

METHOD AND APPARATUS FOR FULLY AUTOMATED BEVERAGE PREPARATION

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims the benefit of Singapore Patent Application No. 10201703675Y, entitled “Modular Architecture For Fully Automated Beverage Preparation” and filed on May 4, 2017, which is expressly incorporated by reference herein in its entirety.

TECHNICAL FIELD

[0002] Various aspects of this disclosure generally relate to food and beverage processing, and more particularly, to beverage preparation.

BACKGROUND

[0003] The beverage retail industry faces many problems. For example, mixing of the ingredients by human is not consistent; preparing the beverage is time consuming; training a proficient staff to mix ingredients to make all beverages in the menu is time consuming; and changing the menu is usually hard for the beverage retailer because of the training.

[0004] A few traditional technologies focus on cocktail and mocktail dispenser. However, traditional technologies are only able to include a fixed number and types of liquid/beverage inside a machine.

SUMMARY

[0005] The following presents a simplified summary in order to provide a basic understanding of various aspects of the disclosed invention. This summary is not an extensive overview of all contemplated aspects, and is intended to neither identify key or critical elements of all aspects nor delineate the scope of any or all aspects. The sole purpose is to present some concepts of one or more aspects in a simplified form as a prelude to the more detailed description that is presented later.

[0006] This disclosure describes a beverage preparation system. The beverage preparation system may include a web-based server, a user interface (UI), and multiple beverage preparation modules. Each beverage preparation module may have a different function and may talk to the user interface via the digital signals through one or more communication protocols. The beverage preparation modules may be added or removed from the system at any time. The web-based server may store recipes for preparing beverages. Each recipe may include the sequential steps in which a corresponding beverage is to be made. In some embodiments, the UI may upload the usage record of the system to the web-based server.

[0007] The architecture of the beverage preparation system aims to introduce modularity in the field of beverage dispensing/preparation. It aims to separate customer requirements into individual modules that can be used in connection with each other (e.g., via digital signals) or individually depending on the situation and need. The overall aim is to minimise cost of production and hence, cost of operation for the retailers or owners. The multitude of modules have the ability to communicate with each other via a common base such as a user interface, a personal computer (PC). Furthermore, the addition and subtraction of these modules does not affect the functionality of any other module in the system.

[0008] In one aspect of the disclosure, a method of beverage preparation is provided. The method may include receiving a first recipe of a first beverage. The method may include determining a first plurality of parameters for a plurality of beverage preparation modules based on the first recipe. The method may include configuring the plurality of beverage preparation modules based on the first plurality of parameters. The method may include providing the first beverage using the plurality of beverage preparation modules that are configured based on the first plurality of parameters. The method may include receiving a second recipe of a second beverage. The method may include determining a second plurality of parameters for the plurality of beverage preparation modules based on the second recipe. The method may include re-configuring the plurality of beverage preparation modules based on the second plurality of parameters. The method may include providing the second beverage using the plurality of beverage preparation modules that are re-configured based on the second plurality of parameters.

[0009] In another aspect of the disclosure, a system for beverage preparation is provided. The system may include a server configured to store a plurality of beverage recipes including a first recipe and a second recipe. The system may include a plurality of beverage preparation modules. The plurality of beverage preparation modules may include a liquid pumping module that includes a pump. The plurality of beverage preparation modules may include a dispensing head configured to dispense a beverage. The plurality of beverage preparation modules may be configured based on the first recipe and the dispensed beverage may be a first beverage. The plurality of beverage preparation modules may be re-configured based on the second recipe and the dispensed beverage may be a second beverage.

[0010] To the accomplishment of the foregoing and related ends, the aspects disclosed include the features hereinafter fully described and particularly pointed out in the claims. The following description and the annexed drawings set forth in detail illustrate certain features of the aspects of the disclosure. These features are indicative, however, of but a few of the various ways in which the principles of various aspects may be employed, and this description is intended to include all such aspects and their equivalents.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is a diagram illustrating an example of a beverage preparation system in accordance with some embodiments of the disclosure.

[0012] FIG. 2 is a diagram illustrating an example of a tea preparation system in a tea retail outlet.

[0013] FIGS. 3A and 3B illustrate an example of a powder dissolving module.

[0014] FIG. 4 illustrates an example of a liquid pumping module.

[0015] FIG. 5 illustrates an example of a beverage preparation system in a retail outlet.

[0016] FIG. 6 illustrates an example of a self-serving beverage preparation system.

[0017] FIG. 7 illustrates an example of a mobile beverage preparation system at an event venue.

[0018] FIG. 8 is a flowchart of a method of beverage preparation.

[0019] FIG. 9 is a conceptual data flow diagram illustrating the data flow between different means/components in an exemplary apparatus.

[0020] FIG. 10 is a diagram illustrating an example of a hardware implementation for an apparatus employing a processing system.

DETAILED DESCRIPTION

[0021] The detailed description set forth below in connection with the appended drawings is intended as a description of various possible configurations and is not intended to represent the only configurations in which the concepts described herein may be practiced. The detailed description includes specific details for the purpose of providing a thorough understanding of various concepts. However, it will be apparent to those skilled in the art that these concepts may be practiced without these specific details. In some instances, well-known structures and components are shown in block diagram form in order to avoid obscuring such concepts.

[0022] Several aspects of beverage preparation will now be presented with reference to various apparatus and methods. The apparatus and methods will be described in the following detailed description and illustrated in the accompanying drawings by various blocks, components, circuits, processes, algorithms, etc. (collectively referred to as “elements”). These elements may be implemented using electronic hardware, computer software, or any combination thereof. Whether such elements are implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system.

[0023] By way of example, an element, or any portion of an element, or any combination of elements may be implemented as a “processing system” that includes one or more processors. Examples of processors include microprocessors, microcontrollers, graphics processing units (GPUs), central processing units (CPUs), application processors, digital signal processors (DSPs), reduced instruction set computing (RISC) processors, systems on a chip (SoC), baseband processors, field programmable gate arrays (FPGAs), programmable logic devices (PLDs), state machines, gated logic, discrete hardware circuits, and other suitable hardware configured to perform the various functionality described throughout this disclosure. One or more processors in the processing system may execute software. Software shall be construed broadly to mean instructions, instruction sets, code, code segments, program code, programs, subprograms, software components, applications,

software applications, software packages, routines, subroutines, objects, executables, threads of execution, procedures, functions, etc., whether referred to as software, firmware, middleware, microcode, hardware description language, or otherwise.

[0024] Accordingly, in one or more example embodiments, the functions described may be implemented in hardware, software, or any combination thereof. If implemented in software, the functions may be stored on or encoded as one or more instructions or code on a computer-readable medium. Computer-readable media includes computer storage media. Storage media may be any available media that can be accessed by a computer. By way of example, and not limitation, such computer-readable media may include a random-access memory (RAM), a read-only memory (ROM), an electrically erasable programmable ROM (EEPROM), optical disk storage, magnetic disk storage, other magnetic storage devices, combinations of the aforementioned types of computer-readable media, or any other medium that can be used to store computer executable code in the form of instructions or data structures that can be accessed by a computer.

[0025] In some embodiments, a module of a beverage preparation system may be a physical unit that comprising certain basic components, performing a desired function independently, controlled by a digital signal protocol. All modules of the beverage preparation system may use the same digital signal protocol or use different digital signal protocols.

[0026] In some embodiments, requirements for a beverage preparation system may include (but not limited to) the kind of services to be provided, types and variety of drinks to be served. Traditional beverage preparation systems require the retailers/owners to purchase machinery that is mass-produced by manufacturers, and design the stores accordingly. The architecture presented in this disclosure gives the retailers or owners the ease of changing and updating their stores without any constraints of heavy-duty machinery.

[0027] In some embodiments, beverage may include liquids such as alcohol, spirits, beer concentrates, juice (with or without pulp), aeriated drinks, syrups, milk, etc.

[0028] In some embodiments, a digital signal may be a signal that is constructed from a discrete set of waveforms of a physical quantity so as to represent a sequence of discrete values. A logic signal may be a digital signal with only two possible values, and describes an arbitrary bit stream. Other types of digital signals may represent three-valued logic or higher valued logics.

[0029] In some embodiments, cloud computing may be a type of Internet-based computing that provides shared computer processing resources and data to computers and other devices on demand. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources (e.g., computer networks, servers, storage, applications and services), which can be rapidly provisioned and released with minimal management effort.

[0030] In some embodiments, user interface may refer to any sort of human interface device that inputs into the beverage preparation system. The human interface device may be a push button, a touchscreen tablet, a Raspberry Pi, or any other such device.

[0031] Some embodiments include a beverage preparation system. The beverage preparation system may include a web-based server, a user interface, and multiple beverage preparation modules. Each beverage preparation module may have a different function and may talk to the user interface via the digital signals through one or more communication protocols. The beverage preparation modules may be added or removed from the system at any time. The web-based server may store recipes for preparing beverages. Each recipe may include the sequential steps in which a corresponding beverage is to be made. In some embodiments, the UI may upload the usage record of the system to the web-based server.

[0032] The architecture of the beverage preparation system aims to introduce modularity in the field of beverage dispensing/preparation. It aims to separate customer requirements into individual modules that can be used in connection with each other (e.g., via digital signals) or individually depending on the situation and need. The overall aim is to minimise cost of production and hence, cost of operation for the retailers/owners. The multitude of modules have the ability to communicate with each other via a common base such as a user interface, a PC. Furthermore, the addition and subtraction of these modules does not affect the functionality of any other module in the system.

[0033] FIG. 1 is a diagram illustrating an example of a beverage preparation system 100 in accordance with some embodiments of the disclosure. In the example, the beverage preparation system 100 may include a cloud-based server 102, a central processor 106, and several beverage preparation modules. The beverage preparation modules may include liquid pumping modules 112 and 116, a powder dissolving module 118, a liquid heating module 120, a liquid cooling module 122, a stirring module 126, and a dispensing head 128.

[0034] Each of the liquid pumping modules 112 and 116 may include one or more pumps that are controlled by a microcontroller. The microcontroller may be capable of controlling the dispensing rate, run time of the one or more pumps and other specifications that may be helpful to the functioning of the system. An external user interface 110 (e.g., push buttons, PC, barcode scanner, RFID touch screen, or Raspberry Pi) may be used to “talk” to the microcontroller via a translator that translates user input to Inter-Integrated Circuit (I²C) signal. The digital signal protocol is what ultimately determines the flow rate and flow speed of the pumping module.

[0035] When another beverage preparation module is added to the beverage preparation system 100, the digital signal protocol makes it easy to integrate the multiple modules. Each module addition action may need to plug a wire into a power supply and a digital signal protocol connection.

[0036] The powder dissolving module 118 may include a powder dispensing container that is powered by a motor with a gearbox. Inside the gearbox is an augur driven by a motor. The augur may dispense powder out of the container unit and into a liquid vortex generator. There may be a cup shaped mixer located within the powder dissolving module 118 for the purpose of the dissolution. Hot water may be injected onto the sides of the cup through an inlet pipe. The blades on the bottom face of the cup rotate and mix the solution. Once the powder has completely dissolved, the solution flows through the pipe due to gravity, into the serving cup. The hot water injected is brought in from an external source, not located within the powder dissolving module 118.

[0037] The dispensing head 128 is the final outlet of the drink/beverage to the customer. The dispensing head 128 may be equipped with multiple pipe inlets (e.g., up to 128 pipes) connected to respective liquid pumping modules. The dispensing head 128 may have an inbuilt microcontroller (connected to a digital signal protocol) that displays the useful data on a touchscreen enabled LCD screen. In order to avoid splashing of liquid while dispensing, at least one of two approaches may be employed in some embodiments. In the first approach, all pipes may be fanned outwards at an angle at the outlet. This angle is adjusted to make the liquid to hit the inner rim of the serving cup and prevent splashing. In the second approach, all (e.g., 128) pipes may be

twisted in the same direction at the outlet point to allow an angle of dispensing with the cup, and prevent splashing.

[0038] The central processor 106 may be linked to the cloud-based server 102. The cloud-based server 102 may store recipes that include essential data like ingredients, pump run time, the sequential steps in which beverage/drink is to be made. In some embodiments, the recipes may be edited and synchronised by the administrator of the particular cloud account via a web service. In some embodiments, the central processor 106 may collect module performance data, user behaviour data, etc., and send the collected data to the cloud-based server 102.

[0039] Once the administrator has entered the recipe, an inbuilt calibrator (e.g., at the cloud-based server 102 or the central processor 106) may calculate and convert each entered volume into a duration for a specific pump to run. In addition, the cloud-based server 102 may act as a collector of data from each machine and outlet in order to analyse the collected data at a later point. This collected data may include performance values, any other information that can be used to collect user behaviour, usage patterns, sales trends, or any other useful values. The calibrator mentioned above may be a software-based service. The collected data will not only assist businesses in data analytics, but will also serve as an indicator for preventive maintenance.

[0040] The data collected from the machines may be downloaded to an application programming interface (API) which can further be integrated with other APIs for higher usability and analytics. The API may provide inventory of the retail outlets, customer behaviour, staff behaviour, sales records, business changes, and any other possible ways that this data can be used.

[0041] The liquid heating module 120 may heat up the liquid on receipt of a digital signal. This digital signal protocol may be used to determine the heating temperature of the instant heating element that is located within the liquid heating module 120. This is an intermediate step in the process of drink/beverage preparation. Hence, the inlet and outlet may vary depending on the recipe.

[0042] The liquid cooling module 122 may cool the liquid on receipt of a digital signal. This digital signal protocol may be used to determine the cooling temperature of the instant cooling element that is located within the liquid cooling module 122. This

is an intermediate step in the process of drink/beverage preparation. Hence, the inlet and outlet may vary depending on the recipe.

[0043] The stirring module 126 may receive signals on stirring speed and stirring time via the digital signal protocol. The cup with rotating blades is connected to numerous inlet pipes corresponding to the various drinks/beverages. First, the liquid enters the stirring module 126. The liquid is then stirred to introduce air into the solution as per the received signal. Subsequently, the liquid may be emptied and progresses onto the next step in the recipe. The stirring module 126 and the inlet pipe are then cleaned using pumps. After the initial cleaning with the cleaning solution, clean water is pumped through the same inlet to ensure complete cleanliness. The stirring module 126 may include three pumps for the following purposes: sucking out as much liquid from the cup as possible thus emptying it; dispensing cleaning liquid into the cup after a drink has been stirred; pumping out dirty liquid from the cup.

[0044] In some embodiments, a user 108 may provide input to the central processor 106 through the user interface 110. For example, the user 108 may select, via the user interface 110, a beverage 130 to be made. The central processor 106 may receive corresponding recipe and module pre-sets from the cloud-based server 102. The central processor 106 may configure or re-configure one or more beverage preparation modules (e.g., the liquid pumping modules 112 and 116, the powder dissolving module 118, the liquid heating module 120, the liquid cooling module 122, the stirring module 126, the dispensing head 128, etc.) based on the recipe and/or the module pre-sets. As a result, the dispensing head 128 may produce the desired drink/beverage 130.

[0045] In some embodiments, in order to serve the fully garnished complex cocktails, a robotic arm with multiple actuators may be attached to the beverage preparation system 100. In some embodiments, the actuators may play one or more of three roles: shaker cup holder, garnishing actuator, or ice picking actuator. The shaker cup holder may take the liquid from beverage preparation modules, seal the container automatically, and shake the drink on the counter. The drink may then be poured into the cup, ready to be served. The garnishing actuator may be connected to an extendable finger like structure that can pick up garnish like lemon wedges, mint leaves, strawberries, or any other garnishes. The ice picking actuator arm may pick up the required quantity of ice and add to the served cup or the shaker cup as per recipe.

[0046] In some embodiments, a centralised CPU (e.g., the central processor 106) may be used to integrate this robotic arm module with the rest of the beverage preparation system 100. The user interface 110 may send the drink name to the digital signal protocol on the robot computer, which will then be managed by the centralised CPU.

[0047] In some embodiments, the beverage preparation system 100 may be re-configured and mounted onto a movable platform. The movable platform may be programmed to avoid collisions and have boards to display the drinks/beverages menu. The system would remain modular and provide the retailer or owner with complete control over the types and variety of drinks/beverages offered.

[0048] In some embodiments, during high moving events/outlets, three bartenders spend too much time filling cups with ice. The beverage preparation system 100 may include a conveyer belt that loads empty cups with ice and brings to a dispensing position and move forward. The user may simply take cups and put in under the dispensing head 128 to serve the customers.

[0049] In some embodiments, the beverage preparation system 100 may be used in medical service. For example, the beverage preparation system 100 may be used to prepare medicines or beverages/drinks for medical purpose.

[0050] FIG. 2 is a diagram illustrating an example of a tea preparation system 200 in a tea retail outlet. The tea preparation system 200 may be a specific example of the beverage preparation system 100 described above in FIG. 1. In the example, the tea preparation system 200 may include several tea barrels 202, a tea pumping module 204, a dispensing head 206, four powder dissolving modules 208, and three syrup pumping modules 210. In some embodiments, the tea pumping module 204 may include five pumps. In some embodiments, each of the powder dissolving modules 208 may store 1.5 kg powder and mix with hot water. In some embodiments, each of the syrup pumping modules 210 may include five pumps. In some embodiments, syrup containers may be stored near the syrup pumping modules 210.

[0051] FIGS. 3A and 3B illustrate an example of a powder dissolving module 300. In some embodiments, the powder dissolving module 300 may be the powder dissolving module 118 described above in FIG. 1 or one of the powder dissolving modules 208

described above in FIG. 2. In some embodiments, the powder dissolving module 300 may need to keep the top panel 302 up at all time.

[0052] FIG. 3A shows a front perspective view of the powder dissolving module 300. As shown, the powder dissolving module 300 may include a front door 304 for topping up the powder and daily maintenance. FIG. 3B shows a rear perspective view of the powder dissolving module 300. As shown, there may be a hot water inlet 306, a beverage outlet 308, and power and communication cable connectors 310 on the back panel of the powder dissolving module 300.

[0053] FIG. 4 illustrates an example of a liquid pumping module 400. In some embodiments, the liquid pumping module 400 may be one of the liquid pumping modules 112 and 116 described above in FIG. 1. In some embodiments, the liquid pumping module 400 may be one of the tea pumping modules 204 or one of the syrup pumping modules 210 described above in FIG. 2. The liquid pumping module 400 may include power and communication cable connectors 410. In some embodiments, the liquid pumping module 400 may include five pumps. Therefore, the liquid pumping module 400 may include five pairs of inlets and outlets 402. Each pair of inlet and outlet 402 may connect to a corresponding pump.

[0054] FIG. 5 illustrates an example of a beverage preparation system 500 in a retail outlet. The beverage preparation system 500 may be a specific example of the beverage preparation system 100 described above in FIG. 1. In the example, the beverage preparation system 500 may include four liquid pumping modules 506, a dispensing head 502, a powder dissolving module 504, a central processor 508, and a barcode scanner 510.

[0055] In some embodiments, each of the liquid pumping modules 506 may include five pumps. In some embodiments, the powder dissolving module 504 may include four types of powder. The powder dissolving module 504 may store 1.5 kg powder for each type of powder and mix each type of powder with hot water independently. In some embodiments, the central processor 508 may include a touch screen user interface. In some embodiments, the barcode scanner may act as a user interface to take drink order detail from a bar code, which may be printed by a point of sale (POS) machine.

[0056] FIG. 6 illustrates an example of a self-serving beverage preparation system 600. The beverage preparation system 600 may be a specific example of the beverage

preparation system 100 described above in FIG. 1. In the example, the beverage preparation system 600 may include two liquid pumping modules 610, a dispensing head 604, and a central processor 602. In some embodiments, each of the liquid pumping modules 610 may include five pumps. In some embodiments, the central processor 602 may include a touch screen user interface.

[0057] FIG. 7 illustrates an example of a mobile beverage preparation system 700 at an event venue. The beverage preparation system 700 may be a specific example of the beverage preparation system 100 described above in FIG. 1. In the example, the beverage preparation system 700 may include six liquid pumping modules 704, two dispensing heads 702, and two central processors 706. In some embodiments, each of the liquid pumping modules 704 may include five pumps. In some embodiments, each of the central processors 706 may include push buttons user interface.

[0058] FIG. 8 is a flowchart 800 of a method of beverage preparation. In some embodiments, the method may be performed by an apparatus (e.g., the apparatus 902/902' shown in FIG. 9 or FIG. 10). In some embodiment, the method may be performed by the beverage preparation systems described above with reference to FIGS. 1-7.

[0059] At 802, the apparatus may receive a first recipe of a first beverage. In some embodiments, the first recipe may be received from a cloud-based server. In some embodiments, the first recipe may be received as a result of a user input. The first recipe may include the ingredients and a plurality of steps for making the first beverage. In some embodiments, the first recipe may include ingredients of the first beverage and a pump run time.

[0060] At 804, the apparatus may determine a first plurality of parameters for a plurality of beverage preparation modules based on the first recipe. The plurality of beverage preparation modules may form a beverage preparation system. In some embodiments, the plurality of beverage preparation modules may include at least one of: a set of liquid pumping modules; a set of powder dissolving modules; a set of dispensing heads; a set of liquid heating modules; a set of liquid cooling modules; or a set of stirring modules. In some embodiments, the first plurality of parameters may include at least one of a dispensing rate of a pump or a run time of the pump.

[0061] At 806, the apparatus may configure the plurality of beverage preparation modules based on the first plurality of parameters.

[0062] At 808, the apparatus may provide or produce the first beverage using the plurality of beverage preparation modules that are configured based on the first plurality of parameters.

[0063] At 810, the apparatus may receive a second recipe of a second beverage. In some embodiments, the first recipe and the second recipe may be stored at a cloud-based server. In some embodiments, the second recipe may be received from a cloud-based server. In some embodiments, the second recipe may be received as a result of a user input. The second recipe may include the ingredients and a plurality of steps for making the second beverage. In some embodiments, the second recipe may include ingredients of the second beverage and a pump run time.

[0064] At 812, the apparatus may determine a second plurality of parameters for the plurality of beverage preparation modules based on the second recipe. In some embodiments, the second plurality of parameters may include at least one of a dispensing rate of a pump or a run time of the pump.

[0065] At 814, the apparatus may re-configure the plurality of beverage preparation modules based on the second plurality of parameters. In some embodiments, to re-configure the plurality of beverage preparation modules, the apparatus may add one or more beverage preparation modules to the plurality of beverage preparation modules based on the second recipe. In such embodiments, the second plurality of parameters may include a set of parameters for the one or more beverage preparation modules. The one or more beverage preparation modules may be configured based on the set of parameters. In some embodiments, to re-configure the plurality of beverage preparation modules, the apparatus may remove one or more beverage preparation modules from the plurality of beverage preparation modules based on the second recipe.

[0066] At 816, the apparatus may provide or produce the second beverage using the plurality of beverage preparation modules that are re-configured based on the second plurality of parameters.

[0067] FIG. 9 is a conceptual data flow diagram 900 illustrating the data flow between different means/components in an exemplary apparatus 902. The apparatus 902 may be a device or a system including multiple devices/modules/components.

[0068] The apparatus may include several beverage preparation modules 908 that produce the drink/beverage 922. In one embodiment, the beverage preparation modules 908 may perform the operations described above with reference to 808 or 816 in FIG. 8.

[0069] The apparatus 902 may include a parameter determination component 904 that determines parameters for configuring the beverage preparation modules 908 based on a recipe received from a server 920. In one embodiment, the parameter determination component 904 may perform the operations described above with reference to 804 or 812 in FIG. 8.

[0070] The apparatus 902 may include a module configuration component 906 that configures the beverage preparation modules 908 based on the parameters determined by the parameter determination component 904. To configure the beverage preparation modules 908, the module configuration component 906 may send configuration signals to the beverage preparation modules. In one embodiment, the module configuration component 906 may perform the operations described above with reference to 806 or 814 in FIG. 8.

[0071] The apparatus 902 may include additional components that perform each of the blocks of the algorithm in the aforementioned flowchart of FIG. 8. As such, each block in the aforementioned flowchart of FIG. 8 may be performed by a component and the apparatus may include one or more of those components. The components may be one or more hardware components specifically configured to carry out the stated processes/algorithm, implemented by a processor configured to perform the stated processes/algorithm, stored within a computer-readable medium for implementation by a processor, or some combination thereof.

[0072] FIG. 10 is a diagram 1000 illustrating an example of a hardware implementation for an apparatus 902' employing a processing system 1014. In some embodiments, the processing system 1014 may be the central processor 106 described above in FIG. 1. In some embodiments, the apparatus 902' may be the apparatus 902 described above with reference to FIG. 9. The processing system 1014 may be implemented with a bus architecture, represented generally by the bus 1024. The bus 1024 may include any number of interconnecting buses and bridges depending on the specific application of the processing system 1014 and the overall design constraints. The bus 1024 links together various circuits including one or more processors and/or hardware components, represented by the processor

1004, the components 904, 906, and the computer-readable medium / memory 1006. The bus 1024 may also link various other circuits such as timing sources, peripherals, voltage regulators, and power management circuits, which are well known in the art, and therefore, will not be described any further.

[0073] The processing system 1014 may be coupled to the beverage preparation modules 908. The processing system 1014 may send configuration signals to the beverage preparation modules 908 to configure the beverage preparation modules 908.

[0074] The processing system 1014 includes a processor 1004 coupled to a computer-readable medium / memory 1006. The processor 1004 is responsible for general processing, including the execution of software stored on the computer-readable medium / memory 1006. The software, when executed by the processor 1004, causes the processing system 1014 to perform the various functions described *supra* for any particular apparatus. The computer-readable medium / memory 1006 may also be used for storing data that is manipulated by the processor 1004 when executing software. The processing system 1014 further includes at least one of the components 904, 906. The components may be software components running in the processor 1004, resident/stored in the computer readable medium / memory 1006, one or more hardware components coupled to the processor 1004, or some combination thereof.

[0075] In the following, various aspects of this disclosure will be illustrated:

[0076] Example 1 is a method or apparatus for beverage preparation. The apparatus may receive a first recipe of a first beverage. The apparatus may determine a first plurality of parameters for a plurality of beverage preparation modules based on the first recipe. The apparatus may configure the plurality of beverage preparation modules based on the first plurality of parameters. The apparatus may provide the first beverage using the plurality of beverage preparation modules that are configured based on the first plurality of parameters. The apparatus may receive a second recipe of a second beverage. The apparatus may determine a second plurality of parameters for the plurality of beverage preparation modules based on the second recipe. The apparatus may re-configure the plurality of beverage preparation modules based on the second plurality of parameters. The apparatus may provide the second beverage using the plurality of beverage preparation modules that are re-configured based on the second plurality of parameters.

[0077] In Example 2, the subject matter of Example 1 may optionally include that, to re-configure, the apparatus may add one or more beverage preparation modules to the plurality of beverage preparation modules based on the second recipe.

[0078] In Example 3, the subject matter of Example 2 may optionally include that the second plurality of parameters may include a set of parameters for the one or more beverage preparation modules, where the one or more beverage preparation modules are configured based on the set of parameters.

[0079] In Example 4, the subject matter of any one of Examples 1 to 3 may optionally include that, to re-configure, the apparatus may remove one or more beverage preparation modules from the plurality of beverage preparation modules based on the second recipe.

[0080] In Example 5, the subject matter of any one of Examples 1 to 4 may optionally include that the plurality of beverage preparation modules may include at least one of: a set of liquid pumping modules; a set of powder dissolving modules; a set of dispensing heads; a set of liquid heating modules; a set of liquid cooling modules; or a set of stirring modules.

[0081] In Example 6, the subject matter of any one of Examples 1 to 5 may optionally include that the first recipe and the second recipe are stored at a cloud-based server.

[0082] In Example 7, the subject matter of any one of Examples 1 to 6 may optionally include that the first plurality of parameters may include at least one of: a dispensing rate of a pump; or a run time of the pump.

[0083] In Example 8, the subject matter of any one of Examples 1 to 7 may optionally include that the first recipe may include ingredients of the first beverage and a pump run time.

[0084] Example 9 is a system for beverage preparation. The system may include a server configured to store a plurality of beverage recipes including a first recipe and a second recipe. The system may include a plurality of beverage preparation modules. The plurality of beverage preparation modules may include a liquid pumping module including a pump; and a dispensing head configured to dispense a beverage. The plurality of beverage preparation modules may be configured based on the first recipe and the dispensed beverage is a first beverage. The plurality of beverage preparation

modules may be re-configured based on the second recipe and the dispensed beverage is a second beverage.

[0085] In Example 10, the subject matter of Example 9 may optionally include that the plurality of beverage preparation modules may be configured based on a first set of parameters derived from the first recipe to produce the first beverage, and the plurality of beverage preparation modules may be re-configured based on a second set of parameters derived from the second recipe to produce the second beverage.

[0086] In Example 11, the subject matter of Example 10 may optionally include that the first set of parameters may include at least one of: a dispensing rate of the pump; or a run time of the pump.

[0087] In Example 12, the subject matter of any one of Examples 9 to 11 may optionally include that, to re-configure the plurality of beverage preparation modules, one or more beverage preparation modules may be added to the plurality of beverage preparation modules.

[0088] In Example 13, the subject matter of any one of Examples 9 to 12 may optionally include that, to re-configure the plurality of beverage preparation modules, one or more beverage preparation modules may be removed from the plurality of beverage preparation modules.

[0089] In Example 14, the subject matter of any one of Examples 9 to 13 may optionally include that the system may further include a liquid heating module configured to heat up the beverage.

[0090] In Example 15, the subject matter of any one of Examples 9 to 14 may optionally include that the system may further include a liquid cooling module configured to cool the beverage.

[0091] In Example 16, the subject matter of any one of Examples 9 to 15 may optionally include that the system may further include a stirring module configured to stir the beverage to introduce air into the beverage.

[0092] In Example 17, the subject matter of any one of Examples 9 to 16 may optionally include that the system may further include a powder dissolving module configured to dissolve a powder into a solution.

[0093] In Example 18, the subject matter of any one of Examples 9 to 17 may optionally include that the first recipe may include ingredients of the first beverage and a pump run time.

[0094] In Example 19, the subject matter of any one of Examples 9 to 18 may optionally include that the dispensing head may include a plurality of pipes, where inlets of the plurality of pipes are connected to respective liquid pumping modules.

[0095] In Example 20, the subject matter of Example 19 may optionally include that outlets of the plurality of pipes may be fanned outwards at an angle.

[0096] A person skilled in the art will appreciate that the terminology used herein is for the purpose of describing various embodiments only and is not intended to be limiting of the present invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0097] It is understood that the specific order or hierarchy of blocks in the processes / flowcharts disclosed is an illustration of exemplary approaches. Based upon design preferences, it is understood that the specific order or hierarchy of blocks in the processes / flowcharts may be rearranged. Further, some blocks may be combined or omitted. The accompanying method claims present elements of the various blocks in a sample order, and are not meant to be limited to the specific order or hierarchy presented.

[0098] The previous description is provided to enable any person skilled in the art to practice the various aspects described herein. Various modifications to these aspects will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other aspects. Thus, the claims are not intended to be limited to the aspects shown herein, but is to be accorded the full scope consistent with the language claims, wherein reference to an element in the singular is not intended to mean "one and only one" unless specifically so stated, but rather "one or more." The word "exemplary" is used herein to mean "serving as an example, instance, or illustration." Any aspect described herein as "exemplary" is not necessarily to be

construed as preferred or advantageous over other aspects. Unless specifically stated otherwise, the term “some” refers to one or more. Combinations such as “at least one of A, B, or C,” “one or more of A, B, or C,” “at least one of A, B, and C,” “one or more of A, B, and C,” and “A, B, C, or any combination thereof” include any combination of A, B, and/or C, and may include multiples of A, multiples of B, or multiples of C. Specifically, combinations such as “at least one of A, B, or C,” “one or more of A, B, or C,” “at least one of A, B, and C,” “one or more of A, B, and C,” and “A, B, C, or any combination thereof” may be A only, B only, C only, A and B, A and C, B and C, or A and B and C, where any such combinations may contain one or more member or members of A, B, or C. All structural and functional equivalents to the elements of the various aspects described throughout this disclosure that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the claims. Moreover, nothing disclosed herein is intended to be dedicated to the public regardless of whether such disclosure is explicitly recited in the claims. The words “module,” “mechanism,” “element,” “device,” and the like may not be a substitute for the word “means.” As such, no claim element is to be construed as a means plus function unless the element is expressly recited using the phrase “means for.”

CLAIMS

WHAT IS CLAIMED IS:

1. A method of beverage preparation, comprising:
 - receiving a first recipe of a first beverage;
 - determining a first plurality of parameters for a plurality of beverage preparation modules based on the first recipe;
 - configuring the plurality of beverage preparation modules based on the first plurality of parameters;
 - providing the first beverage using the plurality of beverage preparation modules that are configured based on the first plurality of parameters;
 - receiving a second recipe of a second beverage;
 - determining a second plurality of parameters for the plurality of beverage preparation modules based on the second recipe;
 - re-configuring the plurality of beverage preparation modules based on the second plurality of parameters; and
 - providing the second beverage using the plurality of beverage preparation modules that are re-configured based on the second plurality of parameters.
2. The method of claim 1, wherein the re-configuring comprises:
 - adding one or more beverage preparation modules to the plurality of beverage preparation modules based on the second recipe.
3. The method of claim 2, wherein the second plurality of parameters comprise a set of parameters for the one or more beverage preparation modules, wherein the one or more beverage preparation modules are configured based on the set of parameters.
4. The method of any one of claims 1-3, wherein the re-configuring comprises:
 - removing one or more beverage preparation modules from the plurality of beverage preparation modules based on the second recipe.

5. The method of any one of claims 1-4, wherein the plurality of beverage preparation modules comprises at least one of:
- a set of liquid pumping modules;
 - a set of powder dissolving modules;
 - a set of dispensing heads;
 - a set of liquid heating modules;
 - a set of liquid cooling modules; or
 - a set of stirring modules.
6. The method of any one of claims 1-5, wherein the first recipe and the second recipe are stored at a cloud based server.
7. The method of any one of claims 1-6, wherein the first plurality of parameters comprises at least one of:
- a dispensing rate of a pump; or
 - a run time of the pump.
8. The method of any one of claims 1-7, wherein the first recipe comprises ingredients of the first beverage and a pump run time.
9. A system for beverage preparation, comprising:
- a server configured to store a plurality of beverage recipes comprising a first recipe and a second recipe; and
 - a plurality of beverage preparation modules comprising:
 - a liquid pumping module comprising a pump; and
 - a dispensing head configured to dispense a beverage,
- wherein the plurality of beverage preparation modules are configured based on the first recipe and the dispensed beverage is a first beverage, where the plurality of beverage preparation modules are re-configured based on the second recipe and the dispensed beverage is a second beverage.

10. The system of claim 9, wherein the plurality of beverage preparation modules are configured based on a first set of parameters derived from the first recipe to produce the first beverage, and the plurality of beverage preparation modules are re-configured based on a second set of parameters derived from the second recipe to produce the second beverage.
11. The system of claim 10, wherein the first set of parameters comprises at least one of:
 - a dispensing rate of the pump; or
 - a run time of the pump.
12. The system of any one of claims 9-11, wherein the re-configuring of the plurality of beverage preparation modules comprises adding one or more beverage preparation modules to the plurality of beverage preparation modules.
13. The system of any one of claims 9-12, wherein the re-configuring of the plurality of beverage preparation modules comprises removing one or more beverage preparation modules from the plurality of beverage preparation modules.
14. The system of any one of claims 9-13, further comprising:
 - a liquid heating module configured to heat up the beverage.
15. The system of any one of claims 9-14, further comprising:
 - a liquid cooling module configured to cool the beverage.
16. The system of any one of claims 9-15, further comprising:
 - a stirring module configured to stir the beverage to introduce air into the beverage.
17. The system of any one of claims 9-16, further comprising:
 - a powder dissolving module configured to dissolve a powder into a solution.
18. The system of any one of claims 9-17, wherein the first recipe comprises ingredients of the first beverage and a pump run time.

19. The system of any one of claims 9-18, wherein the dispensing head comprises a plurality of pipes, wherein inlets of the plurality of pipes are connected to respective liquid pumping modules.
20. The system of claim 19, wherein outlets of the plurality of pipes are fanned outwards at an angle.