

FOOD AND BEVERAGE ORDER MANAGEMENT SYSTEM AND METHOD

TECHNICAL FIELD OF INVENTION

[001] The following relates to a food and beverage order management system and method.

BACKGROUND

[002] The food and beverage (F&B) industry is an industry that is very labour intensive. From the order taking process through to preparation and finally serving the order to the customer, a large amount of labour is required.

[003] Frequently, numerous different ingredients need to be combined in a specific manner for different orders. The kitchen needs to be able to track such orders (including special requests or combinations) as they move through the preparation process. In certain types of F&B establishments, orders may be completely customized resulting in challenges for the establishment to easily take, transmit, prepare and monitor such orders. This also impacts the ability to track store inventory levels accurately and consequently can result in increased costs through non-optimal perishable inventory management. Currently, more advanced establishments have a system comprising a mobile electronic device to take orders that are then transmitted to a receipt printer or visual display system. The tracking of the food preparation process thereafter however, is manual.

[004] Kitchens also need to maintain freshness and inventory of all manner of ingredients. In certain types of F&B establishments, ingredients may be out on a display counter for a length of time and currently, there is no automatic way of tracking the freshness of such ingredients. Currently, printed labels may be used to mark the date the ingredients were laid out or prepared. Furthermore, tracking the amount of and freshness of ingredients placed out for use is not easily done.

[005] Different orders may also need specific processing or cooking steps that may require a particular machine to be operated with different settings due to the ingredients used. In the case of custom orders, it is up to the experience of the kitchen hand to determine such settings. In F&B companies with numerous outlets, it may be difficult to deliver a consistent experience and meal to customers.

[006] Customers of F&B establishments may also wish to know the nutritional and health information of the dish they have purchased. Currently, some F&B

establishments provide such information by way of printed material for standard menu items or online on mobile applications. For instances where orders are customized or designed by the customer from scratch, the customer would have to determine the nutritional information of each ingredient and manually calculate the total nutritional information of the customized order.

[007] A need therefore exists to provide a food and beverage order management system and method that seek to address at least some of the above-mentioned problems.

SUMMARY

[008] According to a first aspect of the present invention, there is provided a food and beverage order management system, comprising: an order processing module configured to obtain an order and generate a set of order fulfilling criteria based on input provided by a database communicatively coupled with the order processing module; and an order tracking module communicatively coupled with the order processing module and configured to track the completion of the set of order fulfilling criteria for successful fulfillment of the order.

[009] In an embodiment, the order fulfilling criteria may comprise one or more of: (i) correct ingredients and quantity are used to prepare the order, (ii) the order is cooked in a proper manner based on prescribed parameters, and (iii) a prescribed sequence is followed to prepare the order.

[010] In an embodiment, the system may further comprise an order taking module configured to receive the order from a customer, wherein the order processing module may be communicatively coupled with the order taking module and configured to obtain the order from the order taking module.

[011] In an embodiment, the system may further comprise an ingredient monitoring module configured to identify an ingredient of the order, wherein the order processing module may be communicatively coupled with the ingredient monitoring module and configured to obtain the identified ingredient of the order from the ingredient monitoring module.

[012] In an embodiment, the order processing module may be further configured to assign a unique identity to each order, wherein a physical object for preparing the order is associated with the unique identity, and wherein the order tracking module is further configured to track an attribute of the physical object based on the

associated unique identity such that the attribute of the physical object provides an indication of the completion of the set of order fulfilling criteria.

[013] In an embodiment, the order tracking module may be disposed at a known location within a food and beverage outlet such that the location of the physical object within the food and beverage outlet is determined based on the known location of the order tracking module.

[014] In an embodiment, the unique identity may be encoded on a tag and wherein the order tracking module may comprise a tag reader configured to decode the unique identity.

[015] In an embodiment, the tag and tag reader may communicate via radio-frequency signals. In another embodiment, the tag may be an optical mark tag and the tag reader is an optical mark tag capturing device.

[016] In an embodiment, the database may be further configured to store a plurality of recipes, and wherein the order processing module may be further configured to access the database to match the order to a respective recipe and generate the set of order fulfilling criteria based on the recipe.

[017] In an embodiment, each recipe may comprise one or more of: ingredients of the order, quantity of each ingredient of the order and/or cooking instructions of the order.

[018] In an embodiment, the database may be further configured to store nutritional information associated with each ingredient of the order and/or cooking method of the order, and wherein the order processing module may be further configured to access the database to obtain a total nutritional information of the order based on the recipe corresponding to the order.

[019] In an embodiment, the system may further comprise an inventory management module configured to monitor an inventory of food and beverage ingredients, and wherein the order processing module may be further configured to update the inventory management module based on the ingredients used for the order.

[020] In an embodiment, the system may further comprise an order instruction module configured to provide instructions for preparing the order based on the recipe corresponding to the order.

[021] In an embodiment, the order instruction module may comprise an indicator for indicating that an ingredient is to be used to prepare the order.

[022] In an embodiment, the ingredient monitoring module may be further configured to determine a rate and/or an amount of an ingredient that is utilized to prepare the order.

[023] In an embodiment, the system may further comprise an expert system communicatively coupled with the order processing module and configured to modify or suggest an existing recipe based on a rule. The order processing module may also be configured to generate a new recipe based on the rule.

[024] In an embodiment, the rule is based on dietary requirements or dietary restrictions of a customer.

[025] According to a second aspect of the present invention, there is provided a method of food and beverage (F&B) order management, comprising: receiving an order from a customer; communicating the received order to an order processing module; generating, by the order processing module, a set of order fulfilling criteria based on input provided by a database communicatively coupled with the order processing module; and tracking the completion of the set of order fulfilling criteria for successful fulfilment of the order using an order tracking module communicatively coupled with the order processing module.

[026] In an embodiment, the order may be received using an order taking module communicatively coupled with the order processing module.

[027] In an embodiment, the input provided by the database may comprise a recipe for preparing the order, and the order fulfilling criteria may comprise one or more of: (i) correct ingredients and quantity are used to prepare the order, (ii) the order is cooked in a proper manner based on prescribed parameters, and (iii) a prescribed sequence is followed to prepare the order.

[028] In an embodiment, tracking the completion of the set of order fulfilling criteria may comprise tracking a location of a container for containing the ingredients of the order, and wherein the location of the container may provide an indication of the completion of the set of order fulfilling criteria.

[029] According to a third aspect of the present invention, there is provided a kit of parts for managing food and beverage orders, comprising: an order processing module; and an order tracking module coupleable with the order processing module, wherein the order processing module is capable of obtaining an order and generating a set of order fulfilling criteria based on input provided by a database communicatively

coupled with the order processing module, and the order tracking is capable of tracking the completion of the set of order fulfilling criteria for successful fulfilment of the order.

BRIEF DESCRIPTION OF THE DRAWINGS

[030] Embodiments of the invention will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way of example only, and in conjunction with the drawings, in which:

[031] Figure 1 is a flowchart illustrating a method of food and beverage (F&B) order management according to an embodiment of the invention;

[032] Figure 2 is a schematic of a food and beverage (F&B) order management system according to an embodiment of the invention;

[033] Figure 3 is a schematic of a food and beverage (F&B) order management system according to another embodiment of the invention;

[034] Figure 4 is a schematic of an order tracking system according to an embodiment of the invention;

[035] Figure 5 is a schematic of an order tracking system according to another embodiment of the invention;

[036] Figure 6 is a schematic of an order tracking system according to yet another embodiment of the invention;

[037] Figure 7 is a schematic of an intelligent ingredient system according to an embodiment of the invention;

[038] Figure 8 is a schematic of an ingredient notification system according to an embodiment of the invention;

[039] Figure 9 shows a sensor grid according to an embodiment of the invention; and

[040] Figure 10 is a schematic showing the components of an exemplary computing device which may be used to realize a processing system according to an embodiment of the invention.

DETAILED DESCRIPTION

[041] Embodiments of the present invention will be described, by way of example only, with reference to the drawings. Like reference numerals and characters in the drawings refer to like elements or equivalents.

[042] Some portions of the description which follows are explicitly or implicitly presented in terms of algorithms and functional or symbolic representations of operations on data within a computer memory. These algorithmic descriptions and functional or symbolic representations are the means used by those skilled in the data processing arts to convey most effectively the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities, such as electrical, magnetic or optical signals capable of being stored, transferred, combined, compared, and otherwise manipulated.

[043] Unless specifically stated otherwise, and as apparent from the following, it will be appreciated that throughout the present specification, discussions utilizing terms such as “selecting”, “scanning”, “calculating”, “determining”, “replacing”, “generating”, “initializing”, “outputting”, or the like, refer to the action and processes of a computer system, or similar electronic device, that manipulates and transforms data represented as physical quantities within the computer system into other data similarly represented as physical quantities within the computer system or other information storage, transmission or display devices. The term “intelligent” is used in the present specification (e.g. intelligent ingredient system, intelligent kitchen apparatus, etc.). In this context, the term “intelligent” refers to a device having its own computing capability. Such devices may incorporate artificial intelligence in their programming to provide some degree of autonomy.

[044] The present specification also discloses apparatus for performing the operations of the methods disclosed herein. Such apparatus may be specially constructed for the required purposes, or may comprise a general purpose computer or other device selectively activated or reconfigured by a computer program stored in the computer. The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various general purpose machines may be used with programs in accordance with the teachings herein. Alternatively, the construction of more specialized apparatus to perform the required method steps may be appropriate. The structure of a conventional general purpose computer will appear from the description below.

[045] In addition, the present specification also implicitly discloses a computer program, in that it would be apparent to the person skilled in the art that the individual steps of the method described herein may be put into effect by computer code. The

computer program is not intended to be limited to any particular programming language and implementation thereof. It will be appreciated that a variety of programming languages and coding thereof may be used to implement the teachings of the disclosure contained herein. Moreover, the computer program is not intended to be limited to any particular control flow. There are many other variants of the computer program, which can use different control flows without departing from the spirit or scope of the invention.

[046] Furthermore, one or more of the steps of the computer program may be performed in parallel rather than sequentially. Such a computer program may be stored on any computer readable medium. The computer readable medium may include storage devices such as magnetic or optical disks, memory chips, or other storage devices suitable for interfacing with a general purpose computer. The computer readable medium may also include a hard-wired medium such as exemplified in the Internet system, or wireless medium such as exemplified in the GSM, GPRS, 3G or 4G mobile telephone systems as well as other wireless systems such as Bluetooth, ZigBee, Wi-Fi. The computer program when loaded and executed on such a general-purpose computer effectively results in an apparatus that implements the steps of the preferred method.

[047] The invention may also be implemented as hardware modules. More particular, in the hardware sense, a module is a functional hardware unit designed for use with other components or modules. For example, a module may be implemented using discrete electronic components, or it can form a portion of an entire electronic circuit such as an Application Specific Integrated Circuit (ASIC) or Field Programmable Gate Array (FPGA). Numerous other possibilities exist. Those skilled in the art will appreciate that the system can also be implemented as a combination of hardware and software modules.

[048] Embodiments of the present invention relate to systems, methods and devices for food and beverage (F&B) order management. Embodiments of the present invention can be used to manage the steps of order taking, dispatch, processing and/or payment.

[049] Figure 1 is a flowchart 100 illustrating a method of food and beverage (F&B) order management according to an embodiment of the invention.

[050] At step 102, a F&B order is received from a customer. An order taking module may be used to receive the order. The order taking module may be communicatively coupled with an order processing module. Alternatively, a customer may verbally communicate his order to a kitchen hand. An order may comprise of

specific F&B items that a customer wishes to have or alternately (or additionally) more general requirements of the customer such as nutritional restrictions (e.g. no gluten), nutritional requirements (e.g. must have at least 100g of carbohydrates), calorie budget (which may be tracked on an ongoing basis by a processing system or order taking module) or any other customer requirement.

[051] At step 104, the received order is communicated to an order processing module. In the case where the order taking module is used to receive the order, the order taking module communicates the received order to the order processing module. The order processing module is communicatively coupled with the order taking module. Details of the order (e.g. list of ingredients, quantity, special requests, preparation style, etc.) may be obtained from the order taking module by the order processing module.

[052] In cases where the customer (i) verbally communicates his order to the kitchen hand, and/or (ii) changes his/her mind about an order or its contents after placing the order, an ingredient use sensor can be used to identify the specific ingredients (and optionally, associated quantity) of the order and this information can be communicated to the order processing module. Alternately, these changes or instructions can be recorded through the user interface.

[053] At step 106, a set of order fulfilling criteria (associated with the received order) is generated by the order processing module. The received order may be assigned a unique identity by the order processing module. The set of order fulfilling criteria is generated based on input provided by a database / data storage device communicatively coupled with the order processing module. For example, based on the details of the order, the input from the database may be a recipe for preparing the order. In such a case, the order fulfilling criteria may be: (i) correct ingredients and quantities of such ingredients are used to prepare the order, (ii) the order is cooked in a proper manner using correct kitchen appliances which may include criteria relating to settings of such kitchen appliances, and/or (iii) a prescribed sequence is followed to prepare the order. Order fulfilling criteria may also incorporate the customer requirements and alterations may be made according to the customer requirements, for instance when the customer's calorie budget is exceeded in a normal version of a recipe, certain ingredient quantities are reduced to satisfy the customer requirement.

[054] Step 108 involves tracking the completion of the set of order fulfilling criteria for successful fulfilment of the received order using an order tracking module. The order tracking module is communicatively coupled with the order processing

module. Following from the example above, the order tracking module may have means to ascertain that (i) the correct ingredients and quantities are used, (ii) the order is cooked in the proper manner using the correct kitchen appliances and settings, and/or (iii) the prescribed sequence is followed to prepare the order. For example, the order tracking module may have means to track an attribute (e.g. the location) of a container containing the ingredients of the received order. Based on the location of the container in the F&B outlet's kitchen (e.g. dry storage, freezer, food preparation area, grilling station, order dispatching area, etc.), it may be possible to ensure that (i) the correct ingredients and quantities are used, (ii) the order is cooked in the proper manner based on using the correct kitchen appliances and settings, and/or (iii) the prescribed sequence is followed to prepare the order. Furthermore, it may also be possible to ensure that prescribed parameters relating to food safety or hygiene such as time spent at a particular temperature are also followed. For instance, to prepare a salad, the container may be brought to the freezer to retrieve the ingredients and brought to the food preparation area to add a salad dressing and meat. Assuming that the same container is used to contain the salad throughout the entire food preparation process, the location of the container (and the time spent at each location) may be used to track the completion of the order fulfilling criteria. If the container was not present at the food preparation area, it may indicate that the order fulfilling criteria is not met (i.e. salad dressing and meat was not added and thus the correct ingredients are not used).

[055] Further details of the order taking module, order processing module and order tracking module will be discussed below.

[056] Figure 2 is a schematic of a food and beverage (F&B) order management system 200 according to an embodiment of the invention. The order management system 200 comprises an order processing module 212, and an order taking module 201, a database / data storage device 208 and an order tracking module 211. In an alternative implementation, the database 208 may be external to (i.e. not part of) the order management system 200. The order taking module 201, the database 208 and the order tracking module 211 are each communicatively coupled with the order processing module 212. The order taking module 201 may also optionally be capable of receiving and/or processing payment information.

[057] The order taking module 201 is configured to receive an F&B order from a customer. The order processing module 212 is configured to obtain the received order from the order taking module 201 and generate a set of order fulfilling criteria based on

input provided by the database 208. The order tracking module 211 is configured to track the completion of the order fulfilling criteria for successful fulfilment of the received order. As described above, the order fulfilling criteria may be: (i) correct ingredients and quantities are used to prepare the order, (ii) the order is cooked in a proper manner using correct kitchen appliances and settings, and/or (iii) a prescribed sequence is followed to prepare the order. The order tracking module 211 may have means to track attributes of a container containing the ingredients of the received order over time and track such attributes as they change. Example attributes include, but are not limited to: a location of the container (including the presence or absence of the container at a certain position / area), a weight of the container and/or its contents, an optical property of the container and/or its contents, a temperature of the container and/or its contents and an electrical property of the container and/or its contents. Based on the attributes of the container in the F&B outlet's kitchen (e.g. dry storage, freezer, food preparation area, grilling station, order dispatching area, etc.), it may be possible to track the completion of the set of order fulfilling criteria.

[058] Figure 3 is a schematic of a food and beverage (F&B) order management system 300 according to another embodiment of the invention. The management system 300 comprises a processing module / system 312 that is connected to (and in communication with) a plurality of modules / components, including a customer interaction device 301, an intelligent ingredient system 302, an intelligent kitchen apparatus 303, an expert system 304, a user interface 306, display systems 307, a data storage system 308, an inventory management system 309, an Enterprise Resource Planning (ERP) system 310, and an order tracking system 311.

[059] The customer interaction device 301 is configured to allow a customer to place an order for an item of food or beverage as well as facilitate payment and loyalty functions. In other words, the customer interaction device 301 functions as an order taking module configured to receive an order from a customer. The customer interaction device 301 may take the form of a smartphone or tablet computer (installed with appropriate mobile application(s) or internet browsers for displaying a website) that communicates with the processing system 312 via the Internet, Wi-Fi, infrared, audio encoded signals, Bluetooth or other suitable type of communication link. A standard smartphone or tablet computer known in the art may be used to perform the role of the customer interaction device 301. The components of such a smartphone or tablet

computer will be known to a person skilled in the art and therefore will not be elaborated further.

[060] The customer interaction device 301 may also take the form of a fixed console or tablet computer located at an F&B establishment that may be communally utilized by different customers to place orders. In Figure 3, only one customer interaction device 301 is shown for simplicity. It will be appreciated that more than one customer interaction device 301 may be connected to the processing system 312.

[061] In an F&B establishment, there may be plurality of customers and each customer has his/her own customer interaction device 301. Suitable techniques have to be used to uniquely identify a customer (and any associated orders that the customer makes using the customer interaction device) to the operator of the management system 300. Even in instances where a fixed customer interaction device is provided for, each customer is uniquely identified.

[062] In one implementation, the customer interaction device 301 has a mobile application installed thereon. The mobile application requires the customer to enter his pre-assigned user identity. The user identity is captured by the customer interaction device 301 and sent to the processing system 312. The processing system is configured to recognize the customer based on the user identity, for example, by accessing a customer database stored at the data storage system 308.

[063] In another implementation, temporal accelerometer correlation may be used. The display system 307 may be configured to display the user interface 306. A customer brings his customer interaction device 301 towards the display system 307 (e.g. by tapping the customer interaction device 301 against the display system 307). The display system 307 may comprise an accelerometer to obtain correlation data. Based on the movements of the customer interaction device 301, the correlation data is obtained and used to identify the customer interaction device 301 and thus, the customer using the customer interaction device 301. For example, by comparing the magnitude of the acceleration that occurs during contact, as well as an accurate timestamp of that event (i.e. the contact), combined with other input / factors such as the approximate location of the customer interaction device 301 through GPS or indoor positioning techniques, it is possible to uniquely discern a specific customer interaction device 301 that has made contact with the display system 307.

[064] Alternatively or in addition, low power Bluetooth beacons and associated radio power readings may be used to determine the proximity of the customer interaction

device 301. Uniquely coded short distance audio signals may be transmitted by the display system 307 and may be received by the customer interaction device 301 if the customer interaction device 301 is brought within close range (e.g. a few centimeters). Upon receipt of the audio signals, the customer interaction device 301 may be configured to send a unique identification signal to the processing system 312 via the Internet or other suitable type of communication link. The identification signal is used to uniquely identify the customer interaction device 301 and thus, the customer using the customer interaction device 301.

[065] Alternatively or in addition, a 1D or 2D barcode may be displayed on the display system 307. The barcode is scanned by the customer interaction device 301 (e.g. using the customer interaction device's integrated camera). If the barcode is recognized by the customer interaction device 301, the customer interaction device 301 may be configured to send a unique identification signal to the processing system 312 via the Internet or other suitable type of communication link. The identification signal is used to uniquely identify the customer interaction device 301 and thus, the customer using the customer interaction device 301.

[066] Alternatively, the display system 307 may be able to scan a 1D or 2D barcode or other unique optical mark displayed on the customer interaction device 301 (e.g. using an integrated camera), and conduct this communication in reverse.

[067] After the customer is identified, he/she uses the customer interaction device 301 to place an order. Alternatively, an order may be pre-stored on the customer interaction device 301 and uploaded / communicated / confirmed upon association or registration with the processing system 312. The customer interaction device 301 captures the details of the order including, in the case of customized orders, the specific ingredients the customer wishes to have. Relevant order data (e.g. list of ingredients, quantity, special requests, preparation style, etc.) along with related metadata (e.g. customers' details which may include nutritional requirements, restrictions, allergies, religious dietary requirements, calorie budget and medical conditions that may influence dietary requirements) are communicated to the processing system 312. The related metadata may be obtained during a registration process using a mobile application installed on the customer interaction device 301. The registration is done prior to ordering and is preferably only performed once. The related metadata may be stored in the data storage system 308.

[068] Based on the relevant order data and metadata, the processing system 312 may then retrieve relevant information from the data storage system 308, including: information about the customer, customer preferences (e.g. specific preparation preferences, nutritional requirements, nutritional restrictions including a possible calorie budget and ongoing state of the budget, allergies, medical conditions that may impact what can be eaten), nutritional information about the ingredients chosen as well as cooking method chosen, and any other relevant and related information. In an implementation, the nutritional information of each ingredient may be stored in the data storage system 308 (e.g. in the following format: "100g of tuna - 120 calories, 1g of fat, 0g of carbohydrates and 25g of protein"). In this way, if an order has a certain amount of tuna, the processing system 312 is able to determine the corresponding nutritional information. The total nutritional information of the order may also be determined.

[069] The retrieved information may be communicated back to the customer interaction device 301, stored with the order placed by the customer, and/or stored with the customer's profile such that a customer may track his/her food consumption information including health and nutritional information, set and update goals such as nutritional goals, as well as create, store and share favourite customized food orders, as well as receive and access a customer loyalty function.

[070] The setting, tracking and storage of goals, nutritional information as well as related information and functions may be performed by the customer interaction device 301, the processing system 312 or by both. The processing system 312 may also have the capability of sending notification messages to the customer interaction device 301 which may take the form of SMS (Short Message Service) messages, e-mail, integration into other mobile / web services, or mobile push notifications to notify users for various purposes. Such notifications may be for the purpose of reminding users of their daily nutrition needs or when certain limits have been reached.

[071] The customer interaction device 301 may optionally be capable of processing / facilitating payment and providing a customer loyalty function. The customer loyalty function provided may take numerous forms with the aim of incentivizing customers to spend more at the F&B establishment. For example, the customer loyalty function may be based on the total spend amount or based on the number of visits to a particular outlet within a given time.

[072] Once an order has been communicated to the processing system 312 (along with any other additional data such as customer information), the order details /

data may be stored in the data storage system 308 and assigned a unique order identity for the purpose of tracking the order. The processing system 312 is configured to assign the unique identity to each received order. The unique order identity may be a string of alphanumeric characters.

[073] The processing system 312 is also configured to lookup the relevant information regarding the item ordered. This information may be stored in the data storage system 308. In the case of a standard menu item, this may be a recipe comprising the ingredients listing including the type and amount as well as preparation and cooking instructions. In the case of a custom order, the processing system 312 may consult past records (if any) and the expert system 304 to determine appropriate preparation and cooking instructions. The expert system 304 may be capable of modifying the order fulfilling criteria.

[074] In an implementation, the expert system 304 may be configured as a rule-based decision system with artificial intelligence in order to emulate the decision-making ability of a human expert. The expert system 304 may be designed to solve complex problems by reasoning about knowledge, represented primarily as "if-else" rules rather than through conventional procedural code. A basic form may include a rule engine coupled with a knowledge base of scenarios. The expert system 304 may contain business and/or recipe logic so that, e.g. a kitchen-hand decides to add 1kg of fish instead of 100 g as prescribed, an alarm/alert may be triggered.

[075] The expert system 304 may also be capable of machine learning. In an implementation, a model may be built based on suitable inputs (e.g. a recipe with an ingredient list and food preparation methods) so that the expert system 304 can be trained to make predictions and/or decisions, rather than following the "if-else" rules mentioned above.

[076] For instance, the expert system 304 may be capable detecting a relatively high liquid content in a customized order, so that the preparation / cooking time may be adjusted to compensate for the effect of the additional liquid (as additional liquid may cause sogginess to the dish or cause to dish to cool faster than normal). In another example, the expert system 304 may detect that the temperature of the ingredients is lower than normal (e.g. not thawed properly) and automatically adjusts the kitchen apparatus (or instructs a kitchen hand to adjust the kitchen apparatus) to a higher temperature to balance out the lower temperature of the ingredients. In this manner, the expert system 304 seeks to provide a uniform and consistent end product. In other

instances, the expert system 304 may be capable of suggesting against certain combinations of ingredients, e.g. due to flavour clashes, unsuitability of preparation methods, or lack of appropriate kitchen equipment available on hand.

[077] As a further example, based on the relevant information retrieved by the processing system 312 from the data storage system 308 such as information about the customer (e.g. order / consumption history), customer preferences (e.g. specific preparation preferences, nutritional requirements, nutritional restrictions, calorie budget, etc.), nutritional information about the ingredients chosen as well as cooking method chosen, the processing system 312 and/or the expert system 304 may be configured to modify an existing recipe, generate a new recipe, generate an order recommendation to a customer, suggest modifications to an order and/or block orders. The expert system 304, is able to modify or suggest an existing recipe, or generate a new recipe based on one or more rules. The one or more rules may be based on dietary requirements or dietary restrictions of a customer. Any newly-generated recipe may then be stored in the data storage system 308 for future reference / use.

[078] For example, the processing system 312 detects that a customer, whose caloric budget is 500 calories, orders 50g of tuna. Based on the information stored on the data storage system 308, it is determined that the 50g of tuna contains 60 calories so that the expert system 304 may modify the recipe or suggest modifications in order for the customer to meet his requirement (i.e. a 500 calorie meal) such as using certain ingredients, ingredients in different quantities, a different cooking method, or even block certain choices of ingredients for a customized order. In another example, the expert system 304 may be able to generate a personalized recipe that takes into account a customer's requirements such as nutritional requirements.

[079] The processing system 312 is also configured to provide pricing for customized orders by consulting a price list that may be stored in the database / data storage system 308 or the ERP system/unit/module 310. The price list may have a unit price of each ingredient (e.g. chicken - \$20 per kilogram) such that the price for a customized order (e.g. 100 grams of chicken in the order) can be obtained (i.e. \$2 for 100 grams). As part of the order collection procedure, the processing system 312 may also notify or update the ERP system 310 or inventory management system/unit/module 309 to facilitate management of the inventory or allow for predictive ordering to minimize inventory shortages as well as minimize wastages. For example, every time an order with chicken meat as an ingredient is taken, the inventory management system 309 is

updated and once the stock of chicken meat is below a pre-determined amount, the F&B establishment's manager is notified so that more chicken meat can be ordered.

[080] Once all the necessary information / data to prepare the order has been retrieved or computed, the processing system 312 then communicates this information to the intelligent ingredient system 302 and/or the intelligent kitchen apparatus 303 depending on the requirements of the order to be prepared. For instance, certain types of dishes such as salads may not require any apparatus to be used. On the other hand, other dishes such as wraps may require a grill to be used for a specific amount of time where the amount of time is calculated based on the contents of the wrap as well as input from expert system 304. The processing system 312 also communicates with the order tracking system 311 that allows orders to be tracked in the kitchen.

[081] As mentioned above, each order is assigned a unique order identity. The order tracking system 311 comprises means for associating the unique order identity with: (i) the specific order and (ii) physical objects associated with the specific order such as a container used to collect the ingredients for the specific order. In other words, a physical object for preparing the order is associated with the unique order identity.

[082] In one implementation, the unique identity is encoded on a tag and the order tracking module comprises a tag reader capable of decoding the unique identity. The order tracking system 311 is configured to track the location of the physical object based on the associated unique identity. In this manner, the location of the physical object provides an indication of the preparation progress of the order. In this implementation, the order tracking system 311 comprises the tag reader. The tag reader is disposed at a known location within a food and beverage preparation area (e.g. a certain part of a kitchen, such as a grill) such that the location of the physical object is determined based on the known location of the tag reader. For example, if a tag reader located at a grill detects the presence of a container, it may imply that the order is almost complete as the order can be served once grilling is complete. In an implementation, indoor positioning systems can be incorporated to allow tag readers to determine their own location in a 3D space.

[083] The unique identity is encoded on a tag and the order tracking module comprises a tag reader capable of decoding the unique identity.

[084] In an implementation, the tag and tag reader may communicate via radio-frequency signals or any other wireless communication protocol (e.g. infra-red). For example, the tag may be a radio-frequency identification (RFID) tag and the tag reader

may be a radio-frequency receiver/transceiver or RFID reader. The RFID tag is attached to the container. In this implementation, a plurality of RFID readers may be used in conjunction with an algorithm to locate (by various means, for instance triangulation via signal strength or proximity) the RFID tag and associated container in the physical world. For example, the various signal strengths are collected from the plurality of RFID readers and combined with a RF propagation model of the RFID signal generated through information such as a 3D model of the location, the location in 3D space of the RFID readers, and optionally information about the material and construction of the location. Further, calibration readings at known locations can be used to further improve the accuracy. This RFID propagation model may be able to estimate the location of the tag by comparing the actual strength readings versus what the model predicts. The RFID tag may further include directional elements by way of two tags separated by a metal that absorbs the signal, therefore allowing further information to be gained based on information such as the orientation of the tag.

[085] Further, calibration readings at known locations can be used to further improve accuracy. This RFID propagation model may be able to estimate the location of the tag by comparing the actual strength readings versus what the model predicts. The RFID tag may further include directional elements by way of two tags separated by metal that absorb the signal, therefore allowing further information to be gained based on information such as the orientation of the tag.

[086] In another implementation, the tag is an optical mark tag and the tag reader is an image capturing device. The optical mark tag is attached to the container used to collect the ingredients. The optical mark tag may be attached to the container in several ways. For example, referring to Figure 4, optical mark tag 402 may be attached directly to the rim of the container 401. Alternatively, an optical mark tag may be attached to the rim by way of a holder. The holder may contain a pre-printed tag that can be recycled, or provide a space to stick a tag. Alternatively, optical mark tag 403 may be attached to the base of the container 401. The optical mark tag 403 may be made of durable material so that it can withstand repeated washings. The optical mark tag may be a barcode, QR-code, other 1D / 2D symbol, or other unique optical mark including unique colours. Specific colours may refer to specific orders. The base of the container may have a recess for accommodating the optical mark tag. The recess may be formed during the stamping process for a metal container, or as feet 404 such that the barcode is raised away from contact with any surface the container may rest on so as to improve

the longevity of the barcode by removing or reducing the friction between that and any surface it may sit on.

[087] Referring to Figure 5, another implementation involves a container 501 placed on a surface 503. In Figure 5, a gap is shown between the container 501 and the surface 503 for easier explanation. The surface 503 may be a transparent surface which is partially or wholly made of glass or a transparent polymer. Alternatively, the surface may be a mesh grid or grating of similar function that is optically permeable.

[088] A sensing system 505 with a lens 504 faces upwards and towards the optical mark tag 502 to read the optical mark tag. Infra-red illuminators (not shown) may be used to enhance the reading and the sensing system 505 may be infra-red sensitive, an infra-red camera, a barcode reader or other similar optical sensing system. In this embodiment, every time the container 501 is placed on the surface 503, the processing system 312 may be able to quickly and accurately identify the location of, and the identity of each container.

[089] Additionally, specific areas of the surface 503 may be designated as "hot zones" wherein placing the container 501 in that area may signify certain actions such as the container is currently being used and this action may be used as an input for the processing system 312 to trigger further action such as altering the information displayed on the display system 307.

[090] In another implementation of the order tracking system 311, optical mark tags and associated sensing system may be substituted by RFID tags that are affixed to each container. Using a plurality of radio-frequency transceivers / RFID readers embedded around a working surface, it may be possible to determine the location and identity of the container based on the RFID reader with the strongest signal.

[091] In another implementation of the order tracking system 311, an infra-red transmitter that emits a unique infra-red code is attached to the container such that a plurality of infra-red receivers around the surface 503 are able to sense the location and identity of each container. Such transmitters may contain a plurality of infrared transmitters configured in a pattern for obtaining further information such as the orientation of the container. One such example of a pattern may be the form of numerous emitters positioned outwards in a radial manner, whereby each emitter transmits a different coded signal.

[092] In yet another implementation of the order tracking system 311, electrical conductance may be used to communicate the identity and location of the container by

attaching thereon a tag or microcontroller that emits or communicates an electronic signal that can be read when placed on the surface 503. Examples of such an implementation include a 1-Wire bus.

[093] Referring to Figure 6, in another implementation of the order tracking system 311, specific locations along a working surface 603 may be designated as “hot spots” where a kitchen hand can place a container 601 at this location, or scan it at this location to signify that this is the order that they are currently working on. This implementation advantageously requires fewer sensing systems 605 and has better reading capability as there is a gap in the surface 603. Due to the gap, there is no optical barrier that may get dirty (e.g. in the case of a transparent surface) and has better code readability (e.g. in the case of an optically permeable mesh surface). Further, the sensing system 605 and any optional lens 604, is pointing towards the unique optical mark tag 602, but is positioned off axis such that any detritus that may fall through the gap in the surface 603, is unlikely to directly hit or obscure the view of the sensing system 605. Additionally, a plurality of load cells 606 may be disposed on appropriate portions of the surface 603 to allow the mass of the contents in the container to be accurately tracked. The plurality of load cells 606 may be part of an intelligent scale 711. Details of the intelligent scale 711 will be elaborated below.

[094] At different points during the food preparation process, using any of the implementations described above, the optical mark or RFID tag may be scanned so as to allow the different components of the processing system 312 to (i) retrieve the order information via the unique order identity as well as any related information; and (ii) detect the physical location of each container. Additional algorithms may be used to combine the multiple implementations described above in order to locate the container. An overhead camera system may be employed to read barcodes that are placed on the top surface of a container (e.g. tag 402) to track the location of containers.

[095] Figure 7 is a schematic of the intelligent ingredient system and its various components, according to an embodiment of the invention. The intelligent ingredient system 700 (designated as reference numeral 302 in Figure 3) is configured to provide a mechanism to instruct and monitor kitchen staff as they prepare food in accordance to instructions received from the processing system 312 (refer to Figure 3). The intelligent ingredient system 700 is also able to monitor the amount of ingredients remaining in dispenser trays / containers. The intelligent ingredient system 700 comprises an

intelligent ingredient processing module / system 713 that is in communication with other various components.

[096] Information regarding the ingredients to be used in a dish is conveyed from the processing system 312 to the intelligent ingredient processing system 713 over a communications link 701 which may be a wired or wireless link such as over Wi-Fi or Bluetooth. Such information conveyed includes the ingredients to be used as well as the amount of each ingredient. It may optionally contain other information, e.g. which kitchen hand should prepare the dish, the order of the ingredients and other relevant information or instructions.

[097] Once the information is conveyed to the intelligent ingredient processing system 713, the intelligent ingredient processing system 713 may combine this information with other information stored in data storage system 708, inventory management system 709, or expert system 704 before being conveyed to the kitchen hand via an ingredient notification system 714. The inventory management system 709 / expert system 704 may be the same system as inventory management system 309 / expert system 304, respectively; or a different system with similar functionality. The data storage system 708 may be the same system as data storage system 308; or a different system with similar functionality. The intelligent scale 711 is configured to measure the mass of the contents in a container and relay this information to the intelligent ingredient processing system 713.

[098] As shown in Figure 8, the ingredient notification system (designated as reference numeral 714 in Figure 7) may take the form of a notification display 802 located at one portion of a standard F&B ingredient tray 801. The notification display 802 may comprise of one or more multi-coloured LEDs and/or a LCD display or any other optical display method for notifying or displaying information pertinent to the kitchen hand or customer.

[099] Figure 9 shows a plurality of standard F&B ingredient trays 901 that can be located in a grid-like manner as is frequently found in the F&B industry. The kitchen hand 902 is located along one aspect of such a grid. Kitchen hands can place containers containing ingredients on a transparent working surface 903. Here, the container refers to a container of food to be prepared, rather than a container of raw ingredients. The order tracking system (designated as reference numeral 311 in Figure 3) is able to locate and track the physical location of the order based on the location of its associated container and unique order identity as described above. The order tracking system 311

may also determine which container the kitchen hand is currently working on as that container is lifted off the working surface 603 and the tracking system detects the sudden absence of that container.

[0100] The ingredient notification system 714 can use the notification display 802 to indicate to the kitchen hand which ingredients need to be used for the preparation of an order at hand. For example, if an order comprises tomatoes and lettuce, LEDs associated with the two ingredient trays containing tomatoes and lettuce may light up. In this manner, the kitchen hand is clearly directed to retrieve tomatoes and lettuce from the ingredient trays and place them into the container. The ingredient notification system 714 may also support multiple kitchen hands simultaneously by assigning a different colour to each kitchen hand. Continuing from the example above, if red is a particular kitchen hand's assigned colour, he only retrieves ingredients for which the associated ingredient tray's red LED is lit up. The LCD display may optionally display additional information. In this implementation, the ingredient notification system 714 functions as an order instruction module that comprises an indicator for indicating that a certain ingredient is to be used (e.g. retrieved from an ingredient tray). In a further embodiment of an ingredient notification system 714, an optical head-mounted display (OHMD) device may be worn to optionally overlay the information such that it can be seen (or optically projected) in the visual path of the kitchen hand.

[0101] As each ingredient in turn is retrieved by the kitchen hand into a container tracked by the order tracking system 311 and associated with a specific order, the ingredient use sensor 702 is able to detect that the ingredient has been retrieved and such retrieval is stored in the data storage system 708 along with additional data such as a timestamp and amount of ingredient used. This in turn can be used to update the inventory management system 709 of ingredient demands as well as track kitchen hand performance, for instance how fast a kitchen hand retrieves all the ingredients. The inventory management system 709 may provide audio, tactile or visual prompts to either the user of the system or staff at other locations in the kitchen through various means to alert users of low stock levels and may include automatic notification to a central kitchen or head office to take necessary steps. Incentives may be offered based on the kitchen hand's performance. In this implementation, the ingredient use sensor 702 functions as an ingredient monitoring module that is configured to identify an ingredient used for the order, determine a rate and/or an amount of an ingredient that is used to prepare an order.

[0102] The ingredient use sensor 702 may comprise one or more of the following sensors: accelerometers, turbidity sensors, optical luminosity sensors, weighing scales and optical level sensors. Suitable algorithms may be used to process the output of the sensor to improve the accuracy of the reading. Accelerometers may be attached to each F&B ingredient tray 501, and weighing scales may be attached to the F&B ingredient tray in a manner that allows the mass of the contents to be detected. Optical level sensors may be incorporated to sense the level of the contents of the F&B ingredient in the ingredient tray 501.

[0103] Depending on the ingredient to be monitored, different types of ingredient use sensors may be used. For example, an optical level sensor may be more appropriate for liquid ingredients such as salad dressings, and less suitable for solid ingredients such as cheese and vegetables. Further, by itself, the weight sensor only detects the weight change of the contents but is not able to know when the contents in the container are depleted as there may be, e.g. residual liquid weight. Accordingly, in one example implementation, an algorithm considers the plurality of sensor inputs as well as information regarding the ingredient. If an ingredient is in liquid form, the algorithm is able to determine that the optical level sensor should be ignored and instead relies on the weighing scale to provide a more accurate gauge on the amount of ingredient consumed. Furthermore, each time the ingredient tray is replenished, the algorithm tracks and learns what the upper and lower bounds for the various sensor readings are, and eventually may be able to learn for each different ingredient which weighting or combination of sensor readings produces an accurate readout of the amount of ingredient consumed.

[0104] As a kitchen hand retrieves ingredients from the ingredient tray, the weighing scale can detect a change in weight and the optical level sensor can detect that the level of an ingredient is falling. The accelerometers attached to the F&B ingredient trays 501 are also able to facilitate detection of the tray which the kitchen hand is currently retrieving ingredients from by comparing the acceleration between the plurality of F&B ingredient trays 501. The tray which experiences the strongest acceleration is likely to correspond to the tray which the kitchen hand is currently retrieving ingredients from.

[0105] In instances where it is not feasible for all ingredient trays in the F&B establishment to have ingredient use sensors 702, kitchen hands may place a container onto the intelligent scale 711 and utilize the user interface 707 and display systems 708

to input what ingredient is about to be placed into the container so that the intelligent ingredient processing system 713 is able to determine the mass of each ingredient added and hence ingredient use information can be obtained through the mass difference and user input. Alternatively or in addition, a computer vision system may be used for object recognition in order to recognize and classify ingredients to automatically determine which ingredient was added. Alternatively or in addition, a utensil (e.g. spoon) that is able to communicate by way of electrical signals or radio-frequency signals (e.g. a RFID reader) is used to determine which container is being accessed and therefore able to determine which ingredient was added.

[0106] The ingredient use sensor 702 may be complimented by other additional sensors to improve the detection accuracy such as an ingredient tray proximity sensor 703. In an embodiment of the present invention, these sensors may be combined by using temporal correlation. In some cases, the ingredient use sensor 702 may receive anomalous readings such as someone adjusting a tray, replacing the tray or otherwise performing an action that should not be recorded as an event. By analysing / combining the information with the ingredient tray proximity sensor 703 in time by looking at when the ingredient use sensor 702 was triggered (among the plurality of other ingredient use sensors) as well as the location of the kitchen hand's hand at the same time, the intelligent ingredient processing system 713 may rule out such anomalous readings or take other action based upon that knowledge.

[0107] The ingredient tray proximity sensor 703 may take the form of an infra-red receiver 803 (see Figure 8) that is located at a part of the F&B tray nearest the kitchen hand. The kitchen hand may wear a wristband that intermittently transmits a uniquely encoded infra-red pulse. Such pulses are unique to each kitchen hand such that when a kitchen hand reaches for an ingredient and his/her wrist is close to the infrared receiver 803, the intelligent ingredient processing system 713 is able to sense which worker is accessing the ingredient, allowing multiple kitchen hands to process orders simultaneously.

[0108] In another form of the ingredient tray proximity sensor 703, RFID tags replace the infra-red transmitter attached to the kitchen hand and a radio-frequency transmitter/receiver/transceiver or RFID reader is used in the place of the infra-red receiver 803. Besides radio-frequency and infra-red, other wireless communication protocols may be used for communication between the ingredient tray proximity sensor

703 and the tracking device worn by the kitchen-hand (e.g. the wristband) for sensing which worker is accessing the ingredient.

[0109] In yet another form of the ingredient tray proximity sensor 703, an overhead vision system / motion detector is used for limb tracking to sense the location of the kitchen hand's hand. This may be combined with inverse kinematic models of the human body for improved accuracy.

[0110] Two or more of the above sensor schemes may be combined to improve tracking accuracy. A combination of sensors including radio-frequency transceivers, RFID readers, infra-red receivers and optical vision sensors may be co-located and used to replace the infrared receiver 803 and combined through sensor fusion algorithms in conjunction with multiple tag types. Each sensor may be configured to provide a confidence rating of its certainty that a particular action was performed. Such confidence ratings may be generated from metrics that differ for each sensor type. For example, in the case of the optical vision sensor, a metric may be calculated based on the image quality or the quality of the limb tracking at a particular point in time. When a particular sensor's accuracy drops, the algorithm may then alter the weighting to rely on the inputs of another sensor so as to preserve an acceptable level of accuracy.

[0111] In certain types of F&B establishments, a second mode of operation may be used where customers place orders by verbally telling the kitchen hand what ingredients he/she wishes to have in his/her dish. Such an example may be at a salad bar where the customer calls out what he/she wants in the salad.

[0112] In this mode of operation, the ingredient tray proximity sensor 703 and the ingredient use sensor 702 can be used to detect which kitchen hand is accessing which ingredient and use this information together with information stored in the data storage system 708 in conjunction with algorithms to determine the pricing, nutritional information as well as other order related information that may be communicated via the communications link 701 back to the processing system 312 for storage or further processing and display or to communicate back to the customer interaction device 301.

[0113] In cases where there are multiple kitchen hands working on multiple orders at the same time, the intelligent ingredient system 302 and order tracking system 311 may be configured to simultaneously track multiple orders. In an example embodiment, kitchen hands wear tracking wristbands on both hands which may be RFID tags, optical mark tags, infrared transmitters or a combination thereof. Corresponding sensors such as radio-frequency transceivers, RFID readers, optical vision sensors and

infra-red receivers are placed at key points distributed throughout the working area (e.g. area 904 in Figure 9) to provide increased resolution, and may be combined with existing sensors (e.g. sensors placed at location 803 shown in Figure 8). These sensors are able to sense when a kitchen hand's left or right hand is over the working area.

[0114] Information from the order tracking system 311 can be used to determine when a container has been lifted from the working surface and by whom. For example, by using the tracking wristbands described above, in conjunction with a sensor grid 904 (see Figure 9), as the kitchen hand puts ingredients from the ingredient tray 901 into the container, the order tracking system 311 is able to determine which container (and therefore associated order) it went into, as the hand holding the bowl is most likely to be right next to the ingredient tray 901 in question.

[0115] Accuracy may be further improved by using information such as hand dominance (e.g. a kitchen hand prefers to hold containers using the right hand and tongs in the left) in the algorithms that are used. This can be supplemented by an overhead vision system and using techniques such as inverse kinematics models and circle detection (e.g. Hough transform) to detect the container and motion / flow analysis.

[0116] Turning back to Figure 3, once the ingredients have been gathered into the container that is associated with an order and tracked by the order tracking system 311, the kitchen hand may then query the order tracking system 311 by scanning a RFID tag or optical mark tag and receiving corresponding information via a display system 307 that may provide instructions on next steps. For instance, a salad dressing may need to be added into the container and the contents mixed thoroughly, or require further preparation (e.g. using a grill or other kitchen apparatus).

[0117] In such an instance, intelligent kitchen apparatus 303 may read the unique order identity associated with an order and its corresponding container of ingredients by scanning the RFID tag or barcode affixed or otherwise associated with the physical container. The processing system 312 may then retrieve information associated with the order and communicate the information to the intelligent kitchen apparatus 303 instructing it on specific settings or preparation variables that may be stored or otherwise computed by the processing system 312. Examples of such settings and variables could include temperature, time and speed. In cases where a customer has allergies, religious dietary restrictions or other dietary limitations, other settings or variables may include a flag/signal/notification to require additional cleaning of cutting surfaces or grills to meet those restrictions. The intelligent kitchen apparatus 303 may take the form of various

kitchen equipment including but not limited to grills, ovens, liquid dispensing systems, chopping devices and frying devices. During this process, the processing system 312 can receive information from the intelligent kitchen apparatus 303 to notify the processing system 312 that the processing step has been completed (including any resulting information which then causes the records associated with the order to be updated). A feedback loop may also be incorporated whereby the outputs are assessed by a human expert that then updates expert system 304 or otherwise provides inputs by way of the user interface 306 such that the processing system 312 may adjust its parameters.

[0118] Once processing in the intelligent kitchen apparatus 303 is completed, the order tracking system 311 may again be queried to determine if further processing is required or if any other ingredients are required.

[0119] Once the order is completed, the processing system 312 can notify the customer through the customer interaction device 301 or the display system 307 and also effect payment, update health or nutritional information and perform loyalty management functions.

[0120] In an embodiment, there is provided a kit of parts for managing food and beverage orders, comprising: an order processing module; and an order tracking module coupleable to the order processing module. The order processing module is capable of obtaining an order and generating a set of order fulfilling criteria based on input provided by a database communicatively coupled with the order processing module. The order tracking module is capable of tracking the completion of the set of order fulfilling criteria for successful fulfilment of the order.

[0121] An exemplary computing device which may be used to realize (at least part of) the order processing module / system 312 and intelligent ingredient processing module / system 713 is described below with reference to Figure 10.

[0122] The following description of the computing device 1000 is provided by way of example only and is not intended to be limiting. Therefore, one or more elements / components of the computing device 1000 may be omitted. Also, one or more elements / components of the computing device 1000 may be combined together. Additionally, one or more elements / components of the computing device 1000 may be split into one or more component parts.

[0123] With reference to Figure 10, the exemplary computing device 1000 includes a processor 1003 for executing software routines. Although a single processor

is shown for the sake of clarity, the computing device 1000 may also include a multi-processor system. The processor 1003 is connected to a communication infrastructure 1006 for communication with other components of the computing device 1000. The communication infrastructure 1006 may include, for example, a communications bus, cross-bar, or network.

[0124] The computing device 1000 further includes a main memory 1007, such as a random access memory (RAM), and a secondary memory 1010. The secondary memory 1010 may include, for example, a hard disk drive 1012 and/or a removable storage drive 1014, which may include a magnetic tape drive, an optical disk drive, or the like. The removable storage drive 1014 reads from and/or writes to a removable storage unit 1018 in a well-known manner. The removable storage unit 1018 may include a magnetic disk, optical disk, or the like, which is read by and written to by removable storage drive 1014. As will be appreciated by persons skilled in the relevant art(s), the removable storage unit 1018 includes a computer readable storage medium having stored therein computer executable program code instructions and/or data. The plurality of tasks and/or rules described above may be stored in the secondary memory 1010.

[0125] In an alternative implementation, the secondary memory 1010 may additionally or alternatively include other similar means for allowing computer programs or other instructions to be loaded into the computing device 1000. Such means can include, for example, a removable storage unit 1022 and an interface 1050. Examples of a removable storage unit 1022 and interface 1050 include a program cartridge and cartridge interface, a removable memory chip (such as an EPROM or PROM) and associated socket, and other removable storage units 1022 and interfaces 1050 which allow software and data to be transferred from the removable storage unit 1022 to the computing device 1000.

[0126] The computing device 1000 also includes at least one communication interface 1024. The communication interface 1024 allows software and data to be transferred between computing device 1000 and external devices via a communication path 1026. In various implementations, the communication interface 1024 permits data to be transferred between the computing device 1000 and a data communication network, such as a public data or private data communication network. The communication interface 1024 may be used to exchange data between different computing devices 1000 which such computing devices 1000 form part an

interconnected computer network. Examples of a communication interface 1024 can include a modem, a network interface (such as an Ethernet card), a communication port, an antenna with associated circuitry and the like. The communication interface 1024 may be wired or may be wireless. Software and data transferred via the communication interface 1024 are in the form of signals which can be electronic, electromagnetic, optical or other signals capable of being received by communication interface 1024. These signals are provided to the communication interface via the communication path 1026.

[0127] As shown in Figure 10, the computing device 1000 further includes a display interface 1002 which performs operations for rendering images to an associated display 1030 and an audio interface 1032 for performing operations for playing audio content via associated speaker(s) 1034.

[0128] As used herein, the term "computer program product" may refer, in part, to removable storage unit 1018, removable storage unit 1022, a hard disk installed in hard disk drive 1012, or a carrier wave carrying software over communication path 1026 (wireless link or cable) to communication interface 1024. A computer readable medium can include magnetic media, optical media, or other recordable media, or media that transmits a carrier wave or other signal. These computer program products are devices for providing software to the computing device 1000. Computer readable storage medium refers to any non-transitory tangible storage medium that provides recorded instructions and/or data to the computing device 1000 for execution and/or processing. Examples of such storage media include floppy disks, magnetic tape, CD-ROM, DVD, Blu-ray Disc™, a hard disk drive, a ROM or integrated circuit, USB memory, a magneto-optical disk, or a computer readable card such as a PCMCIA card and the like, whether or not such devices are internal or external of the computing device 1000. Examples of transitory or non-tangible computer readable transmission media that may also participate in the provision of software, application programs, instructions and/or data to the computing device 1000 include radio or infra-red transmission channels as well as a network connection to another computer or networked device, and the Internet or Intranets including e-mail transmissions and information recorded on Websites and the like.

[0129] The computer programs (also called computer program code) are stored in main memory 1007 and/or secondary memory 1010. Computer programs can also be received via the communication interface 1024. Such computer programs, when

executed, enable the computing device 1000 to perform one or more steps that facilitate the implementation of an agricultural worker management system. Accordingly, such computer programs may represent controllers of the computing device 1000.

[0130] Software may be stored in a computer program product and loaded into the computing device 1000 using the removable storage drive 1014, the hard disk drive 1012, or the interface 1050. Alternatively, the computer program product may be downloaded to the computing device 1000 over the communications path 1026. The software, when executed by the processor 1003, causes the computing device 1000 to perform the necessary operations to execute one or more steps that facilitate the implementation of an agricultural worker management system.

[0131] It will be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive. For example, a food and beverage order management system, comprising various modules / sub-systems, has been described. The food and beverage order management system may include and/or exclude any one of the described modules / sub-systems, for example to cater to different requirements of different food and beverage establishments.

CLAIMS

1. A food and beverage order management system, comprising:
an order processing module configured to obtain an order and generate a set of
5 order fulfilling criteria based on input provided by a database communicatively coupled
with the order processing module; and
an order tracking module communicatively coupled with the order processing
module and configured to track the completion of the set of order fulfilling criteria for
successful fulfilment of the order.
10
2. The system as claimed in claim 1, wherein the order fulfilling criteria comprises
one or more of:
(i) correct ingredients and quantity are used to prepare the order,
(ii) the order is cooked in a proper manner based on prescribed parameters, and
15 (iii) a prescribed sequence is followed to prepare the order.
3. The system as claimed in claim 1 or 2, further comprising an order taking module
configured to receive the order from a customer, wherein the order processing module is
communicatively coupled with the order taking module and configured to obtain the
20 order from the order taking module.
4. The system as claimed in claim 1 or 2, further comprising an ingredient
monitoring module configured to identify an ingredient of the order, wherein the order
processing module is communicatively coupled with the ingredient monitoring module
25 and configured to obtain the identified ingredient of the order from the ingredient
monitoring module.
5. The system as claimed in any one of the preceding claims, wherein the order
processing module is further configured to assign a unique identity to each order,
30 wherein a physical object for preparing the order is associated with the unique identity,
and wherein the order tracking module is further configured to track an attribute of the
physical object based on the associated unique identity such that the attribute of the
physical object provides an indication of the completion of the set of order fulfilling
criteria.

6. The system as claimed in claim 5, wherein the order tracking module is disposed at a known location within a food and beverage outlet such that the location of the physical object within the food and beverage outlet is determined based on the known
5 location of the order tracking module.

7. The system as claimed in claim 5 or 6, wherein the unique identity is encoded on a tag and wherein the order tracking module comprises a tag reader configured to decode the unique identity.
10

8. The system as claimed in claim 7, wherein the tag and tag reader communicate via radio-frequency signals.

9. The system as claimed in claim 7, wherein the tag is an optical mark tag and the
15 tag reader is an optical mark tag capturing device.

10. The system as claimed in any one of the preceding claims, wherein the database is further configured to store a plurality of recipes, and wherein the order processing module is further configured to access the database to match the order to a respective
20 recipe and generate the set of order fulfilling criteria based on the recipe.

11. The system as claimed in claim 10, wherein each recipe comprises one or more of: ingredients of the order, quantity of each ingredient of the order and/or cooking instructions of the order.
25

12. The system as claimed in claim 11, wherein the database is further configured to store nutritional information associated with each ingredient of the order and/or cooking method of the order, and wherein the order processing module is further configured to access the database to obtain a total nutritional information of the order based on the
30 recipe corresponding to the order.

13. The system as claimed in claim 11 or 12, further comprising an inventory management module configured to monitor an inventory of food and beverage

ingredients, and wherein the order processing module is further configured to update the inventory management module based on the ingredients used for the order.

5 14. The system as claimed in any one of claims 10 to 13, further comprising an order instruction module configured to provide instructions for preparing the order based on the recipe corresponding to the order.

10 15. The system as claimed in claim 14, wherein the order instruction module comprises an indicator for indicating that an ingredient is to be used to prepare the order.

15 16. The system as claimed in claim 4, wherein the ingredient monitoring module is further configured to determine a rate and/or an amount of an ingredient that is utilized to prepare the order.

17. The system as claimed in claim 10, further comprising an expert system communicatively coupled with the order processing module and configured to modify or suggest an existing recipe based on a rule.

20 18. The system as claimed in claim 10, further comprising an expert system communicatively coupled with the order processing module and configured to generate a new recipe based on a rule.

25 19. The system as claimed in claim 17 or 18, wherein the rule is based on dietary requirements or dietary restrictions of a customer.

30 20. A method of food and beverage (F&B) order management, comprising:
receiving an order from a customer;
communicating the received order to an order processing module;
generating, by the order processing module, a set of order fulfilling criteria based on input provided by a database communicatively coupled with the order processing module; and

tracking the completion of the set of order fulfilling criteria for successful fulfilment of the order using an order tracking module communicatively coupled with the order processing module.

5 21. The method as claimed in claim 20, wherein the order is received using an order taking module communicatively coupled with the order processing module.

22. The method as claimed in claim 20 or 21, wherein the input provided by the database comprises a recipe for preparing the order, and the order fulfilling criteria
10 comprises one or more of:

- (i) correct ingredients and quantity are used to prepare the order,
- (ii) the order is cooked in a proper manner based on prescribed parameters, and
- (iii) a prescribed sequence is followed to prepare the order.

15 23. The method as claimed in any one of claims 20 to 22, wherein tracking the completion of the set of order fulfilling criteria comprises tracking a location of a container for containing the ingredients of the order, and wherein the location of the container provides an indication of the completion of the set of order fulfilling criteria.

20 24. A kit of parts for managing food and beverage orders, comprising:
 an order processing module; and
 an order tracking module coupleable with the order processing module,
 wherein the order processing module is capable of obtaining an order and
 generating a set of order fulfilling criteria based on input provided by a database
 25 communicatively coupled with the order processing module, and the order tracking is
 capable of tracking the completion of the set of order fulfilling criteria for successful
 fulfilment of the order.