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(54) **COOKING SYSTEM COMPRISING A COOKING APPLIANCE AND METHOD FOR OPERATING A COOKING APPLIANCE**

(57) A method for operating a cooking system (1) comprising a cooking appliance (2) and a controller (16, 22) for the cooking appliance, wherein the controller contains a plurality of algorithms each suitable for controlling a cooking process of a respective class of food items, the method comprising the steps of:

- providing to the controller a target image of a target food item at a target cooking level;
- selecting, among the plurality of algorithms, one algorithm based on the class of food items the target food

item belongs to;

- deriving a cooking parameter set by the selected algorithm, based on the target image;
- storing the derived cooking parameter set in the controller;
- identifying a food item to be cooked; and
- if the identified food item corresponds to the target food item, starting a cooking process based on the stored cooking parameter set.

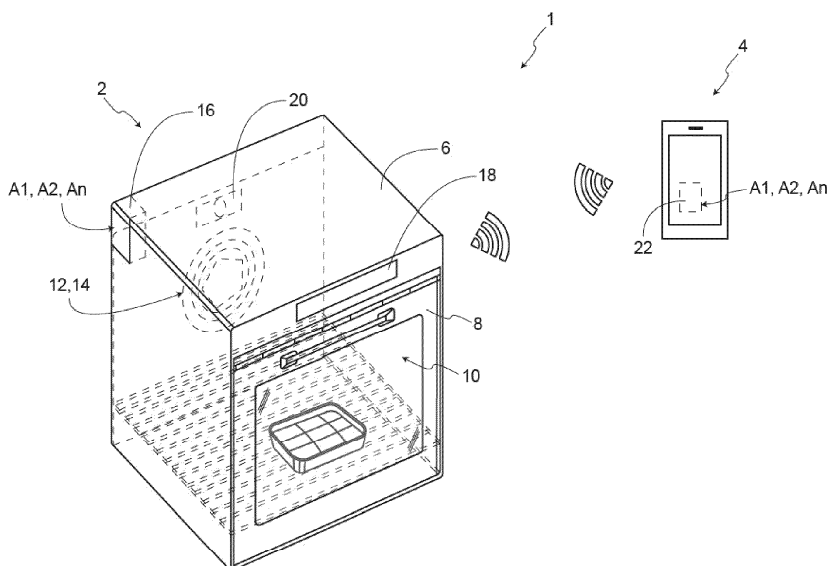


Fig. 1

Description

[0001] The invention relates to a method for operating a cooking appliance. Further, the invention relates to a cooking system comprising a cooking appliance.

[0002] A cooking appliance may be a cooking hob, an oven, a microwave oven, a steam cooker or a combination thereof. When cooking specific food items, a monitoring of the cooking process may be desired by the user in order to avoid overcooking, which can cause the food item to become scorched or too dry. Modern cooking appliances are already adapted to take over at least part of such monitoring, especially in case of oven-made meals. The monitoring may be based on the use of temperature probes or cameras. When a temperature probe is used, cooking is typically based on the temperature value detected at the core of the food. This solution is particularly suitable when cooking steaks or roasts, for example. When a camera is used, a picture of the food item inside the oven is typically compared with a reference image and the cooking process is stopped when the taken picture is similar, within given limits, to the reference image. By that, overcooking may be prevented automatically.

[0003] The object of the invention is to make the cooking process even simpler and more efficient for a user. The object of the invention is to allow a more precise determination of the doneness level of food.

[0004] This object is solved by a method for operating a cooking appliance and a cooking system with the features according to the claims of the present patent application.

[0005] The method according to the invention serves for operating a cooking appliance and comprises the step of providing, in a controller for the cooking appliance, a plurality of algorithms for controlling a cooking process of a class of food items, so that the controller can contain (i.e. can have stored therein) these algorithms.

[0006] The method further comprises the step of providing to the controller a target image of a target food item at a target cooking level; more in detail, this step includes presenting to the controller, via a respective interface of the controller, a target image of a specific target food item at a user-specific target cooking level. The method further comprises the step of selecting one algorithm among the plurality of algorithms, based on the class of food items the target food item belongs to.

[0007] Preferably, the selected algorithm is a self-learning algorithm, in particular a completely taught-in algorithm, adapted and pretrained to derive a cooking parameter set for a cooking process, particularly to be performed by means of the cooking appliance, by a number of optically detectable measures that are characteristic for a cooking level of a specific class of food items.

[0008] The method further comprises the step of deriving a cooking parameter set by the selected algo-

rithm, based on the target image. In particular, a cooking parameter set may be chosen by the selected algorithm and based on the target image, that has at least a predefined probability predefined probability of leading to the user-specific target cooking level a food item of the same kind as the target image. This predefined probability can be for example at least 60 %.

[0009] Additionally, the method comprises the step of storing, preferably in the controller, for example within a memory unit of the controller, the deriving cooking parameter set as a user-specific cooking parameter set at least for said kind of target food item.

[0010] The method further comprises the steps of identifying a food item to be cooked and, if the identified food item corresponds to the target food item, starting a cooking process based on the stored cooking parameter set. More in details, in order to perform a user-specific cooking process directly or at a later time compared to the above choosing of the cooking parameter set, the method comprises the steps of identifying a specific food item to be cooked, choosing a respectively stored user-specific parameter set based upon the identified specific food item, and starting a new cooking process, particularly a user-specific cooking process, based on the chosen user-specific parameter set.

[0011] Thus, the method enables the cooking appliance, especially a cooking system comprising that cooking appliance, to generate cooking parameter sets that are specific for specific kinds of food items and/or even user-specific cooking parameter sets for cooking specific kinds of food items, especially at least based upon optically derivable characteristics of such food items, to retrieve such user-specific cooking parameter sets when a food item to be cooked is recognized and to (especially automatically) perform a cooking process based upon such user-specific cooking parameter set.

[0012] Therefore, such a method constitutes a very convenient cooking experience for a user since the cooking appliance can almost fully automatically control a cooking process, especially when known food items are to be cooked.

[0013] A food item is considered to be known when there is a set of cooking parameters stored and/or pre-programmed for that food item or at least for the same class of food items. In particular, the invention allows the automation of cooking processes of food items that belong to the same class but which may present different characteristics during cooking, for example cakes of the same class may present different colors due to their ingredients. Using only the color of the cake as the target measurement may result in different cooking levels.

[0014] By deriving, for a specific target food item, a specific cooking parameter set, the probability of matching results is increased. Additionally, the repetition of cooking processes of known food items is fostered, particularly the ones that have been successful,

preferably by means of the stored user-specific cooking parameter sets.

[0015] The cooking system according to the invention comprises the above-mentioned cooking appliance. Such cooking appliance is preferably an oven. Further, the cooking system comprises the controller. The controller is adapted to execute the method described here and in the following. Most preferably the controller is adapted by way of a computer program product comprising program code that - when executed - causes the controller to execute the method as described here and in the following. Preferably, the cooking system further comprises a camera aligned to monitor a cooking room of the cooking appliance, especially of the oven.

[0016] Since the cooking system, especially the controller, is adapted to perform the method according to the invention, the cooking system also encompasses all benefits described in connection with the method. Additionally, the cooking system comprises all physical features described in connection with the method as being part of the cooking system or the cooking appliance. Also, the method may make use of all features described in connection with the cooking system or the cooking appliance.

[0017] According to an expedient variant of the method, for the identification of the specific food item, a camera is used and the identification is preferably done automatically. For that purpose, such camera is directed into the cooking room of the cooking appliance. In an alternative variant, the specific kind of the food item may be entered by a user via a user-interface being in data connection with the controller. However, the identification by way of the camera makes up for an automatic and, thus, convenient way of cooking.

[0018] According to a further expedient variant of the method, the specific food item is being monitored during the cooking process optically, especially by using the camera.

[0019] According to a preferred variant of the method, a current image of the specific food item within the cooking room, preferably taken by the camera, is being compared with a reference image of the same kind of food item at the user-specific target-cooking level. Optionally, the comparison may be based on extracted features of both the current image and the reference image. Those features may be the above-mentioned optically detectable measures. Due to that, the status quo of the cooking process may be ascertained at a quite precise level.

[0020] According to an expedient embodiment of the aforementioned variant of the method, the target image is being used as the reference image. This is advantageous since the target image is usually the image the user uses to create the new specific cooking process. Thus, that image is usually the reference for the user.

[0021] Preferably, as the target image, an image taken from a previous cooking process may be taken. For

example, the user has been cooking a specific kind of food item, such as a lasagna, and wants to cook it again in the future, an image taken of the "result", in the example of the lasagna, in its finished state, would serve as a new target or reference image. In that case, also the user-specific cooking parameter set stored for that previous cooking proves is being used for performing the cooking process, thus, for repeating an already known cooking process.

[0022] According to an alternative embodiment of the method, the current image of the specific food item is being compared with data extracted from a plurality of reference images of the same kind of food item at the user-specific target-cooking level. In particular, the latter may be the case if already several repetitions of the same cooking process have been performed. The extracted data may resemble the above-mentioned optically detectable measures, such as a distinct color or the like in distinct regions of the food item. For example, a nearest neighbor method, such as a k-nearest neighbor classification method, may be applied for that comparison. Thereby, it is for example ascertained whether a distinct measure is within a sufficiently small distance to the respective single points of the same measure of the reference images. If this is the case, a probability is set to a high value indicating that the respective cooking stage is reached regarding the respective measure.

[0023] According to a preferred variant of the method, a notification is being issued to the user if the current image is within a prescribed similarity range to the reference image and/or the cooking process is being stopped. Thus, the user gets to know about the reaching of the target cooking state and/or an overcooking of the specific food item may be avoided by stopping the cooking process. Optionally, a measure taken when stopping the cooking process may be chosen by the respective algorithm based on the respective food item. For example, if the cooking process is baking a cheesecake it may be expedient to leave the cake within the cooking room after terminating the cooking process in order to let it cool down very slowly. On the other hand, a biscuit cake would have to be taken out of the oven soon. In that case, the oven may also comprise a controllable door that may be opened by a control signal of the controller, preferably by means of an electro-motor.

[0024] According to an expedient variant of the method, a number of consecutive process images of the target food item is provided to the controller via the respective interface. These consecutive process images represent an evolution of the cooking level. Additionally, based on these consecutive process images the cooking parameter set is being amended or, optionally, another cooking parameter set is chosen, especially if these pictures hint to an unwanted evolution of the cooking process or if a distinct cooking stage of the cooking process has been reached. For example, in the case of meat, if a low temperature cooking level is

reached the cooking parameter set could, in that case, be switched to a high temperature grilling parameter set for the consecutive cooking stage of the same piece of meat.

[0025] Preferably, at least one algorithm that is used for deriving the cooking parameters may be implemented as a heuristic algorithm based on heuristic concepts. Other algorithms that may be used may be implemented as a convolutional neural network or the like.

[0026] According to a preferred variant of the method, at least the self-learning algorithm is adapted and especially pretrained to consider as the optically detectable measures a color, a volume, a volume change and/or a structure of a surface of the target food item. Additionally or alternatively, the self-learning algorithm is adapted to consider a change rate of the measures mentioned before. Especially in the case of coloring, the algorithm is adapted to perform preferably a semantic segmentation. In the latter case, all elements within the respective image with the same surface coloring are grouped together. Especially all elements such as pixels of the image taken. That may enhance recognition of the present cooking stage.

[0027] The measures mentioned above mostly have for each class a respective manifestation that makes it characteristic for a class of food items. For example, a cake made as shortcrust pastry will show no or nearly no volume change but may have a distinct browning, such as coloring behavior. A yeast dough, on the other hand, usually shows a quite strong volume change during cooking, but mostly with a quite smooth or closed surface. Casseroles such as a lasagna would usually show a change in surface texture or structure due to the melting cheese and a strong browning component.

[0028] According to a further preferred variant of the method, at least the self-learning algorithm is adapted to consider, additionally to the optically detectable measures, a subjective information added to the target image. That subjective information comprises a human subjective evaluation of the cooking level at least of raw, ready, and over-cooked. In that case and especially as long as "not ready" is chosen, the algorithm considers the target image of the target food item to resemble an intermediate cooking level, for example "still too raw" or an overcooked cooking level, like "too dry" or "scorched". Thus, the algorithm adjusts the cooking parameters, especially by a prolonged, in the case of raw, or shortened, in the case of over-cooked, cooking period.

[0029] According to a further preferred variant of the method, at least the self-learning algorithm is adapted to choose the cooking parameter set for the target food item based on a nearest neighbour principle. In other words, the self-learning algorithm compares the target image, especially the aforementioned optically detectable measures, such as color, volume, surface structure, of the food item within the target image to refer-

ence images of other food items. In an easy way, the algorithm then chooses the nearest neighbour, for example the reference image with a reference food item that matches the characteristics, especially the optically detectable measures, best and uses the process parameters that are connected to that reference food item. That procedure has the advantage of saving computational time.

[0030] According to an optional embodiment of this variant, the algorithm may be adapted to interpolate between two reference process parameter sets that are connected to respective reference food items that both lay within a predetermined distance to the target food item. In other words, if there are two reference food items that are comparable within the predetermined limits to the target food item, a process parameter set having values intermediate between the values of the two reference process parameter sets may be taken for the cooking process of the target food item. Especially by using that nearest neighbor principle, the probability of leading to the target cooking level is set or considered to meet the predefined probability.

[0031] According to an expedient variant of the method, at least the self-learning algorithm is adapted to derive a respective cooking parameter set for at least two subclasses of the respective food item class. Especially, that means that the respective self-learning algorithm is preferably assigned to only one class of food items, which means it is adapted to derive the cooking parameter set for only that class. However, such self-learning algorithm is also adapted to derive, within that class, cooking parameter sets for at least two subclasses, for two specific food items of that class. For example, the respective algorithm is assigned to the class of stirring dough and within that class it is adapted to derive cooking parameter sets for a plain stirring dough and a banana stirring dough.

[0032] According to a preferred variant of the method, the specific food item to be cooked is being identified by using a further self-learning pretrained algorithm. Such algorithm is preferably designed as a pattern or object recognition algorithm pretrained on food items or classes of food items.

[0033] According to an alternative variant of the method, the specific food item to be cooked is being identified via a user input, especially to the aforementioned user interface.

[0034] Optionally, the user may be prompted to correct or verify the automatic identification of the class of food items via the above mentioned further self-learning algorithm or via the user interface.

[0035] According to a preferred variant of the method, for at least two different classes of food items at least two different self-learning and pretrained algorithms for controlling a cooking process are provided, particularly for deriving the respective cooking parameter sets. In other words, the method may comprise the step of providing, for at least two different classes of

food items, at least two different self-learning and pre-trained algorithms for controlling the cooking process. In that case, after recognition of the specific food item a control algorithm assigned to the same class of food items gets chosen for deriving the cooking parameter set and controlling the cooking process. For example, after recognizing a plain stirring dough within the cooking room, particularly within a cooking chamber of the oven, an algorithm assigned to the class of stirring doughs is chosen to derive the respective cooking parameter set. Other algorithms provided may be assigned to the class of bread, meat roasts, casseroles etc., respectively.

[0036] According to an expedient variant of the method, the optically detectable measures are extracted from a current image of the specific food item within the cooking room. From that image a remaining cooking time for the specific food item is being derived and especially notified to the user by means of the user interface. That may also be the case if the cooking parameter set is not derived from the images provided presently because the food item to be cooked is an already known food item, whereby the controller may optionally refer to a database of already known and/or already performed cooking parameter sets. That database may be saved to a local memory of the controller or to a remote memory, such as a cloud platform.

[0037] For example, as the measure for color a grade of brown of the specific food item is determined from the respective image, especially from extracted measures of that image. In that case, for example, a pixel-by-pixel classification, a pixel grouping and/or clustering, such as to identify like pixels, and/or cluster classification, such as to determine whether a group of pixels is representative of a grade of browning the target food item, may be used.

[0038] As it has been mentioned already before, the respective self-learning algorithm is provided preferably as a respective neural network, for example a convolutional neural network, or even other self-learning algorithms known in the art. Accordingly, the method of the invention may further comprise the step of providing, as the selected algorithm, a respective neural network.

[0039] Also, preferably any pre-training of such algorithms is performed based on a respective and preferably controlled database of images of food items. That food items may be categorized by their respective class. "Controlled" in that context means especially that the respective images are chosen for representing a specific example of a food item, such as a plain stirring dough cake, and that, especially in the case of a dynamic database, where new food items are entered in in order to widen the database and let other algorithms also learn from new knowledge of others, new entries are only entered upon an audit by control personnel or even by an algorithm that checks for distinct criteria, for example approval by not only one user or the like.

[0040] According to a preferred embodiment, the

controller is part of a smart mobile device such as a smartphone or may also be implemented in a cloud environment. Smart devices often have the advantage that their microprocessors are already adapted to run self-learning algorithms and are mostly renewed by the respective user in shorter terms than the respective cooking appliance, particularly the oven, which would lead to more efficient processing. A cloud environment may also provide a vast computing power so that respective solution may easily be retrieved by, such as a smartphone or the cooking appliance. Alternatively, the controller may be a controller of the respective cooking appliance. Most preferably, the controller is a distributed controller made up from the controller of the smart mobile device or the cloud environment, both especially performing the computational parts of the method such as object recognition, deriving the cooking parameter sets etc. and the controller of the cooking appliance, performing the topical control of the cooking process based on the cooking parameter set received from the mobile device's controller.

[0041] Further, the camera used may be a camera of the smart mobile device and/or of the cooking appliance itself. Optionally, the first target image may be taken by the mobile device's camera whereas images taken during the respective cooking process may also be taken by a camera assigned to the respective cooking appliance, preferably the camera is integrated into the cooking appliance.

[0042] The conjunction "and/or" is to be understood, here and in the following, in such a way that the features linked by means of this conjunction can be formed both together and as alternatives to each other.

[0043] In the following, an embodiment of the invention is explained in more detail with reference to a drawing. In particular:

- Fig. 1 schematically shows, in a perspective view, a cooking system comprising an oven as a cooking appliance and a smartphone,
- Fig. 2 schematically shows, in a perspective view, a specific kind of food item in a non-cooked state and a finished state, and
- Fig. 3 shows, by a flow chart, a method for controlling the cooking appliance.

[0044] Fig. 1 shows a cooking system 1 comprising a cooking appliance 2 and a smart mobile device 4. In the present embodiment, the cooking appliance 2 is an oven and the smart mobile device 4 is a smartphone 4.

[0045] The oven 2 comprises a housing 6 with a front door 8. The housing 6 encloses a cooking room 10, here also referred to as cooking chamber or oven chamber. The oven 2 also comprises a heating device 12 and a rear fan 14, schematically shown. The oven chamber 10 may also comprise heating elements at the bottom and the top (not shown). Preferably, for controlling the heating device 12, the oven 2 further comprises

a first controller 16 and a user interface 18. The user interface 18 and the heating device 12 are both connected to the first controller 16 for data transmission. Additionally, the oven 2 comprises a camera 20 that is directed with its field of view towards the oven chamber 10, i.e. it is arranged so as to take images of the oven chamber 10. The camera 20 can be positioned on an inner part of the housing 6, but could be also external to the housing, for example on the door handle.

[0046] The smartphone 4 comprises a second controller 22. The smartphone 4 and the oven 2 each comprise a wireless communication device (not shown) by means of which they can connect to each other for bidirectional signal and data transmission. Preferably, the wireless communication device in both the oven 2 and the smartphone 4 comprises a WiFi module. Moreover, data transmission preferably takes place via a WLAN network.

[0047] Preferably, the first controller 16 and the second controller 22 form a combined and distributed controller of the cooking system 1. For that, a control application may be installed on the second controller 22 that, when executed, enables the smartphone 4 to control at least part of the oven's 2 operational status and system. Preferably, the control application is a software application. The second controller 22 preferably comprises a microprocessor and a memory unit. Moreover, the second controller 22 is preferably enabled to issue control signals to the first controller 16, to be executed by the first controller 16.

[0048] However, also the first controller 16 is preferably enabled to perform an operating mode of the oven 2 by itself. Accordingly, a user may choose via the user interface 18 a cooking process that will only run under the control of the first controller 16.

[0049] The cooking system 1 may be enabled, by a respective software application installed in the first controller 16 and/or in the second controller 22, to perform a method for controlling the oven 2 for automatic cooking control of specific food items.

[0050] Fig. 2 shows, on the left side, the food item 30 in a non-cooked state R, a so called "raw" cooking level and, on the right side, the food item 30 in a ready cooked state D, also called "done" cooking level. As an example, a lasagna is taken as a specific kind of food items. The doneness of the food item may be visible thanks to the appearance of cooking signs 32 on the surface of the food item 30. In the case of lasagna, for example, the doneness may become evident from the appearance of spots of browned cheese on the top surface of it.

[0051] As it is further described with reference to Fig. 3, in a first method step S1 after activation of the oven 2, the software program and, thus, the respective controller 16 or 22 that runs it, provides (i.e. makes available) a plurality of self-learning algorithms A1, A2, ..., An that are each assigned to a respective class of food items, for example meat roasts, casseroles, fruit cakes,

other cakes and the like. Each algorithm A1, A2, ..., An is adapted and pretrained to derive a cooking parameter set CPS for a cooking process from an image of a food item. In particular, each algorithm A1, A2, ..., An is preferably enabled to derive a cooking parameter set CPS by a number of optically detectable measures that are characteristic for a cooking level of a specific class of food items. The optically detectable measures may comprise a color, a volume, a volume change and/or a structure of a surface of the target food item. Also, each algorithm A1, A2, ..., An is also adapted to control the respective cooking process of the oven 2.

[0052] In a second method step S2, the user chooses a target food item and a corresponding target image. That target image is preferably made available to the second controller 22. For that, the user may take that target image by a camera of the smartphone 4, or may select it from the memory of the smartphone, or may choose it from the internet. In the present example, the chosen target food item is a lasagna and the corresponding target image is a lasagna at its done cooking level D.

[0053] In a third method step S3, the second controller 22 asks the user, for example by a message on its user interface or by showing a list of possible classes of food items, to enter or select a class of the food item of the target image, or alternatively starts an object recognition algorithm OR that is adapted to recognize the food item of the target image. When the user has entered or selected the corresponding class, or the object recognition algorithm OR has identified the food item, the second controller 22 chooses one self-learning algorithm Ai among the self-learning algorithms A1, A2, ..., An, in particular a self-learning algorithm Ai linked to the chosen target food item. For example, if the food item is a lasagna, the chosen self-learning algorithm Ai can be an algorithm suitable for casseroles.

[0054] In a fourth method step S4, the chosen algorithm Ai derives, on the basis of the target image, a cooking parameter set CPS and a cooking time, which are adapted for the same class of food items and will lead to a comparable result. For example, a cooking parameter set CPS is a temperature value of the heating device 12 and/or a heating setting such as circulating air or bottom and top heat. After having derived the cooking parameter set CPS, the second controller 22 saves it into a memory. The memory can be in the smartphone 4, in the first controller 16 inside the oven 2, or in the cloud. If it is in the oven or in the cloud, the cooking parameter set CPS must be transferred there from the second controller 22 through the wireless connection.

[0055] In a fifth step S5, the user places the food item 30 into the oven chamber 10. One or more images of the cooking chamber 10 are then taken by the camera 20 and sent to the second controller 22. The camera 20 can for example be activated by the closure of the oven's door 8, or by instructions of the second control-

ler 22. The second controller 22 can therefore detect if a food item 30 is present in the cooking chamber 10, for example by comparison with previous images of the cooking chamber 10 when empty. When a food item 30 is detected in the cooking chamber 10, the second controller 22 starts the object recognition algorithm OR or another algorithm for the same purpose. The object recognition algorithm OR identifies the food item 30 in the cooking chamber 10 and takes it as a target food item, which in the present embodiment would be the lasagna. Then the second controller 22 chooses from the memory the cooking parameter set CPS and activates the heating device 12 accordingly. The one or more images of the target food item may be stored on the smartphone 4 or on the cloud and become part of a dataset for a machine learning image recognition system that can recognize this food item a next time it is placed in the oven 2.

[0056] In a sixth method step S6, during the cooking process performed by means of the cooking parameter set CPS, the second controller 22 (or alternatively the first controller 16) instructs the camera 20 to take images of the food item 30 in order to check its cooking level. These images are compared to the target image, which is here taken as a reference image. In particular, the second controller 22 executes a distinct self-learning algorithm that extracts the respective measures from the taken images, for example by means of a semantic segmentation, and compares these measures to the respective measures of the reference image.

[0057] Also, the second controller 22 is set up to estimate, based on the images taken during the cooking process, a remaining cooking time and to notify it to the user. The second controller 22 is adapted to derive from the images taken during the cooking process if the target image's characteristics may be reached at least within the cooking time. If the second controller 22 derives that the target cooking level would not be reached within the cooking time or even not at all, the second controller 22 is also adapted by a respective algorithm to change, during operation, the cooking parameter set CPS, for example the heat applied by the heating device 12 or simply the cooking time, in order to adapt the cooking process to meet the target characteristics.

[0058] When the second controller 22 recognizes, by means of the above-mentioned comparison of a topically (currently) taken image with the reference image that the target cooking level is reached, the controller 22 terminates the cooking process and prompts a notification to the user that the cooking process is finished.

[0059] According to a further development of the above embodiment, the cooking parameter set CPS remains stored in the above-mentioned memory. Preferably, the user is prompted by the first controller 16 or the second controller 22 to enter information whether the user is satisfied with the result of the cooking process. If the user is satisfied, the cooking parameter set

CPS stays in the memory, while if the user is not satisfied the cooking parameter set CPS could be erased or used as basis for a new parameter set that would have to be amended. If the user is satisfied with the result, the image that resulted in the decision that the target cooking level is reached is stored together with the cooking parameter set CPS as a new target image. The images taken during the cooking process may also be stored as respective reference images for the stages before reaching the target cooking level. If the user wants to cook the same food item 30 again and repeat the same cooking process, he/she may easily choose from the memory, in the second method step S2, the user-specific target image of that prior cooking process. In that case, the respective controller 16 or 22 would choose the cooking parameter set CPS that was stored in connection with that image. Thus, repetition of cooking processes of food items that have already been cooked at least once before is enabled.

[0060] Alternatively, if in a next cooking process the user inserts a similar food item in the oven 2, this food item can be recognized by the recognition algorithm OR, and the smartphone 2 can suggest to mimic the results from previous time. If the user accepts the same cooking conditions are automatically applied, including the same cooking parameter set CPS, so that the user doesn't have to manually set the cooking function and parameters. With the image recognition system the oven will try to bake the dish until the colour, texture and shape of the dish look similar as the end-result image it captured previously.

[0061] In a preferred variant of the above embodiment, all algorithms described above are executed by the second controller 22 of the smartphone 4. In another possible variant, all algorithms described above are executed by the first controller 16.

[0062] List of reference signs

1	cooking system
2	oven
4	smartphone
6	housing
8	front door
10	oven chamber
12	heating device
14	fan
16	controller
18	user interface
20	camera
22	second controller
30	food item
32	spots on the food item

R	raw cooking level
D	done cooking level
S1-S6	method step
A1, A2, ..., An	algorithm
OR	object recognition algorithm

CPS cooking parameter set

Claims

1. A method for operating a cooking system (1) comprising a cooking appliance (2) and a controller (16, 22) for the cooking appliance (2), wherein the controller (16, 22) contains a plurality of algorithms (A1, A2, ..., An) each suitable for controlling a cooking process of a respective class of food items, the method comprising the steps of:
 - providing to the controller (16, 22) a target image of a target food item at a target cooking level;
 - selecting one algorithm (Ai) among the plurality of algorithms (A1, A2, ..., An) based on the class of food items the target food item belongs to;
 - deriving a cooking parameter set (CPS) by the selected algorithm (Ai), based on the target image;
 - storing the derived cooking parameter set (CPS);
 - identifying a food item (30) to be cooked; and
 - if the identified food item corresponds to the target food item, starting a cooking process based on the stored cooking parameter set (CPS).
2. Method according to claim 1, wherein the selected algorithm (Ai) is a self-learning algorithm adapted and pretrained to derive a cooking parameter set (CPS) by a number of optically detectable measures that are characteristic for a cooking level of a specific class of food items.
3. Method according to claim 1 or 2, wherein deriving a cooking parameter set (CPS) comprises deriving, by the selected algorithm (Ai) and based on the target image, a cooking parameter set (CPS) that has at least a predefined probability of leading the target food item to the target cooking level by the cooking process.
4. Method according to any of the preceding claims, wherein identifying a food item (30) to be cooked comprises the step of using a camera (20) arranged so as to take images of a cooking room (10) of the cooking appliance (2).
5. Method according to claim 4, further comprising the step of optically monitoring, by using the camera (20), the identified food item (30) during the cooking process.
6. Method according to claim 5, further comprising the step of comparing a current image of the identified food item (30) in the cooking room (10) with a reference image of the same kind of food item at the target cooking level or with data extracted from said reference image or from a plurality of reference images.
7. Method according to claim 6, further comprising the step of using the target image as the reference image.
8. Method according to claim 6 or 7, further comprising, if the current image is within a prescribed similarity range to the reference image, the step of notifying a user and/or stopping the cooking process.
9. Method according to any of the preceding claims, further comprising the step of providing to the controller (16, 22) a number of consecutive process images of the target food item representing an evolution of the cooking level and amending, on the basis of the consecutive process images, the cooking parameter set (CPS).
10. Method according to any of the preceding claims, wherein at least one of the algorithms (A1, A2, ..., An) is adapted to take into account, as the optically detectable measures, at least one measure among a color of the target food item, a volume of the target food item, a volume change of the target food item and a surface structure of the target food item, and/or a change rate of any of said at least one measure.
11. Method according to claim 9 or 10, wherein at least one of the algorithms (A1, A2, ..., An) is adapted to take into account, additionally to the optically detectable measures, an information added to the target image comprising a subjective evaluation of the cooking level.
12. Method according to any of the preceding claims, wherein at least one of the algorithms (A1, A2, An) is adapted to choose the cooking parameter set (CPS) for the target food item based on a nearest neighbour principle.
13. Method according to any of the preceding claims, wherein at least one of the algorithms (A1, A2, An) is adapted to derive a respective cooking parameter set (CPS) for at least two subclasses of the respective class of food items.
14. Method according to any of the preceding claims, wherein identifying a food item (30) to be cooked comprises using a self-learning pretrained algorithm (OR).
15. Cooking system (1), comprising a cooking appli-

ance (2), a camera (20) arranged so as to monitor a cooking room (10) of the cooking appliance, and a controller (16, 22) adapted to execute the method according to one of claims 1 to 14.

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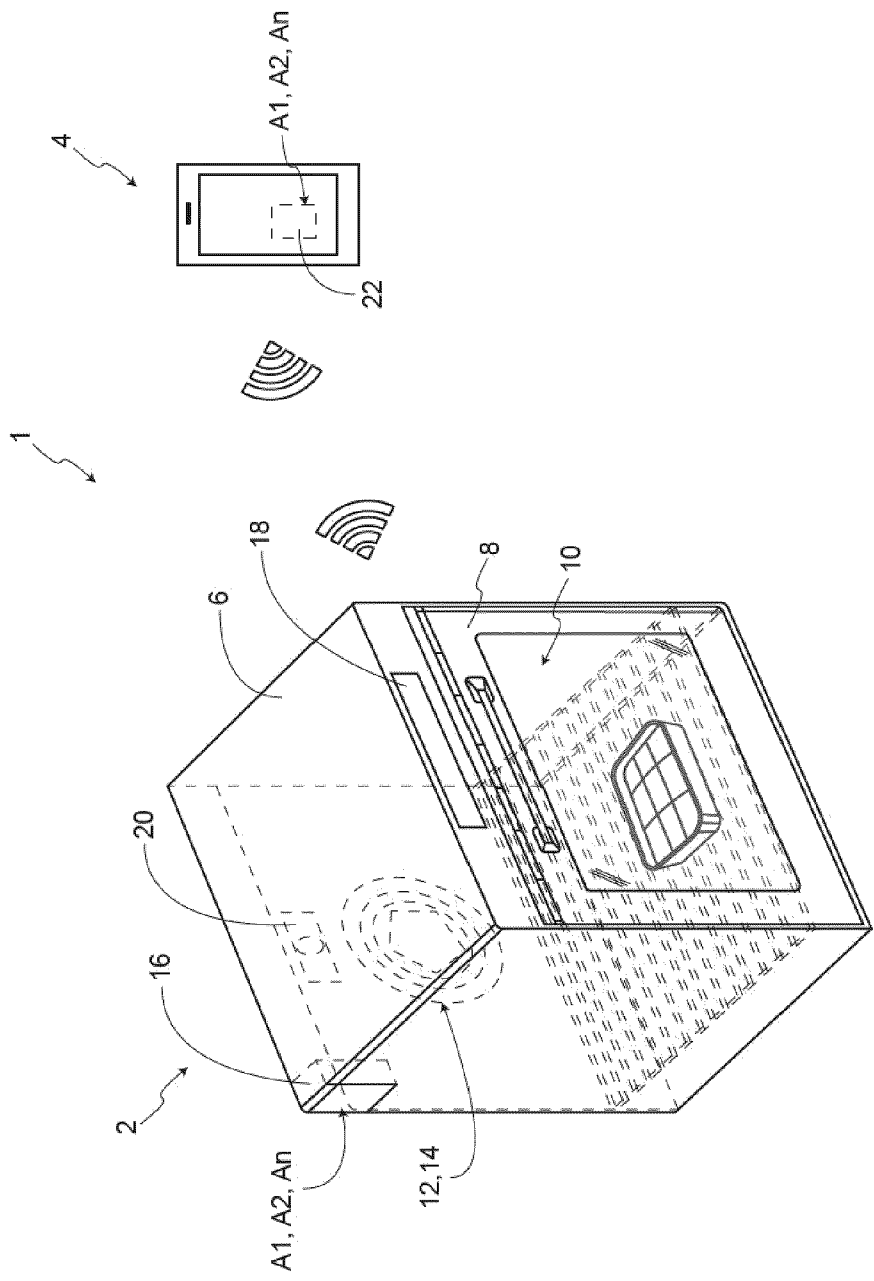


Fig. 1

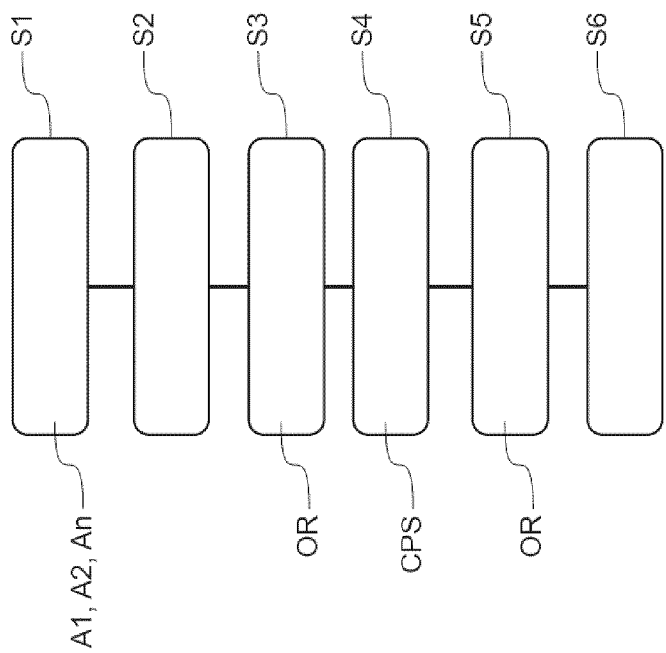


Fig. 3

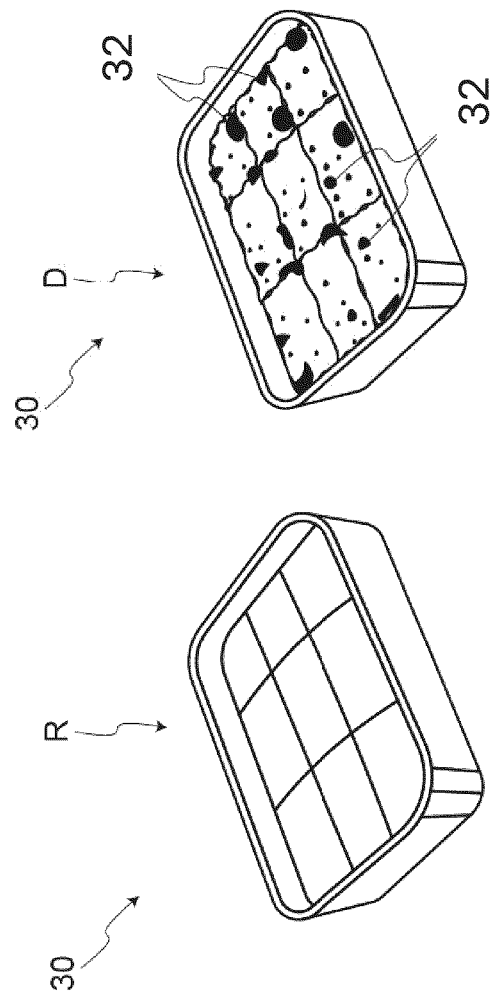


Fig. 2



EUROPEAN SEARCH REPORT

Application Number

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Place of search The Hague		Date of completion of the search 11 September 2025	Examiner Fest, Gilles
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