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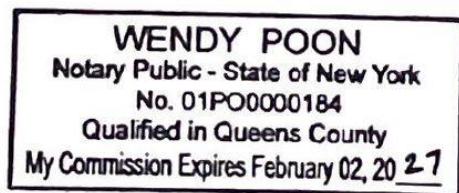


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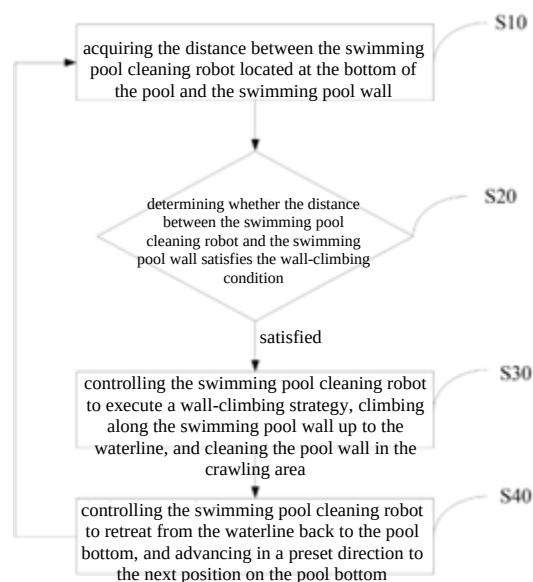
2 pages of Claims 6 pages of Specification 3 pages of Attached
Drawings

(54) Title of the Invention

METHOD, SYSTEM, AND MEDIUM FOR
CLEANING SWIMMING POOL WALLS

(57) Abstract

The present disclosure relates to a method, system, and medium for cleaning swimming pool walls. The method comprises: acquiring the distance between a swimming pool cleaning robot located at the bottom of the pool and the swimming pool wall; determining whether the distance between the swimming pool cleaning robot and the swimming pool wall satisfies a wall-climbing condition; if the wall-climbing condition is satisfied, controlling the swimming pool cleaning robot to execute a wall-climbing strategy, wherein the wall-climbing strategy comprises: controlling the swimming pool cleaning robot to climb along the swimming pool wall up to the waterline of the swimming pool wall, and cleaning the pool wall in the crawling area of the swimming pool cleaning robot; controlling the swimming pool cleaning robot to retreat from the waterline back to the pool bottom, and advancing in a preset direction to the next position on the pool bottom. The present disclosure ensures that the swimming pool cleaning robot can continuously clean along swimming pool walls of various shapes, and prevents the robot from repeatedly cleaning the same area, thereby improving the cleaning efficiency of the swimming pool.



1. A method for cleaning swimming pool walls, characterized in that the method is applied to a swimming pool cleaning robot, and comprises the following steps:

step S10: acquiring the distance between the swimming pool cleaning robot located at the pool bottom and the swimming pool wall;

step S20: determining whether the distance between the swimming pool cleaning robot and the swimming pool wall satisfies a wall-climbing condition;

step S30: If the wall-climbing condition is satisfied, controlling the swimming pool cleaning robot to execute a wall-climbing strategy, wherein the wall-climbing strategy comprises: controlling the swimming pool cleaning robot to climb along the swimming pool wall up to the waterline of the swimming pool wall, and cleaning the pool wall in the crawling area of the swimming pool cleaning robot;

step S40: controlling the swimming pool cleaning robot to retreat from the waterline back to the pool bottom, and advancing in a preset direction to the next position on the pool bottom;

step S50: returning to execute steps S10 to S40 to clean the swimming pool wall of the next climbing area.

2. The method for cleaning swimming pool walls according to Claim 1, characterized in that, the wall-climbing condition is that the distance between the swimming pool cleaning robot located at the pool bottom and the swimming pool wall is less than or equal to a first preset distance.

3. The method for cleaning swimming pool walls according to Claim 1, wherein the front end of the swimming pool cleaning robot is provided with an ultrasonic probe, and the step of acquiring the distance between the swimming pool cleaning robot located at the pool bottom and the swimming pool wall comprises:

using the ultrasonic probe to detect the distance between the swimming pool cleaning robot located at the pool bottom and the swimming pool wall.

4. The method for cleaning swimming pool walls according to Claim 3, characterized in that, the swimming pool cleaning robot is provided with a water pump motor, a gyroscope, and an accelerometer, and in step S30, controlling the swimming pool cleaning robot to execute a wall-climbing strategy, wherein the wall-climbing strategy comprises: the step of controlling the swimming pool cleaning robot to climb along the swimming pool wall up to the waterline and clean the pool wall in the crawling area of the swimming pool cleaning robot comprises:

step S301: turning off the water pump motor and maintaining forward speed, so that when the swimming pool cleaning robot encounters the swimming pool wall, it changes from a horizontal state to a vertical state;

step S302: using the gyroscope and accelerometer to detect the attitude of the swimming pool cleaning robot, and when the robot reaches a nearly vertical state, turning on the water pump motor so that the swimming pool cleaning robot presses against and climbs up the swimming pool wall;

step S303: using the ultrasonic probe to detect the distance between the swimming pool cleaning robot and the water surface, until the robot climbs to the waterline, and remaining at the waterline for a first preset period.

5. The method for cleaning swimming pool walls according to Claim 4, characterized in that, in step S40, controlling the swimming pool cleaning robot to retreat from the waterline back to the pool bottom and advance in a preset direction to the next position on the pool bottom comprises:

step S401: using the gyroscope and accelerometer to obtain the angle between the swimming pool cleaning robot and the pool bottom, and determining based on the angle whether the swimming pool cleaning robot has returned to the pool bottom;

step S402: if so, controlling the swimming pool cleaning robot to continue reversing for a second preset period to increase the distance from the swimming pool wall;

step S403: controlling the swimming pool cleaning robot to turn in a preset direction by a predetermined angle, and advancing the swimming pool cleaning robot to the next position on the pool bottom.

6. The method for cleaning swimming pool walls according to Claim 5, characterized in that, in step S402, controlling the swimming pool cleaning robot to continue reversing for a second preset period to increase the distance from the swimming pool wall further comprises:

when the swimming pool cleaning robot has reversed to a second preset distance from the swimming pool wall, controlling the swimming pool cleaning robot to turn 90°, and using the ultrasonic probe to detect whether there is a wall on the side of the swimming pool cleaning robot;

if there is, then upon the next reversal, directly switch to cleaning the adjacent wall;

if not, controlling the swimming pool cleaning robot to turn again, rotating 90° to return to the normal direction.

7. The method for cleaning swimming pool walls according to any one of Claims 1 to 6, characterized in that, before step S10, the method further comprises:

controlling the swimming pool cleaning robot to move forward at a set speed, without locking the forward direction during the process.

8. The method for cleaning swimming pool walls according to Claim 7, characterized in that, during the process of the swimming pool cleaning robot cleaning the swimming pool wall, if the swimming pool wall is arc-shaped, the swimming pool cleaning robot climbs upward along the tangent of the wall.

9. A swimming pool wall cleaning system, characterized in that the system comprises a memory, a processor, and a swimming pool wall cleaning program stored on the processor, wherein the swimming pool wall cleaning program, when executed by the processor, performs the steps of the method according to any one of Claims 1 to 8.

10. A computer-readable storage medium, characterized in that the computer-readable storage medium stores a swimming pool wall cleaning program, wherein the swimming pool wall cleaning program, when executed by a processor, performs the steps of the method according to any one of Claims 1 to 8.

METHOD, SYSTEM, AND MEDIUM FOR CLEANING SWIMMING POOL WALLS**Technical Field**

[0001] The present disclosure relates to the field of robotics technology, and more particularly, to a method, system, and medium for cleaning swimming pool walls.

Prior Art

[0002] Swimming pool cleaning robots are consumer-grade household robots used for cleaning swimming pools. Their function is similar to that of robotic vacuum cleaners; however, unlike robotic vacuum cleaners, swimming pool cleaning robots operate underwater and are designed to work within swimming pools. Cleaning swimming pools has always been a challenging task, as manual cleaning is cumbersome and time-consuming. The industry has generally begun to use robots for pool cleaning. Many companies are researching path planning algorithms to enable robots to clean pools along predetermined routes, thereby achieving higher cleaning efficiency.

[0003] Currently, some cleaning robots on the market lack path planning and clean in a completely random manner, resulting in relatively low cleaning efficiency. Some cleaning robots with path planning tend to follow repetitive routes or get stuck in certain areas, as many machines cannot adapt to different wall surfaces. When the machine follows a specific route, it is prone to slipping or displacement issues, and when encountering certain wall surfaces, it may repeatedly traverse the same route, causing it to remain stuck in a particular area.

Summary of the Invention

[0004] The primary objective of the present disclosure is to provide a method, system, and medium for cleaning swimming pool walls, aiming to ensure that the swimming pool cleaning robot can continuously clean along pool walls of various shapes without repeatedly cleaning the same location, thereby improving the efficiency of swimming pool cleaning.

[0005] To achieve the above objective, the present disclosure provides a swimming pool wall cleaning method, which is applied to a swimming pool cleaning robot. The method comprises the following steps:

[0006] step S10: acquiring the distance between the swimming pool cleaning robot located at the pool bottom and the swimming pool wall;

[0007] step S20: determining whether the distance between the swimming pool cleaning robot and the swimming pool wall satisfies a wall-climbing condition;

[0008] step S30: If the wall-climbing condition is satisfied, controlling the swimming pool cleaning robot to execute a wall-climbing strategy, wherein the wall-climbing strategy comprises: controlling the swimming pool cleaning robot to climb along the swimming pool wall up to the waterline of the swimming pool wall, and cleaning the pool wall in the crawling area of the swimming pool cleaning robot;

[0009] step S40: controlling the swimming pool cleaning robot to retreat from the waterline back to the pool bottom, and advancing in a preset direction to the next position on the pool bottom;

[0010] step S50: returning to execute steps S10 to S40 to clean the swimming pool wall of the next climbing area.

[0011] In a further technical solution of the present disclosure, the wall-climbing condition is that the distance between the swimming pool cleaning robot located at the pool bottom and the swimming pool wall is less than or equal to a first preset distance.

[0012] In a further technical solution of the present disclosure, the front end of the swimming pool cleaning robot is provided with an ultrasonic probe, and the step of acquiring the distance between the swimming pool cleaning robot located at the pool bottom and the swimming pool wall comprises:

[0013] using the ultrasonic probe to detect the distance between the swimming pool cleaning robot located at the pool bottom and the swimming pool wall.

[0014] In a further technical solution of the present disclosure, the swimming pool cleaning robot is provided with a water pump motor, a gyroscope, and an accelerometer, and in step S30, controlling the swimming pool cleaning robot to execute a wall-climbing strategy, wherein the wall-climbing strategy comprises: the step of controlling the swimming pool cleaning robot to climb along the swimming pool wall up to the waterline and clean the pool wall in the crawling area of the swimming pool cleaning robot comprises:

[0015] step S301: turning off the water pump motor and maintaining forward speed, so that when the swimming pool cleaning robot encounters the swimming pool wall, it changes from a horizontal state to a vertical state;

[0016] step S302: using the gyroscope and accelerometer to detect the attitude of the swimming pool cleaning robot, and when the robot reaches a nearly vertical state, turning on the water pump motor so that the swimming pool cleaning robot presses against and climbs up the swimming pool wall;

[0017] step S303: using the ultrasonic probe to detect the distance between the swimming pool cleaning robot and the water surface, until the robot climbs to the waterline, and remaining at the waterline for a first preset period.

[0018] In a further technical solution of the present disclosure, in step S40, controlling the swimming pool cleaning robot to retreat from the waterline back to the pool bottom and advance in a preset direction to the next position on the pool bottom comprises:

[0019] step S401: using the gyroscope and accelerometer to obtain the angle between the swimming pool cleaning robot and the pool bottom, and determining based on the angle whether the swimming pool cleaning robot has returned to the pool bottom;

[0020] Step S402: if so, controlling the swimming pool cleaning robot to continue reversing for a second preset period to increase the distance from the swimming pool wall;

[0021] Step S403: controlling the swimming pool cleaning robot to turn in a preset direction by a predetermined angle, and advancing the swimming pool cleaning robot to the next position on the pool bottom.

[0022] In a further technical solution of the present disclosure, in step S402, controlling the swimming pool cleaning robot to continue reversing for a second preset period to increase the distance from the swimming pool wall further comprises:

[0023] when the swimming pool cleaning robot has reversed to a second preset distance from the swimming pool wall, controlling the swimming pool cleaning robot to turn 90°, and using the ultrasonic probe to detect whether there is a wall on the side of the swimming pool cleaning robot;

[0024] if there is, then upon the next reversal, directly switch to cleaning the adjacent wall;

[0025] if not, controlling the swimming pool cleaning robot to turn again, rotating 90° to return to the normal direction.

[0026] In a further technical solution of the present disclosure, before step S10, the method further comprises:

[0027] controlling the swimming pool cleaning robot to move forward at a set speed, without locking the forward direction during the process.

[0028] In a further technical solution of the present disclosure, during the process of the swimming pool cleaning robot cleaning the swimming pool wall, if the swimming pool wall is arc-shaped, the swimming pool cleaning robot climbs upward along the tangent of the wall.

[0029] To achieve the above objectives, the present disclosure further provides a swimming pool wall cleaning system, comprising a memory, a processor, and a swimming pool wall cleaning program stored on the processor, wherein the swimming pool wall cleaning program, when executed by the processor, performs the steps of the method described above.

[0030] To achieve the above objectives, the present disclosure further provides a computer-readable storage medium storing a swimming pool wall cleaning program, wherein the swimming pool wall cleaning program, when executed by a processor, performs the steps of the method described above.

[0031] The beneficial effects of the swimming pool wall cleaning method, system, and medium of the present disclosure are as follows:

[0032] Through the above technical solutions, acquiring the distance between a swimming pool cleaning robot located

at the bottom of the pool and the swimming pool wall; determining whether the distance between the swimming pool cleaning robot and the swimming pool wall satisfies a wall-climbing condition; if the wall-climbing condition is satisfied, controlling the swimming pool cleaning robot to execute a wall-climbing strategy, wherein the wall-climbing strategy comprises: controlling the swimming pool cleaning robot to climb along the swimming pool wall up to the waterline of the swimming pool wall, and cleaning the pool wall in the crawling area of the swimming pool cleaning robot; controlling the swimming pool cleaning robot to retreat from the waterline back to the pool bottom, and advancing in a preset direction to the next position on the pool bottom; returning to execute steps described above to clean the swimming pool wall of the next climbing area, ensuring that the swimming pool cleaning robot can continuously clean along swimming pool walls of various shapes, and prevents the robot from repeatedly cleaning the same area, thereby improving the cleaning efficiency of the swimming pool.

Brief Description of the Drawings

[0033] In order to more clearly illustrate the technical solutions in the embodiments of the present disclosure or the prior art, a brief introduction to the drawings required for describing the embodiments or the prior art is provided below. It is obvious that the drawings described below are only some embodiments of the present disclosure. For those of ordinary skill in the art, other drawings can also be obtained based on the structures shown in these drawings without creative efforts.

[0034] FIG. 1 is a schematic diagram of the overall process of the first embodiment of the swimming pool wall cleaning method according to the present disclosure;

[0035] FIG. 2 is a schematic diagram of the detailed process of step S30;

[0036] FIG. 3 is a schematic diagram of the detailed process of step S40;

[0037] FIG. 4 is a schematic diagram of the steering of the swimming pool cleaning robot.

[0038] The objectives, functional features, and advantages of the present disclosure will be further described in conjunction with the embodiments and with reference to the accompanying drawings.

Detailed Description

[0039] The following provides a clear and complete description of the technical solutions in the embodiments of the present disclosure, in conjunction with the accompanying drawings. It is evident that the described embodiments are only part of the embodiments of the present disclosure and not all embodiments. Based on the embodiments in the present invention, all other embodiments obtained by one of ordinary skill in the art without creative work fall within the protection scope of the present invention.

[0040] The present disclosure provides a method for cleaning swimming pool walls, which is applied to a swimming pool wall cleaning robot. By adopting the swimming pool wall cleaning method of the present disclosure, the swimming pool cleaning robot can continuously clean along walls of different shapes, ensuring cleaning efficiency as much as possible and preventing the robot from repeatedly cleaning the same area.

[0041] Please refer to FIGS. 1 to 4. A preferred embodiment of the swimming pool wall cleaning method of the present disclosure comprises the following steps:

[0042] step S10: acquiring the distance between the swimming pool cleaning robot located at the pool bottom and the swimming pool wall;

[0043] In this embodiment, the front end of the swimming pool cleaning robot is provided with an ultrasonic probe. Step S10 specifically comprises:

[0044] using the ultrasonic probe to detect the distance between the swimming pool cleaning robot located at the pool bottom and the swimming pool wall.

[0045] step S20: determining whether the distance between the swimming pool cleaning robot and the swimming pool wall satisfies a wall-climbing condition.

[0046] As an implementation, in this embodiment, the wall-climbing condition is that the distance between the swimming pool cleaning robot at the bottom of the pool and the swimming pool wall is less than or equal to a first preset distance. This first preset distance can be set based on experience, for example, set to 40 cm.

[0047] When the ultrasonic probe detects that the distance between the swimming pool cleaning robot and the swimming pool wall is less than or equal to 40 cm, the wall-climbing strategy program is activated.

[0048] step S30: If the wall-climbing condition is satisfied, controlling the swimming pool cleaning robot to execute a wall-climbing strategy, wherein the wall-climbing strategy comprises: controlling the swimming pool cleaning robot to climb along the swimming pool wall up to the waterline of the swimming pool wall, and cleaning the pool wall in the crawling area of the swimming pool cleaning robot;

[0049] In this embodiment, the swimming pool cleaning robot is provided with a water pump motor, a gyroscope, and an accelerometer, and in step S30, controlling the swimming pool cleaning robot to execute a wall-climbing strategy, wherein the wall-climbing strategy comprises: the step of controlling the swimming pool cleaning robot to climb along the swimming pool wall up to the waterline and clean the pool wall in the crawling area of the swimming pool cleaning robot comprises:

[0050] step S301: turning off the water pump motor and maintaining forward speed, so that when the swimming pool cleaning robot encounters the swimming pool wall, it changes from a horizontal state to a vertical state.

[0051] It should be noted that, in this embodiment, when the water pump motor is on, a negative pressure is formed between the bottom of the swimming pool cleaning robot and the pool bottom or wall, causing the robot to adhere to the pool bottom or wall under pressure, thereby preventing it from falling off the wall. When the water pump motor is turned off, the negative pressure between the bottom of the robot and the pool bottom or wall disappears.

[0052] step S302: using the gyroscope and accelerometer to detect the attitude of the swimming pool cleaning robot, and when the robot reaches a nearly vertical state, turning on the water pump motor so that the swimming pool cleaning robot presses against and climbs up the swimming pool wall.

[0053] After detecting via the gyroscope and speedometer that the robot's attitude has changed from a horizontal state to a nearly vertical state, turn on the water pump motor to allow the robot to climb up the wall.

[0054] step S303: using the ultrasonic probe to detect the distance between the swimming pool cleaning robot and the water surface, until the robot climbs to the waterline, and remaining at the waterline for a first preset period.

[0055] After the robot climbs up the wall, use the ultrasonic probe to detect the distance between the robot and the water surface until it reaches the waterline (a very small distance indicates arrival at the waterline), and remain at the waterline for 1–120 seconds.

[0056] step S40: controlling the swimming pool cleaning robot to retreat from the waterline back to the pool bottom, and advancing in a preset direction to the next position on the pool bottom;

[0057] After cleaning at the waterline is completed, the robot begins to retreat from the waterline down to the pool bottom, and advances to the next position on the pool bottom in a preset direction.

[0058] Specifically, step S40 includes the following steps:

[0059] step S401: using the gyroscope and accelerometer to obtain the angle between the swimming pool cleaning robot and the pool bottom, and determining based on the angle whether the swimming pool cleaning robot has returned to the pool bottom.

[0060] After cleaning at the waterline is completed, the robot begins to retreat from the waterline. By fusing data from the gyroscope and speedometer, the calculated angle is used to determine whether the robot has returned to the flat pool bottom. When the robot has returned to the flat pool bottom, the angle between the plane of the bottom of the robot and the plane of the pool bottom is 0 degrees.

[0061] Step S402: if so, controlling the swimming pool cleaning robot to continue reversing for a second preset period to increase the distance from the swimming pool wall.

[0062] The second preset period may be set based on practical experience, for example, 1–30 seconds. The purpose of controlling the robot to continue retreating for the second preset period in this embodiment is to increase the distance between the robot and the pool wall, thereby facilitating the handling of different obstacles or walls.

[0063] Step S403: controlling the swimming pool cleaning robot to turn in a preset direction by a predetermined angle, and advancing the swimming pool cleaning robot to the next position on the pool bottom.

[0064] After the robot continues to retreat for the second preset period, control the robot to turn a predetermined angle in a preset direction, for example, turn left or right by 5° to 45°, to switch to the next section of the wall for cleaning.

[0065] step S50: returning to execute steps S10 to S40 to clean the swimming pool wall of the next climbing area.

[0066] Furthermore, in this embodiment, after step S402 (controlling the robot to continue retreating for the second preset period to increase the distance from the pool wall), the following step is also included:

[0067] when the swimming pool cleaning robot has reversed to a second preset distance from the swimming pool wall, controlling the swimming pool cleaning robot to turn 90°, and using the ultrasonic probe to detect whether there is a wall on the side of the swimming pool cleaning robot.

[0068] if there is, then upon the next reversal, directly switch to cleaning the adjacent wall.

[0069] if not, controlling the swimming pool cleaning robot to turn again, rotating 90° to return to the normal direction.

[0070] In this embodiment, when the swimming pool cleaning robot has retreated to the pool bottom and is at a certain distance from the pool wall, the swimming pool cleaning robot is controlled to turn 90°. Ultrasonic detection is then used to determine whether there is a wall on the side of the swimming pool cleaning robot. If a wall is detected, the next time the robot descends after reversing, it will directly switch to cleaning the wall surface. After the detection is completed, the swimming pool cleaning robot is controlled to turn again, returning to its normal direction to continue executing the original program. This wall detection operation may be performed every time, or after a greater number of cycles; the present disclosure does not limit this aspect.

[0071] Further, in this embodiment, before step S10, the following is also included: controlling the swimming pool cleaning robot to move forward at a set speed, without locking the forward direction during the process.

[0072] In this embodiment, during the process of the swimming pool cleaning robot cleaning the swimming pool wall, if the swimming pool wall is arc-shaped, the swimming pool cleaning robot climbs upward along the tangent of the wall.

[0073] In this embodiment, the swimming pool cleaning robot is driven to displace in a set direction by changing its angle. Regardless of whether the wall is flat, curved, or of another irregular shape, the swimming pool cleaning robot can move forward smoothly to clean. Each time it climbs the wall, it ascends along the tangent of the wall, thereby achieving self-adaptation to different wall shapes.

[0074] The beneficial effects of the swimming pool wall cleaning method of the present disclosure are as follows:

[0075] Through the above technical solutions, acquiring the distance between a swimming pool cleaning robot located at the bottom of the pool and the swimming pool wall; determining whether the distance between the swimming pool cleaning robot and the swimming pool wall satisfies a wall-climbing condition; if the wall-climbing condition is satisfied, controlling the swimming pool cleaning robot to execute a wall-climbing strategy, wherein the wall-climbing strategy comprises: controlling the swimming pool cleaning robot to climb along the swimming pool wall up to the waterline of the swimming pool wall, and cleaning the pool wall in the crawling area of the swimming pool cleaning robot; controlling the swimming pool cleaning robot to retreat from the waterline back to the pool bottom, and advancing in a preset direction to the next position on the pool bottom; returning to execute steps described above to clean the swimming pool wall of the next climbing area, ensuring that the swimming pool cleaning robot can continuously clean along swimming pool walls of various shapes, and prevents the robot from repeatedly cleaning the same area, thereby improving the cleaning efficiency of the swimming pool.

[0076] To achieve the above objectives, the present disclosure further provides a swimming pool wall cleaning system, comprising a memory, a processor, and a swimming pool wall cleaning program stored on the processor, wherein the swimming pool wall cleaning program, when executed by the processor, performs the steps of the method described above, which will not be repeated here.

[0077] To achieve the above objectives, the present disclosure further provides a computer-readable storage medium storing a swimming pool wall cleaning program, wherein the swimming pool wall cleaning program, when executed by a processor, performs the steps of the method described above, which will not be repeated here.

[0078] The above descriptions are only preferred embodiments of the present disclosure and should not be construed

as limiting the scope of the patent. Any equivalent structural changes made based on the conception of the present disclosure, or direct/indirect application in other related technical fields, are all included within the scope of patent protection of the present disclosure.

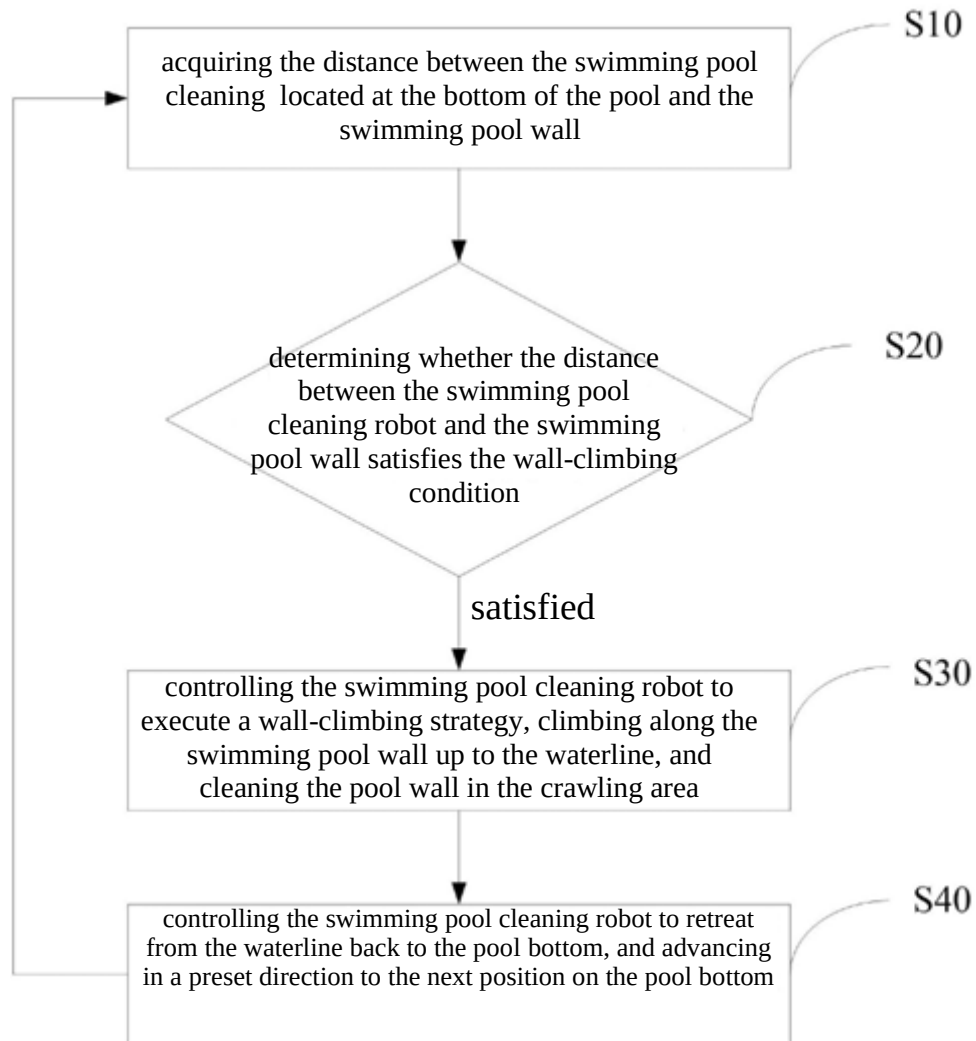


FIG. 1

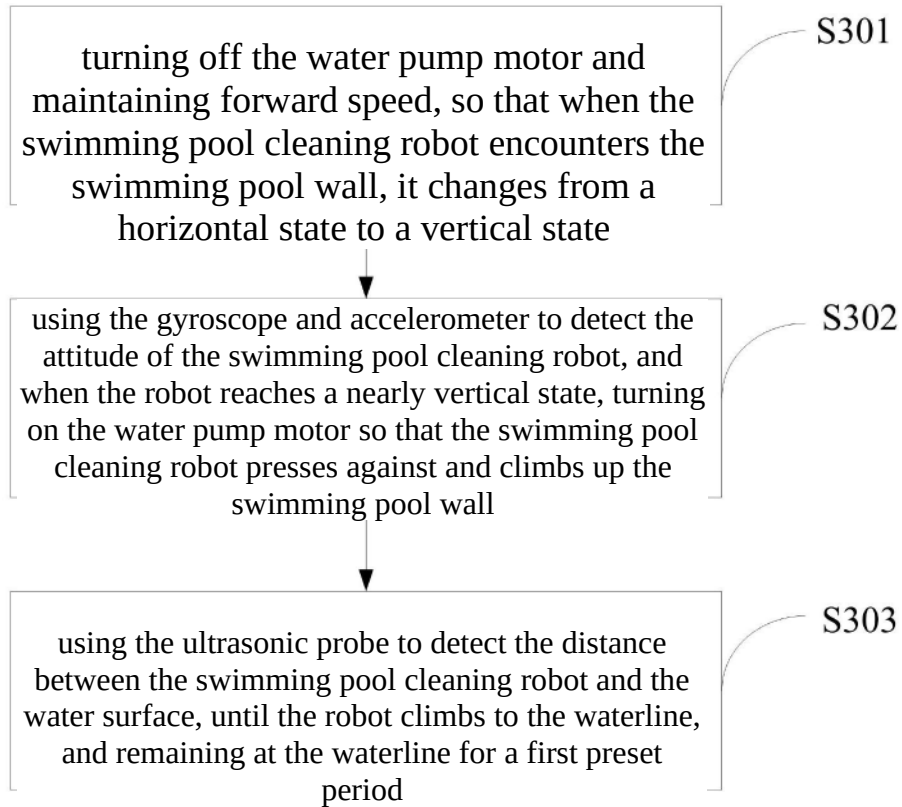


FIG. 2

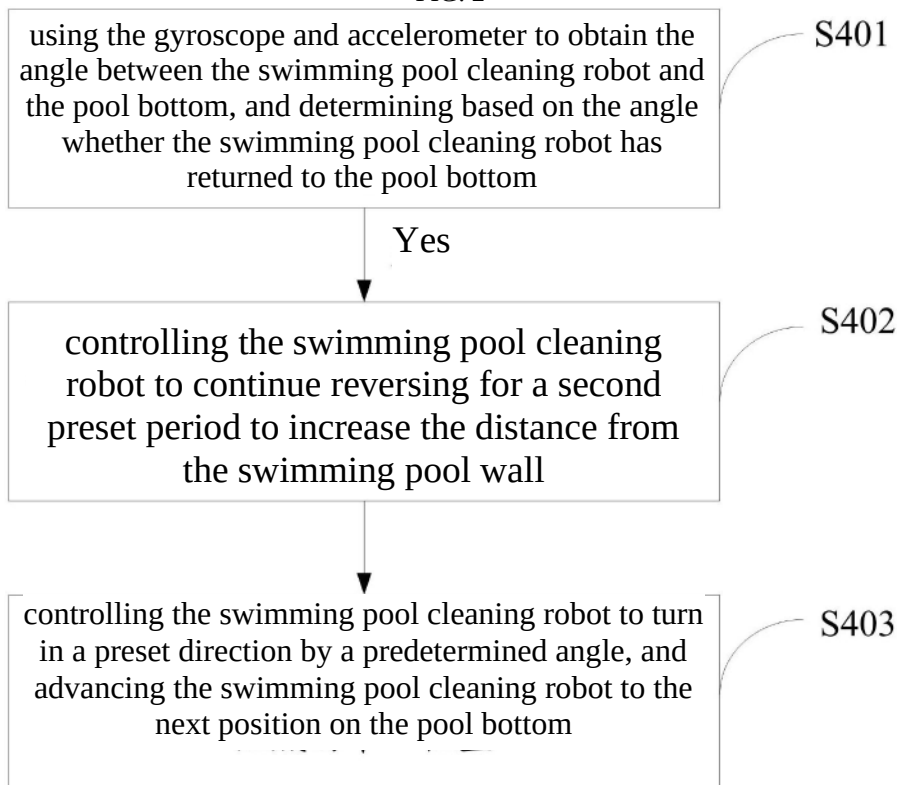


FIG. 3

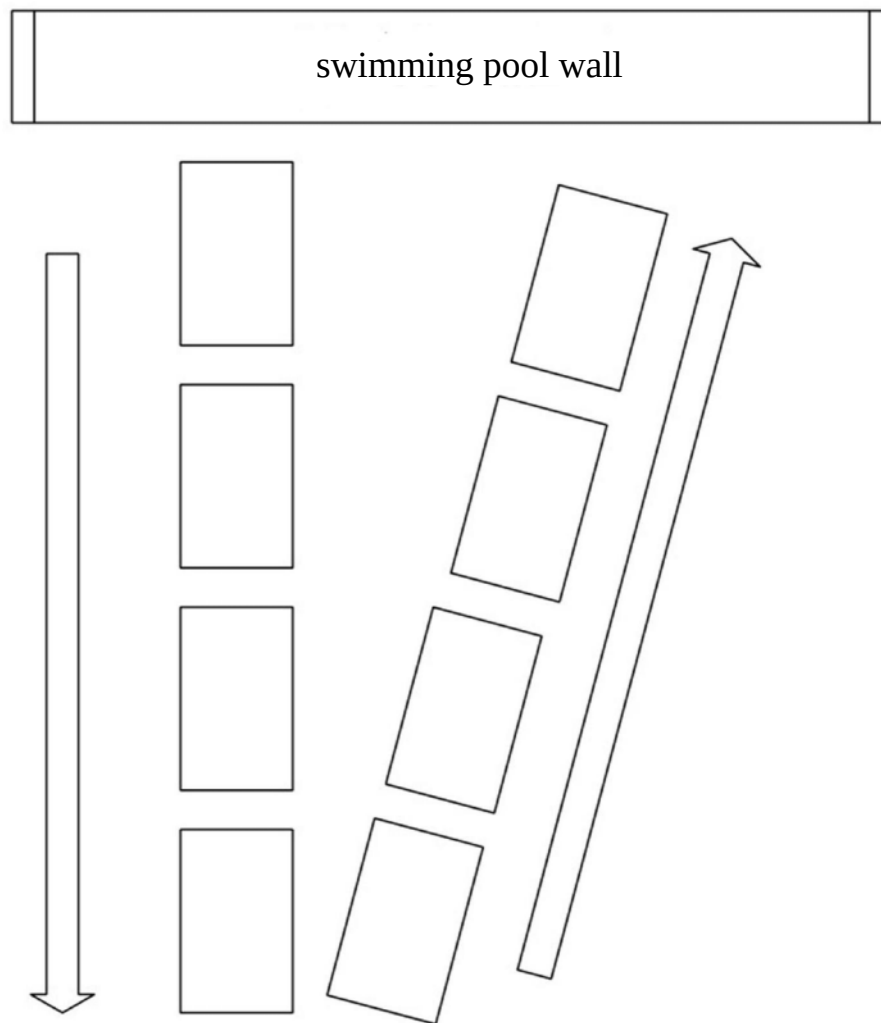


FIG. 4