid strategy: a mix of both barcodes and QR codes. The expenses will balance against efficiency. Barcodes can be used where simple inventory tracking is required, while QR codes can be tapped in cases that require more exact information tracking expiration dates among others [10][11]. Since QR codes are more expensive than barcodes, they do offer more flexibility and data capacity. For companies that want to improve their inventory management without always having huge expenditures involved, a hybrid system is very useful.

13) Recipes management:

Integrating an advanced recipe management system with current technology to improve recipe selection and automate ingredient amount computations can improve accuracy, efficiency, time savings, and resource usage in recipe management systems, resulting in a more efficient and productive cooking experience.

14) The most recent technology utilized in recipe management:

One of the most modern technologies used is Interactive cooking lessons in recipe management systems, to provide food recipes with a more dynamic and engaging experience than standard recipe forms. providing cooks Interactive learning approaches allow culinary personnel to experiment with recipes, learn new skills, and remember information more effectively. [12] M. Chang and others developed an online interactive system for viewing and evaluating hundreds of recipes for a single meal. They extract food preparation steps from handwritten recipe sheets and assess their procedural resemblance to a computerized system.

15) Challenges of using interactive culinary tutorials by chefs:

Interacting chefs with culinary tutorials presents various issues when incorporating them into the inventory. For example, due to languages and cultural differences among the diverse staff of cooks. Also, cooking with huge amounts of ingredients takes time to calculate and put instructions. Furthermore, preparers of food are not authorized to use any external equipment when cooking for safety concerns. Also, provide chefs with positive comments and assessments based on their interactions with classes, particularly in a busy kitchen with limited time.

16) Solutions:

Providing strategic solutions for restaurants to help them effectively implement and use interactive culinary courses. For example, for language and culture differences it can include multilingual choices, visual assistance, and cultivating a friendly environment. For preparing huge amounts of food, cooks can enter the amount of food to be prepared, and the instruction will include all computed measurements based on the quantity entered. Implementing a structured feedback system, conducting frequent performance assessments, and auto-playing instructions can all help to reduce feedback and safety difficulties.

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17) Ingredients management:
Using barcode scanners to handle ingredients in restaurants improves speed, accuracy, productivity, and informed decision-making. The goal is to provide high-quality meals while also allowing for the substitution of raw components, eliminating delays and maintaining consistent supply operating efficiency, and minimizing waste.

18) The latest technology used in ingredient management*:*
There are several technologies to manage ingredients in the inventory, one of them is using a pocket scanner [13]. H. Chung introduced the pocket scanner. Utilize an existing refrigerator to track the location of food entering and leaving the refrigerator to better organize the space and cut down on time spent looking for ingredients. It can also automatically record the purchase date and distribution duration, which means it will sound like an alarm to notify kitchen staff when the distribution time is about to expire or approach.

19) Challenges of using the pocket scanner:
Using a pocket scanner inside a refrigerator might provide several types of issues. One big problem is the restricted area within the refrigerator, which makes it difficult to move the scanner comfortably. Furthermore, the freezing temperatures within the refrigerator might have an impact on the scanner's operation, which will decrease accuracy. Another issue is the existence of moisture or frost within the refrigerator, which makes it difficult to scan objects clearly.

20) Solutions:
We can tackle this problem by considering pocket scanners with tiny designs that can withstand cold temperatures and easily expand the limited space inside a refrigerator. In addition, pocket scanners with anti-fog or condensation-resistant technology allow for clear scanning even in humid conditions inside the refrigerator.

21) Temperature is an important consideration in food safety*:*
Temperature is a critical influence on the activity of enzymes and microbiological development in food products. Temperature changes could accelerate the degradation operation, decrease shelf life, and, most critically, improve the risk of dangerous pathogens such as Salmonella, Listeria monocytogenes, and Escherichia coli. These pathogens, especially in the danger zone (between 5°C and 60°C), succeed in situations with temperature variations because they encourage bacterial development. Temperature is a crucial factor in food protection [19].

22) The technology used in temperature and humidity monitoring:
Now we have evolved the temperature and humidity monitoring technology considerably as an outcome of detectors and data collectors that allow real-time tracking and logging of environmental parameters. In refrigerators and freezers, wireless monitoring systems are routinely various storage facilities, to provide fast notifications if temperature or humidity levels go outside permissible parameters, hence reducing wastage. Furthermore, several restaurants have used cloud-based monitoring systems, allowing management to remotely monitor storage conditions, receive alarms, and generate compliance reports for health inspections. Time-temperature integrators (TTIs), commonly used in cold chain logistics, can also be used in restaurants to track temperature exposure for specific products, assuring safe storage, particularly in freezers and coolers. These technologies enhance food quality, regulatory compliance, and restaurant operational effectiveness [19].

23) The positive aspect of using predictive modeling in food spoilage prevention:
Modeling that predicts helps to reduce food spoilage. Using real-time environmental data (temperature and humidity), predictive algorithms can detect spoilage before it occurs, facilitating prompt intervention. This not only improves food safety but also decreases waste products, which save money in the long run. The study stresses how this strategy improves the precision of food storage management [20].

24) The negative aspect of using predictive modeling in food spoilage prevention:
Predictive models rely largely on accurate, highest-quality information to work properly. When these algorithms rely on insufficient or biased microbial growth data, their ability to predict food deterioration is compromised. This can result in one of these results either wasteful food waste from incorrect calculations or a decrease in food quality [21].

25) Temperature and humidity monitoring in restaurant management systems:
To enhance the nutritional value of food and prevent waste, these monitoring systems increase productivity by automating tasks such as preparing compliance reports and notifying management of any deviations. Restaurants can improve inventory tracking and quickly address environmental concerns that may impact food quality. This integration of technology eliminates human mistakes, saves time, and lowers the overall costs of wastage and noncompliance fines [22].

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26) Ingredients order from supplier:

Ingredients play a big role in restaurants because food quality is what makes a restaurant's reputation. Thus, when a restaurant buys good-quality ingredients from a supplier, it hugely impacts restaurant food. For that, buying from an excellent supplier that would provide good quality ingredients is challenging for many restaurants.

27) The process of selecting a supplier:

Finding good suppliers for a restaurant is not an easy process. Restaurants need first to have a list of all the ingredients they need, then look for suppliers that provide those ingredients. For selecting a supplier there is a two-step process. The first is to see if the listed suppliers meet specific buying criteria, and the second step is to choose the supplier that matches all the standard specifications. The criteria for selecting suppliers are they provide good prices, service, quality, and delivery on time also the suppliers need to have excellent financial condition, reputation, technology, and experience [23]. Having all the standards will make a significant difference in the choice of restaurant for suppliers.

28) The effect of ingredients quality on restaurant food:

The effect of ingredient quality on restaurant food is one of the most vital competitive advantages for any restaurant. Thus, restaurants can offer customers good quality food by using good ingredients. According to Isabelle Warwick, there are recent trends in many restaurants that show an increasing emphasis on quality, sustainability, and transparency, also they are becoming increasingly important in sourcing practices [23]. In conclusion, restaurants should shift their focus to the quality of ingredients and enhance customers' taste experience with food, which will affect the restaurant's reputation and profit.

III. CONCLUSION

This literature review emphasizes the growing importance of smart inventory management systems in the restaurant industry, namely enhancing operational effectiveness, food safety, and supplier management. By exploring emerging technologies such as Vision Transformer (ViT) for food safety monitoring, QR code systems for streamlined inventory tracking, predictive models for environmental monitoring, and automated supplier integration, this study emphasizes the promise of innovative solutions to break through existing issues. In spite of these developments, challenges such as high implementation costs, limitations due to compatibility issues, and end-user flexibility persist as the foremost challenges. There should be more emphasis on developing low-cost, scalable, and easy-to-use systems, which can be easily embedded in various restaurant environments. Besides, further strengthening data-driven decision-making with the aid of real-time analysis and higher usage of predictive models can also optimize resources as well as minimize wastage. The proposed StockMate system would aim to transmit these findings into an integrated and innovative solution addressing the operations and sustainability objectives of the restaurant industry.

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