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Kitchen assistance robot and robot-assisted kitchen environment (P-62476/EP)

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Description

Kitchen assistance robot and robot-assisted kitchen environment

The present invention relates to a kitchen assistance robot, particularly an assistance robot for a domestic kitchen according to claim 1. The present invention further relates to a robot-assisted kitchen environment, particularly a robot-assisted kitchen cooking environment, according to claim 11.

Performing housework, specifically preparation of dishes, is attracting increasing interest. Cooking events in private circles among friends are nowadays more and more popular. However, such kind of food preparation is also associated with standard tasks, which take more time and are usually boring, e. g. peeling potatoes or clearing up and cleaning the kitchen countertop after the preparation activities. Therefore, in recent years kitchen assistance robots have been proposed, which shall relieve kitchen staff or other kitchen users, both in industrial and in domestic kitchens. However, robots moving around in a kitchen environment have to be fully under control in order to avoid critical situations, if any malfunction in the control system will occur, particularly in an encounter with a person present in the same kitchen environmont.

From US 2009/099691 A1 a cooking assistance robot and a cooking assistance method capable of efficient mixing are known. Ingredients are physically moved in a cooking container by the cooking assistance robot and an efficient mixing is performed, with which the ingredients in the cooking container are unlikely to be unevenly heated. Further, different detectors are implemented, which are configured to detect an abnormality of the

mixing operation and, if said abnormality is detected, the mixing operation is stopped.

It is an object of the present invention to provide a kitchen assistance robot and a robot-assisted kitchen environment, which enable a safe collaboration with a human operator, i. e. a person performing kitchen work, so as to protect a joint doing of the kitchen work. Further, potentially harmful or hazardous situations for a living being present in the kitchen or for the home furnishing or equipment shall be avoided resulting from the activities of the kitchen assistance robot.

The object is achieved by a kitchen assistance robot operating in a kitchen environment and relieving a person working in the kitchen of kitchen work. The kitchen assistance robot comprises a robot body and at least one robot arm having a gripper device or a hand device at one of its ends. The kitchen assistance robot is adapted to operate a kitchen appliance and/or a kitchen equipment. Additionally or alternatively, the gripper device or hand device includes or is adapted to grasp a tool for performing kitchen work. The kitchen assistance robot comprises a safety means, which is configured to put itself, i.e. the kitchen assistance robot, in a safety state or to a higher safety level in case of a potentially hazardous situation for a living being present in the kitchen or for the home furnishing or equipment.

In particular, the kitchen assistance robot is an assistance robot for a domestic kitchen. The kitchen environment may be a kitchen cooking environment. The kitchen assistance robot, specifically the robot body, is preferably moveable along a linear axis. In particular, the kitchen assistance robot is axially moveable along a linear guiding rod or rail. At least one of the

robot arm and the gripper device or hand device may be moveable in six degrees of freedom.

In case of said potentially hazardous situation, a safety routine may be activatable by the kitchen assistance robot, particularly by a control unit controlling the kitchen assistance robot. Additionally or alternatively, the safety routine may be activatable by a device or appliance, which operates in collaborative environment with the kitchen assistance robot.

According to one specific embodiment, the kitchen assistance robot is configured to perform the kitchen work at the person's side and/or in collaboration with the person. Said person may be a human operator, e.g. a human chef. Preferably, the kitchen assistance robot is transferable into a safety state or it can be raised to a higher safety level in case of a critical contact or approach between the kitchen assistance robot and a living being, e.g. any person including adults and children or any pet, present in the kitchen.

It is advantageous to provide that the safety state comprises a stop, preferably an immediate stop, of the movement of the kitchen assistance robot in case of any critical contact or approach between the kitchen assistance robot and a living being. The stop is particularly related to its robot arm or even only to its gripper device or hand device. Alternatively, the kitchen assistance robot or any of its above-mentioned parts may carry out a backward movement related to its present movement direction.

Preferably, the kitchen assistance robot includes at least one integrated sensor means, particularly for identification of a collision or an approaching collision. Additionally or

alternatively, communication means may be included for data transmission with at least one externally arranged sensor device, which is particularly configured to provide information about any of said situations, which information may be derived from a parson's or a pet's actual movement or any typical movement patterns.

Said integrated sensor means particularly comprises at least one torque sensor and/or force sensor that is sensitive for any encounter of the kitchen assistance robot with a living being. Preferably, such type of sensor is arranged at or collaborates with the at least one robot arm or the gripper device or hand device.

The externally arranged sensor device may be a camera for monitoring at least portions of the kitchen environment. Preferably, at least two cameras, which may be two 3D cameras, are arranged or arrangeable in the kitchen environment in a way as to monitor at least working places of the kitchen environment from different viewing directions and/or viewing angles. However, a monitoring of the whole kitchen environment may be more favourable than keeping an eye only on portions of the kitchen environment. Instead of the externally arranged camera or cameras, also a provision of at least one integrated camera may be considered.

The camera, regardless of its integration in the kitchen assistance robot or of an external arrangement, is particularly adapted to provide information about the kitchen environment to the kitchen assistance robot. Specifically, information about any detection of presence and/or of moving directions of the person or another living being that is present in the kitchen environment may be provided. Additionally or alternatively,

information about any detection of objects, specifically those ones located on a kitchen countertop, may be delivered as well.

The kitchen assistance robot is preferably adapted to perform cooking preparation activities. Additionally or alternatively, cooking process assisting activities and/or cleaning or clearing up activities may be executable by the kitchen assistance robot.

According to embodiments, the safety state or higher safety level comprises a pre-defined safety procedure. In addition or as an alternative, activation or alerting of a safety device or equipment may be envisaged. To this end, a local fire alarm device and/or a fire-extinguishing equipment may be included.

Moreover, an activation of a remote-controlled mode may be provided. In particular, said activation is caused by an automatic safety routine included in a control unit, specifically in an operating program, of the kitchen assistance robot.

The object is also achieved by a robot-assisted kitchen environment, which is particularly a robot-assisted kitchen cooking environment, and which comprises at least one kitchen appliance and/or a kitchen equipment and a kitchen assistance robot, which is configured to relieve a person working in the kitchen of kitchen work. The kitchen assistance robot comprises a robot body and at least one robot arm having a gripper device or a hand device at one of its ends. The kitchen assistance robot may be adapted to operate the kitchen appliance. Additionally or alternatively, the gripper device or hand device includes or is adapted to grasp a tool for performing kitchen work. Further, the kitchen assistance robot is configured according to anyone of the afore-described embodiments or, alternatively, the kitchen appliance or kitchen equipment is configured to put

itself into a safety state or to a higher safety level in case of a potentially harmful or hazardous situation for a living being present in the kitchen or for the home furnishing or equipment.

Said kitchen appliance is particularly a cooking hob, an oven, an extractor hood, a dishwasher, a refrigerator and/or a freezer. The kitchen equipment may be a water tap, specifically an IR tap. The kitchen assistance robot is particularly an assistance robot for domestic kitchens.

A preferred embodiment of the robot-assisted kitchen environment includes a kitchen assistance robot, which is adapted to perform cooking preparation activities and/or cooking process assisting activities and/or cleaning or clearing up activities. Said activities include an operation of a tap for drawing water from the water supply. The tap includes or is affected by a shut off valve, which is preferably closed in case of an exceptional water tapping, particularly an extraordinarily high water tapping.

A more advanced kitchen assistance robot or robot-assisted kitchen environment is characterized by communication means, particularly wireless communication means, for a communication and/or data transmission between at least two of

- the kitchen assistance robot,
- the kitchen appliance or kitchen equipment,
- a smart device.

The smart device is particularly a smartphone, a tablet PC, a notebook or a stationary computer. The communication means may be uni- or bidirectional.

A particularly preferred embodiment of the present invention is characterized by a periodic signal, in particular a heartbeat message, which is generatable by the kitchen assistance robot. The periodic signal indicates normal operation and is receivable by the kitchen appliance and/or the kitchen equipment or by the smart device. If no such signal will be received, or if the signal will have unusual or abnormal characteristics, an interpretation of abnormal operation may result therefrom. In particular, depending on receipt of the periodic signal, and, if applicable, depending on the signal characteristics, at least one of the actions

- closure of a shut off valve, in particular depending on an information about the approximate amount of requested water;
- shut off of the kitchen appliance and preferably removal of an item, particularly a cookware, from a heating zone;
- activation of an alarm system, in particular transmission of a warning signal to the smart device.

is triggerable.

The object may be also achieved by a robotic system, which comprises the kitchen assistance robot according to anyone of the afore-mentioned embodiments and which further comprises at least one external camera and a software program for a control of the kitchen work performed by the kitchen assistance robot. The at least one external camera is adapted to provide information about local conditions to the kitchen assistance robot. Said local conditions may include conditions of at least one working place of the kitchen environment or, preferably, of the whole kitchen environment. The at least one external camera may be a 3D camera. For an increased monitoring effect, at least two cameras are preferably provided.

Another or alternative embodiment provides for a robot-assisted kitchen environment, a robotic system or a kitchen assistance robot, which is configured and/or mounted or mountable in the kitchen environment, particularly on or next to a kitchen island or kitchenette, in a way that opposite ends of a countertop are accessible to the robot arm and/or the gripper device or hand device. Naturally, said access to the opposite ends includes also the space between these two extreme positions.

The object may be also achieved by a method for operating the kitchen assistance robot according to anyone of above-described embodiments, wherein a controlling person provides the kitchen assistance robot with at least one command causing the kitchen assistance robot to execute at least one preparation step and/or cooking step. Said controlling person is particularly a human operator, who works in collaboration or beside the kitchen assistance robot. The at least one command may be provided at any time before starting and also during execution of the preparation or cooking process.

According to one particularly preferred embodiment, the kitchen assistance robot controls the kitchen appliance and/or operates a water supply means, particularly an IR tap. Said control function over the kitchen appliance may be limited to only certain, in particular less critical, operations of the kitchen appliance. However, it is in any case favourable to provide for a safety means putting the kitchen assistance robot in a safety state or to a higher safety level in case of a potentially hazardous situation for a living being present in the kitchen or for the home furnishing or equipment. Further, at least one camera may provide information to the kitchen assistance robot about presence and specific location, e. g. on the kitchen

countertop, of particular objects, which the kitchen assistance robot has to clear or to remove.

Novel and inventive features of the present invention are set forth in the appended claims.

The present invention will be described in further detail with reference to the drawing, in which

Fig. 1 illustrates a perspective view of a kitchenette of a household comprising a collaborative kitchen robot;

Fig. 2 is a schematic side view of the collaborative kitchen robot of Fig. 1 having a base portion of a robot body included in a rear section of a kitchen base; and

Fig. 3 schematically illustrates a slightly different embodiment of the collaborative kitchen robot according to Fig. 2 with a further or different task performance.

Fig. 1 illustrates in a perspective view a kitchenette 1 as is common in different households. The kitchenette 1 according to the illustration is in a single-line alignment, which is only an example and other arrangements of the cabinet elements 3, 5 and the implemented kitchen appliances 11, 19, 25 are considerable. It may be positioned at a kitchen wall or it may be a kitchen island that is arranged distant from any kitchen wall, particularly for providing kitchen work from all its sides.

The kitchenette according to Fig. 1 comprises a number of cabinet elements 3, 5 arranged side by side like an unbroken line. The present example of Fig. 1 is an arrangement of solely base cabinets 3 and a tall cabinet 5 forms an end element of the

kitchenette 1. Although the illustrated kitchenette 1 does not comprise any hanging cabinets, such cabinet elements may generally be comprised as well.

A top side of the arrangement of base cabinets 3 is covered by a countertop 7, which is of a continuous design and abuts a sidewall 9 of the tall cabinet 5. The kitchenette 1 comprises several kitchen appliances 11 partly implemented in the arrangement of side by side cabinets 3, wherein some of the kitchen appliances may be integrated in the interior of a cabinet element 3, while others may be slid-in without any surrounding by a cabinet 3. An example for the latter case is a dishwasher 11, in Fig. 1 illustrated by an open door element.

Also in the countertop 7 a number of appliances or devices are fed-in. These appliances or devices are from left to right: a sink unit 13 fillable with water by a tap 15, which in the present example is an IR tap operable by merely approaching an IR sensor (not shown); a container 17 for spices, salt and long-lasting food (according to Fig. 1 only placed on top of the countertop 7, rather than implemented therein); a cooking hob 19, which is preferably an induction cooking hob; a toolbox 21 for providing tools for kitchen work, e. g. a sponge or kitchen utensils; and a tray 23 for storing and providing ingredients for specific dish to be prepared and cooked. An extractor hood 25 is arranged in a hanging position above the cooking hob 19 in a distance from the top side, e. g. formed by a glass plate, of the cooking hob 19 for extraction of cooking smells. Instead of the illustrated hanging extractor hood 25, also a downdraft hood may be implemented in the kitchenette 1, which may be an integral part of the cooking hob 19. Fig. 1 also shows a pot 27 and a pan 29, both being placed on the cooking hob 19 for performing a cooking process. The kitchenette 1 further comprises a trash

bin, particularly with different compartments for different waste, which is located in one cabinet element 3 or below the cabinet (not shown). In case of its arrangement in a cabinet element 3, an allocated cutout in the countertop 7 may be provided, so that the waste can be moved to the trash bin from the top side of the countertop 7.

The kitchenette 1 is further equipped with a collaborative kitchen robot, which is moveably arranged close to a rear edge of the countertop 7. Said collaborative kitchen robot is a kitchen assistance robot 31, which is configured to support a kitchen staff, generally a human operator, i. e. a user of the kitchenette 1, in usual kitchen work. The kitchen robot 31 is adapted to help the user e. g. in cleaning the kitchen and assisting during the cooking process. Thereby, the kitchen robot 31 is designed to work hand in hand with human beings. In a shared work process, this apparatus is provided for supporting and relieving the human operator.

As can be best seen in Fig. 2, which is a side view of the kitchen robot 31 and a sectional view of a cabinet element 3, the kitchen robot 31 comprises a robot base 33 with an upper 33a and a lower 33b portion, a robot arm 35 and a gripper device 37, wherein the robot arm 35 forms an intermediate section between robot base 33 and gripper device 37. The upper portion 33a of the robot base 33 is arranged above the countertop 7, while the lower portion 33b is included in the cabinet 3 space. In order to enable the moveable arrangement of the kitchen robot 31 along a linear axis close to the rear upper edge of the cabinet, the lower base portion 33b is equipped with a linear actuator means, which may comprise, as illustrated in Fig. 2, a gear drive system 39.

The gripper device 37 includes or is adapted to grasp a tool 41 for performing kitchen work, which tool 41 is preferably exchangeable and/or removable from the gripper device 37. The kitchen robot 31 is configured to self-dependently grab a tool 41 from the toolbox 21. The tool 41 is dedicated for a robot use, but it may have a uniform design, so that it can be used both from the kitchen robot 31 and from the user.

The robot arm 35 and the above-mentioned moveable arrangement are designed that way that all areas of the countertop 7 are accessible by the collaborative kitchen robot 31. To this end, the robot arm 35 has seven degrees of freedom, which means the total number of independent displacement or aspect of motion.

One particular task of the kitchen robot 31 is to remove objects from and to clean the countertop 7 after the preparation and cooking activities. Fig. 3 shows a kitchen robot 31, which is similar to the embodiment of Fig. 2; however, it additionally includes a suction hose 43 with a suction funnel 45 at its inlet, as well as a suction device 47 for drawing in kitchen waste particles. Said suction device 47 is arranged beneath the countertop 7 and includes a filter. This suction device 47 leads to a trash bin 49, arranged beneath the countertop 7, too. Hence, the suction hose 43 can act like a vacuum cleaner for the countertop 7.

The kitchen robot 31 can interact, i. e. communicate, with other devices like kitchen appliances 11, 19, 25 connected to a network, such as a connected hob, a connected hood, a smartphone device with an application, etc.. Said network connection may be wireless. An interaction with a cooking hob 19, specifically an induction cooking hob 19, may include a full control of the cooking hob 19 by the kitchen robot arm 35, such as turning

on/off the hob 19 and setting a power level, which interaction is particularly supervised by the human operator.

Said supervision and a control of the kitchen robot 31 is performed by means of a smart device, such as a smartphone, in conjunction with a specific software program, in general referred to as application. More in general, the application allows the user to control the kitchen robot 31, particularly sending commands for the kitchen robot 31 to cook. Those commands can be sent before the cooking process and during the cooking process. The application is configured to assign specific tasks of kitchen work to the kitchen robot 31, so that the user can focus on other tasks in the meantime. The user can select from a list of tasks, which tasks should be executed by the kitchen robot 31. Certain tasks can be disabled and tasks may be automatically done by the kitchen robot 31.

Assignment of tasks to the kitchen robot 31 may be executed in a way that the user works “hand in hand” with the kitchen robot 31, just as two human operators would do when jointly doing the food preparation. For example, while the kitchen robot 31 is cooking a pasta recipe, the user can bake deserts in the same cooking area than the kitchen robot 31. It needs to be mentioned that both user and kitchen robot 31 can use the same utensils in the kitchen, wherein a general priority to the user may be provided, so that the kitchen robot 31 either has to wait until the needed kitchen utensil is available or a similar utensil has to be selected by the kitchen robot 31.

For a better control of the performance of the kitchen robot 31 several sensors including at least two cameras 51, particularly IR cameras, are installed in the kitchen environment. The cameras 51 are positioned distant from each other, i. e. on

opposite sides of the kitchenette 1, so that a full overview of the kitchen countertop 7 area is provided. Thereby, the two cameras 51 provide information regarding the kitchen cooking environment including human detection as well as objects detection on the surface of the kitchen countertop 7, specifically by creating a 3D map of the whole kitchen environment. This enables the application to receive in live time the images from the cameras 51 and a real video of the cooking process can be performed in the smartphone application. That way, the full cooking process is visible for the user in the mobile application including the possibility to select a pause function, i. e. to stop for a limited period of time until a "Continue" button will be pressed, or to abort the cooking process at any time. During the cooking process the user can at any time choose via the application that the kitchen robot 31 stops executing the task.

Due to the fact that the kitchen robot 31 is a collaborative robot, it provides a more intelligent control system including a safety system or fallback system as well as a sensor technology with a shut-off system that can immediately deactivate such collaborative robots, allowing users to work safely beside them. Therefore, when the kitchen robot 31 or its robot arm 35 is moving, e. g. in order to perform any kitchen work and it encounters a collision, such as a user's touch or a hit from a ball thrown by a child in the kitchen, the kitchen robot 31 or the robot arm 35 immediately stops its movement. Such kind of sensor technology provides a safety system that doesn't require any barrier between the user and the moving kitchen robot 31.

The safety system or fallback system may include a routine performing an immediate stop of the robot arm after a collision or when an approaching collision is detected, particularly by respective information provision by a camera 51. If such stop

occurs in the middle of a task performed by the kitchen robot 31, a notification is sent to the user's smart device, particularly to the running application, and the user is asked whether the kitchen robot 31 shall proceed with the previous task it was performing. In case of the user's approval, the robot continues its task and movement from the stopping position. Upon the user's refusal, the kitchen robot 31 takes a resting position.

In order to not only protect a living being's life and health but also a damage-free condition of home furnishing and equipment, the safety system or fallback system may further include a safety procedure for collaborative activities with a kitchen appliance. In particular, when the kitchen robot 31 performs a cooking or boiling process by operating the cooking hob 19, the kitchen robot 31 is in a constant intercommunication procedure with the cooking hob 19. During this intercommunication procedure, the kitchen robot 31 sets up a heartbeat protocol, which requires that the robot has to answer a query from the cooking hob 19 every minute to demonstrate its proper state. If said query will not be properly answered, the cooking hob 19 will shut off. The kitchen robot preferably also notifies the cooking hob 19 of the maximum expected cooking time for the specific cooking process, so the cooking hob 19 can switch off if this time has been exceeded. Finally, the cooking hob 19 may be equipped with a local fire alarm, based on smoke detection, e. g. detected by a sensor arranged at the extractor hood 25, and/or a contactless temperature sensor, and it will immediately switch off in case of a detection of any dangerous situation. Preferably, also any means for extinguishing small fires are included.

Also dangerous in relation to food preparation by cooking is a situation in which small children may burn them caused by hot

articles, in particular if they are left unattended in the kitchen. Before moving hot articles or opening an oven door, the kitchen robot 31 is requested to "look around", in particular by interpreting information provided by the cameras 51, to ensure that there is no living being inside a pre-defined safety zone. If someone enters said safety zone, a respective safety routine causes the kitchen robot 31 to close the oven door or to put the hot article down onto the closest surface on the countertop 7 that has been qualified as a heat resistant one.

A further critical situation in an autarkic operation of the kitchen robot 31 is water tapping by the kitchen robot 31. Any malfunction could lead to flooding, so the tap 15 may be equipped with an emergency shut off valve that sets up a similar heartbeat protocol to the kitchen robot 31 and also knows the approximate volume that the kitchen robot 31 has to draw from the tap 15 in each operation.

The robot may also have the opportunity to fall back to a remote-controlled mode if it ends up in a situation that it cannot control. In this case, a remote-controlled operation either by the user using a remote-control app or by a service provider experienced in remote control of a kitchen robot 31, particularly the manufacturer or vendor of the kitchen robot 31 may be performable.

The afore-described kitchen robot 31 can be helpful particularly for a physically challenged person, who may be supported by this assistant device in performing tasks, which cannot be executed due to the handicap.

Although an illustrative embodiment of the present invention has been described herein with reference to the accompanying

drawing, it is to be understood that the present invention is not limited to that precise embodiment, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope or spirit of the invention. All such changes and modifications are intended to be included within the scope of the invention as defined by the appended claims.

List of reference numerals

1	kitchenette
3	base cabinets
5	tall cabinet
7	countertop
9	sidewall
11	dishwasher
13	sink unit
15	tap
17	container
19	cooking hob
21	toolbox
23	tray
25	extractor hood
27	pot
29	pan
31	kitchen robot
33	robot base
33a, 33b	upper, lower portions
35	robot arm
37	gripper device
39	gear drive system
41	tool
43	suction hose
45	suction funnel
47	suction device
49	trash bin
51	cameras

Claims

1. A kitchen assistance robot (31), particularly an assistance robot for domestic kitchens, operating in a kitchen environment, particularly a kitchen cooking environment, and relieving a person working in the kitchen of kitchen work, the kitchen assistance robot (31) comprising a robot body (33) and at least one robot arm (35) having a gripper device (37) or a hand device at one of its ends, at least one of the robot arm (35) and the gripper device (37) or hand device particularly being moveable in six degrees of freedom, wherein
   - the kitchen assistance robot (31) is adapted to operate a kitchen appliance (11, 19, 25) and/or a kitchen equipment (15), and/or
   - the gripper device (37) or hand device includes or is adapted to grasp a tool (41) for performing kitchen work,

   and wherein the kitchen assistance robot (31) comprises a safety means, which is configured to put the kitchen assistance robot (31) in a safety state or to a higher safety level in case of a potentially hazardous situation for a living being present in the kitchen or for the home furnishing or equipment, in particular a safety routine is activatable by the kitchen assistance robot (31).

2. The kitchen assistance robot (31) according to claim 1, characterized in that
   the kitchen assistance robot (31) is configured to perform the kitchen work at the person’s side and/or in collaboration with the person, wherein the kitchen assistance robot (31) is transferable into a safety state or to a higher safety level in case of a critical contact or approach between the kitchen assistance robot (31) and a living being present in the kitchen.

3. The kitchen assistance robot (31) according to claim 2, characterized in that
the safety state comprises a stop, preferably an immediate stop, of the movement of the kitchen assistance robot (31), particularly of its robot arm (35), in case of the critical contact or approach between the kitchen assistance robot (31) and a living being.

4. The kitchen assistance robot (31) according to anyone of the preceding claims,
characterized in that
the kitchen assistance robot (31) includes at least one integrated sensor means and/or comprises communication means for data transmission with at least one externally arranged sensor device (51).

5. The kitchen assistance robot (31) according to claim 4, characterized in that
the integrated sensor means comprises at least one torque sensor and/or force sensor, which preferably is arranged at or collaborates with the at least one robot arm (35) or the gripper device (37) or hand device.

6. The kitchen assistance robot (31) according to claim 4 or 5, characterized in that
the externally arranged sensor (51) device is a camera for monitoring at least portions of the kitchen environment, wherein preferably at least two cameras (51), particularly two 3D cameras, are arranged or arrangeable in the kitchen environment in a way as to monitor at least working places of the kitchen environment, preferably the whole kitchen

environment, from different viewing directions and/or viewing angles.

7. The kitchen assistance robot (31) according to claim 6, characterized in that
the camera (51) is adapted to provide information about the kitchen environment to the kitchen assistance robot (31), in particular information about a detection of presence and/or moving directions of the person or another living being present in the kitchen environment and/or detection of objects, specifically located on a kitchen countertop (7).

8. The kitchen assistance robot (31) according to anyone of the preceding claims,
characterized in that
the kitchen assistance robot (31) is adapted to perform cooking preparation activities and/or cooking process assisting activities and/or cleaning or clearing up activities.

9. The kitchen assistance robot (31) according to anyone of the preceding claims,
characterized in that
the safety state or higher safety level comprises a pre-defined safety procedure and/or activating or alerting a safety device or equipment, which preferably includes a local fire alarm device and/or a fire-extinguishing equipment.

10. The kitchen assistance robot (31) according to anyone of the preceding claims,
characterized in that
a remote-controlled mode is activatable, in particular by an automatic safety routine included in a control unit of the kitchen assistance robot (31).

11. A robot-assisted kitchen environment, particularly a robot-assisted kitchen cooking environment, comprising
- at least one kitchen appliance (11, 19, 25), particularly a cooking hob (19), an oven, an extractor hood (25), a dishwasher (11), a refrigerator and/or a freezer, and/or a kitchen equipment, in particular a water tap (15), and
- a kitchen assistance robot (31), particularly an assistance robot (31) for domestic kitchens, which is configured to relieve a person working in the kitchen of kitchen work, the kitchen assistance robot (31) comprising a robot body (33) and at least one robot arm (35) having a gripper device (37) or a hand device at one of its ends,

wherein
- the kitchen assistance robot (31) is adapted to operate the kitchen appliance (11, 19, 25), and/or
- the gripper device (37) or hand device includes or is adapted to grasp a tool (41) for performing kitchen work,

and wherein
- the kitchen assistance robot (31) is configured according to anyone of the preceding claims, or
- the kitchen appliance (11, 19, 25) or kitchen equipment (15) is configured to put itself into a safety state or to a higher safety level in case of a potentially harmful or hazardous situation for a living being present in the kitchen or for the home furnishing or equipment.

12. The robot-assisted kitchen environment according to claim 11, characterized in that
the kitchen assistance robot (31) is adapted to perform cooking preparation activities and/or cooking process assisting activities and/or cleaning or clearing up activities, which activities include an operation of a tap (15) for drawing

water from the water supply, wherein the tap (15) includes or is affected by a shut off valve.

13. The kitchen assistance robot (31) or the robot-assisted kitchen environment according to anyone of the preceding claims,
characterized by
communication means, particularly wireless communication means, for a communication between at least two of
- the kitchen assistance robot (31),
- the kitchen appliance (11, 19, 25) or kitchen equipment (15),
- a smart device, particularly a smartphone, a tablet PC, a notebook or a stationary computer.

14. The kitchen assistance robot (31) or the robot-assisted kitchen environment according to claim 13,
characterized by
a periodic signal, in particular a heartbeat message, is generatable by the kitchen assistance robot (31) indicating normal operation and is receivable by the kitchen appliance (11, 19, 25) and/or the kitchen equipment (15) or by the smart device.

15. The kitchen assistance robot (31) or the robot-assisted kitchen environment according to claim 14,
characterized in that
depending on receipt of the periodic signal, at least one of the actions
- closure of a shut off valve, in particular depending on an information about the approximate amount of requested water;

- shut off of the kitchen appliance (11, 19, 25) and preferably removal of an item, particularly a cookware (27, 29), from a heating zone;
- activation of an alarm system, in particular transmission of a warning signal to the smart device.

is triggerable.

Abstract

A kitchen assistance robot (31) operates in a kitchen environment and relieves a person working in the kitchen of kitchen work. The kitchen assistance robot (31) comprises a robot body (33) and at least one robot arm (35) having a gripper device (37) or a hand device at one of its ends. The kitchen assistance robot (31) is adapted to operate a kitchen appliance (11, 19, 25) and/or a kitchen equipment (15), and/or the gripper device (37) or hand device includes or is adapted to grasp a tool (41) for performing kitchen work. The kitchen assistance robot (31) comprises a safety means, which is configured to put the kitchen assistance robot (31) in a safety state or to a higher safety level in case of a potentially hazardous situation for a living being present in the kitchen or for the home furnishing or equipment.

Moreover, a robot-assisted kitchen environment is disclosed, which comprises at least one kitchen appliance (11, 19, 25) and/or a kitchen equipment (15) as well as a kitchen assistance robot (31).

Fig. 1

Fig.1

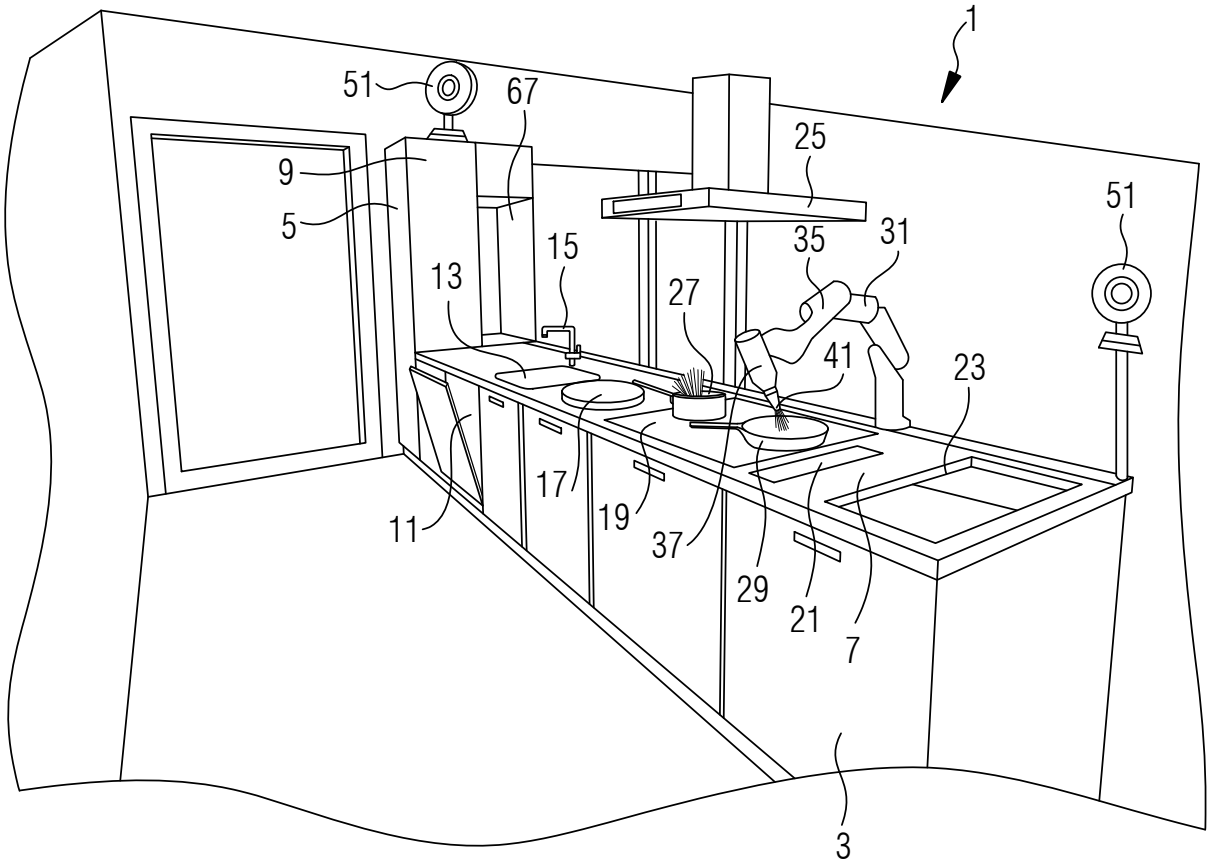

Fig.2

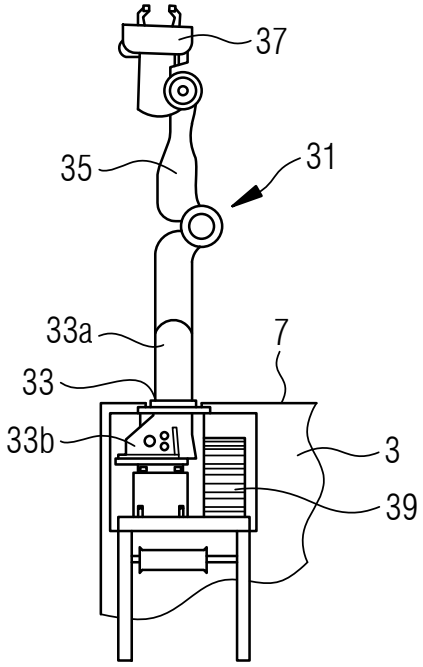

Fig.3