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ARTICLE-WINNING GAME DEVICE

Abstract

An article-winning game device includes: a game field that includes a placement area and a dropping slot; a crane that includes an arm; an operating panel that receives an operation by a player; sensors that detect passage of at least one of the articles, and a data processor that: drives the crane in response to the operation, determines whether the at least one of the articles passing through the dropping slot is a first article to be acquired, and sets, based on a user instruction, an acquisition range with respect to the first article. Upon determining that the number of passage reactions with respect to the at least one of the articles passing through the dropping slot is within the acquisition range, the data processor determines that the at least one of the articles passing through the dropping slot is the first article.

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Background/Summary

BACKGROUND

Technical Field

[0001] The present invention relates to an article winning game in which articles such as prizes are acquired by moving them.

Description of Related Art

[0002] Many game centers have crane game machines (article acquisition game machines) has been installed. Crane game machines have a stage (game field) inside the housing, and special prizes (article) such stuffed toys, sweets, and the like are placed on the stage. Players use a joystick or various buttons to operate the crane (acquisition mechanism). Upon successfully grabbing a prize with the crane and move it to the dropping slot, players can win prizes (see Patent Document 1).

PATENT LITERATURE

[0003] [Patent Literature 1] JP 2021-145937 A

TECHNOLOGICAL PROBLEM TO BE SOLVED BY INVENTION

[0004] In a crane game machine, in order to create a so that the tip of the crane arm can be inserted under prizes, there are times when balls or other gap-filling components are placed on the stage beforehand. On top of the many balls spread out, prizes are placed thereon. In this configuration, the crane sometimes grabs balls instead of prizes and carries and drops them into the dropping slot accidentally. For business purposes, the operator needs to be aware of the payout rate of the crane game machine, so it is desirable for the operator to be able to recognize whether a prize or an article other than a prize falls into the dropping slot. Also, since there are various prizes that are inserted into the crane game machine, it is necessary to be able to flexibly accommodate a variety of prizes.

SUMMARY

[0005] One or more embodiments of the present invention provide a technology for easily detecting whether articles that have fallen into the dropping slot of the crane game machine are prizes or not.

[0006] In one aspect of the present invention, an article-winning game device includes: a game field that is disposed in a play space and includes: a placement area where articles are placed; and a dropping slot through which at least one of the articles may pass, a crane that comprises an arm for acquiring at least one of the articles, an operating panel that receives an operation by a player, sensors that are arranged in the dropping slot and detect passage of the at least one of the articles; and a data processor that: drives the crane in response to the operation, determines whether the at least one of the articles passing through the dropping slot is a first article to be acquired, and sets, based on a user instruction, an acquisition range with respect to the first article, where the acquisition range indicates a range of a number of passage reactions, and the number of passage reactions indicates a number of sensors, among the sensors, that react to an article passing through

the dropping slot.

[0007] Upon determining that the number of passage reactions with respect to the at least one of the articles passing through the dropping slot is within the acquisition range, the data processor determines that the at least one of the articles is the first article.

[0008] According to one or more embodiments of the present invention, the article-winning game device will be able to more easily detect the dropping of prizes using a simple configuration.

Description

BRIEF DESCRIPTION OF DRAWINGS

[0009] FIG. 1 is a perspective view of a crane game machine.

[0010] FIG. 2 is a functional block diagram of the crane game machine.

[0011] FIG. 3 is a schematic diagram showing the placement state of prizes in the placement area.

[0012] FIG. 4 is a perspective view of the base.

[0013] FIG. 5 is a perspective view of a prize sensor.

[0014] FIG. 6 is a front side view of a prize sensor.

[0015] FIG. 7 is a schematic diagram for explaining a method for detecting prizes and color balls.

[0016] FIG. 8 is a diagram showing a setting screen.

[0017] FIG. 9 is a flowchart showing the process when an article passes through the dropping slot.

[0018] FIG. 10 is a schematic diagram showing the relationship in size between unnecessary articles and prizes in a modified example.

[0019] FIG. 11 is a perspective view of a prize sensor in a modified example.

[0020] FIG. 12 is a graph showing the change over time in the number of passage reactions in the modified example.

[0021] FIG. 13 is a front side of view of the prize sensor in a modified example.

[0022] FIG. 14 is a first top view of the prize placement stand composed of a plurality of panels.

[0023] FIG. 15 is a second top view of the prize placement stand composed of a plurality of panels.

DETAILED DESCRIPTION OF EMBODIMENTS

[0024] FIG. 1 is a perspective view of crane game machine **100**.

[0025] The crane game machine **100** is generally installed in amusement facilities, such as amusement parks, game centers, and the like. As shown in FIG. 1, an explanation will be provided the crane game machine **100** as seen by the player with the left and right directions being the X direction, the front and back directions being the Y direction, and the up and down directions being the Z direction.

[0026] The crane game machine **100** includes a rectangular parallelepiped base table **102** and a box-shaped prize storage part **104** provided on the rectangular parallelepiped base table **102**. A play space S is formed inside the prize storage part **104**, and a prize placement table **106** (game field) is disposed in this play space S. In addition to prizes such as stuffed toys, miscellaneous goods, and the like, color balls for decorating the prize placement table **106** are disposed (described below) on the prize placement table **106**. A crane **108** is provided above the prize placement table **106**. The crane **108** can move back and forth, left and right, and up and down in the play space S to grab/release prizes.

[0027] The prize storage part **104** has a front side, a left side, and a right side, which are all made of transparent glass. This was done with consideration given to the visibility of the prizes from outside. A camera may be installed on the ceiling of the prize storage part **104** to photograph the prize placement table **106** from above. A glass door **110** is provided on the front of the prize storage part **104**, so that a staff member (store employee) can open the door **110** and place prizes in the prize storage part **104**.

[0028] The prize placement table **106** is sectioned into a placement area **112** (a first area) and a

dropping slot **114** (a second area). The prizes are placed in the placement area **112**, and the player can win prizes if they can carry them from the placement area **112** to the dropping slot **114**. A shielding plate **128** is installed between the placement area **112** and the dropping slot **114**. The shielding plate **128** prevents prizes or color balls in the placement area **112** from falling down into the dropping slot **114**.

[0029] On the front surface of the base table **102**, a prize removal opening **116** is formed for removing prizes dropped from the dropping slot **114**.

[0030] An operating unit (or operating panel) **118** and a setting display unit **120** are provided on the front side of the base table **102**. To start a game, a player inserts a coin into the coin slot or touches an IC card that has been charged with electronic money. Below, with respect to the crane game machine **100**, the surface on which the operating unit **118** and the like are installed, in other words, the surface on which the player is located, is called the “front side”, and the surface on the back side (the side in the positive Y-axis direction) as seen from the player is called the “back side”.

[0031] The control unit **118** includes a control stick **122** for moving the crane **108** back and forth and left and right to determine the point of descent, and a grab button **124** for lowering the crane **108** to grab prizes.

[0032] A touch panel is provided to the setting display unit **120**. The setting display unit **120** functions as a “setting input unit” where the operator (store employee) enters game setting information, and functions as a “display unit” that displays information about the game, such as how to operate the operating unit **118**, game results, and the like. The crane game machine **10** also includes a speaker (not illustrated), an external connection terminal, and the like.

[0033] The crane **108** has three arms **126** capable of grasping and releasing prizes. The number of arms **126** may be two or four or more. The crane **108** includes a motor that drives the arms **126** to open and close. The crane **108** grasps and releases prizes by opening and closing the arms **126**.

[0034] The crane **108** can move along a guide rail (not illustrated) installed above the prize storage part **104**, and is driven by a crane driver **130** (described below). The crane driver **130** includes a moving mechanism that drives the crane **108** in the horizontal (X-direction) and in the vertical direction (Y direction) and a lifting-lowering mechanism that drives the crane **108** in the up-down direction (Z direction). The movement mechanism includes an X-direction motor and a Y-direction motor. The lifting-lowering mechanism includes a Z-direction motor. The crane driver **130** can drive the crane **108** to be able to move to any position in the play space S.

[0035] The crane **108** in one or more embodiments is the so-called “triple catcher” type, which has three arms **126**. If players complete the game within the time limit, for example, the crane **108** can be freely moved forward, backward, left, and right by the operating stick **122**. The player moves the crane **108** above the prize and then presses the grab button **124**. When the grab button **124** is pressed, the crane **108** will descend. The crane **108** automatically moves the arms **126** in the closing direction (hereinafter referred to as “grabbing” or “grabbing action”) after descending a predetermined distance. At this time, the crane **108** is able to use the arms **126** to grab the relatively large prizes at the descent point. In addition, when the grip button **124** is pressed again while the crane **108** is descending, the arms **126** can be caused to perform a grabbing action at the time the grip button **124** is pressed.

[0036] While maintaining the grabbing action, the crane **108** will rise, and then automatically move to the dropping slot **11**. The crane **108** will move the arms **126** in the releasing direction (hereinafter referred to as “releasing” or “releasing action”) above the dropping slot **114**. If a prize is firmly grasped, the prize carried by the crane **108** to the dropping slot **114** and then dropped from above the dropping slot **114** (crane game success). On the other hand, if the arms **126** are not able to grasp the prize firmly, the prize may fall from the crane **108** before the crane **108** reaches directly above the dropping slot **114** (crane game failure).

[0037] The operator can also rotate the crane **108** horizontally (rotates around the Z axis). As shown in FIG. **1**, while the home position is when one of the three arms **126** is on the player's side,

the operator can adjust the horizontal rotation angle of the crane **108** in light of the prize arrangement situation. A design cover **132** is installed on the front surface of the crane **108**. In one or more embodiments, a logo (advertising information) indicating the product name is printed on the design cover **132**.

[0038] A plurality of optical sensors are installed inside dropping slot **114**. The optical sensors detect prizes falling into the dropping slot **114** (hereinafter, also simply referred to as “prize acquisition”). In addition, while these optical sensors are configured to be able to distinguish whether color balls or prizes have dropped, the details will be described later in relation to FIG. 4, etc.

[0039] At the rear of the prize storage part **104**, one or more display bars **134** are installed. The display bar **134** is a metal bar extending in the X direction, and prizes for display can be placed inside. The operator opens the door **110** and drops it into the dropping slot **114** to place display bar **134** on the back side. The number and height of the bars **134** may be freely determined.

[0040] A storage box for storing color balls and other equipment is provided at the back of the dropping slot **114**.

[0041] FIG. 2 is a functional block diagram of the crane game machine **100**.

[0042] Each constituent element of the crane game machine **100** is realized by hardware that includes arithmetic units such as a CPU (Central Processing Unit) and various co-processors, memory and storage devices, and wired or wireless communication lines that connect these together, as well as software that is stored in the storage device and provides processing instructions to the arithmetic units. A computer program or instructions may be composed of a device driver, an operating system, various application programs that are located in the upper layer of these, and libraries that provide common features to these programs or instructions. Each block described below are composed of functional block units instead of hardware units.

[0043] The crane game machine **100** includes a user interface processing unit (or user interface processor) **140**, a mechanism driving unit **142**, a data processing unit (or data processor) **144**, a communication unit **160** (or communication interface), and a data storage unit (or data storage) **146**.

[0044] The user interface processing unit **140** receives operations from a player via various input devices, and is also responsible for user interface-related processing such as image display and audio output. The mechanism driving unit **142** drives the various acquisition mechanisms such as the crane **108**. The data storage unit **146** stores various data. The data processing unit **144** executes various processes based on the input from the user interface processing unit **140** and the data stored in the data storage unit **146**. The communication unit **160** is responsible for communication with external devices such as the store terminal used by the operator. The data processing unit **144** also functions as an interface for the mechanism driving unit **142**, user interface processing unit **140**, communication unit **160**, and data storage unit **146**.

[0045] The user interface processing unit **140** includes an output unit **150** that outputs various information to the input unit **148**. The output unit **150** includes a display unit **162** that outputs images. The display unit **162** displays various images on a display device such as the setting display unit **120**.

[0046] The input unit **148** receives setting input from an operator (user) via the setting display unit **120**. The input unit **148** also receives operation input from the player via the operating unit **118**. The crane game machine **100** has two setting modes. In the settings mode, the operator can configure various settings (describe below). The settings for delivery of prizes or installation of the display bar **134** are also set while in the settings mode. In the play mode, a player operates the operating unit **118** to play the crane game.

[0047] The mechanism driving unit **142** includes the crane driver **130** and a group of sensors **152**. As mentioned above, the crane driver **130** is used to move the crane **108** and to grab and release the arms **126**. The group of sensors **152** corresponds to the optical sensors (described below) and the

like at the dropping slot **114**.

[0048] The data processing unit **144** includes the movement control unit **154**, the acquisition determination unit **156**, the settings unit **158**, an inventory management unit **164**, and a replenishment request unit **166**.

[0049] The movement control unit **154** instructs the crane **108** to move, grab, and release according to the operation instructions from the operating unit **118**. The acquisition determination unit **156** determines whether the prize has fallen into the dropping slot **114**, or in other words, whether the crane game has been successful. In addition, the acquisition determination unit **156** also determines whether the article that has passed through the dropping slot **114** is a prize (a first article) or a color ball (a second article) (described below). In the settings mode, the operator can set the size of prizes. The settings unit **158** is used to set the detection criteria for prizes or color balls according to the operator's input (described later). The inventory management unit **164** manages the number of prizes remaining on the prize placement table **106** (hereafter simply referred to as "the remaining number"). When the remaining number falls below the specified threshold T, the replenishment request unit **166** instructs the communication unit **160** to send a request for replenishment of the prizes to the store terminal. The operator can freely set the threshold T in the settings mode.

[0050] The data storage unit **146** stores information such as the crane game program, crane game settings, and game play results (payout rate).

[0051] FIG. **3** is a schematic diagram showing the placement state of a prize **172** in the placement area **112**.

[0052] A plurality of color balls **174** are laid out in the placement area **112**. Various prizes **172** such as stuffed toys and the like are placed on a layer of color balls **174**. In this case, the dimensions of the prize **172** in length, width, and depth are all larger than those of the color balls **174**. The color balls **174** are vinyl balls having elasticity. One of the purposes of laying down the color balls **174** is to enhance the decorative quality of the play space S. In addition, because there is a possibility that the arms **126** or the placement area **112** will become damaged if the arms **126** come into direct contact with the placement area **112**, a layer of color balls **174** is formed to prevent contact between the placement area **112** and the arms **126**.

[0053] In addition, the layers of color balls **174** create a gap underneath the prizes **172**, making it easier to insert the arm **126** underneath prize **172**s. Therefore, by creating a layer of color balls **174**, the arms **126** will be able to firmly grab prizes **172**.

[0054] The prize that the player can obtain is the prize **172**, and the color balls **174** are not originally intended to be acquired as prizes. However, in rare cases, color balls **174** may be picked up by the arms **126** and fall into the dropping slot **114**. The operator needs to be aware of the payout rate of the crane game machine, i.e. the difficulty of acquiring prizes. For this reason, crane game machines **100** need to have a feature that detects the fall of prizes **172**. There is a possibility that when color balls **174** fall into the dropping slot **114**, it will be mistakenly recognized as the acquisition of the prize **172**. The following explains the structure for easily distinguishing between color balls **174** or a prize **172** that has fallen into the drop slot **114**.

[0055] FIG. **4** shows a perspective view of the base table **102**. FIG. **5** shows the diagonal of the prize sensor **176**.

[0056] The prize sensor **176** is disposed on the inner wall surface of the dropping slot **114**. The prize sensor **176** includes a first detection plate **176a** (a first detection unit) and a second detection plate **176b** (a second detection unit) that face each other. There are 50 optical sensors each on the first detection plate **176a** and the second detection plate **176b**, for a total of 100 optical sensors.

[0057] Alternatively, instead of attaching the first detection plate **176a** and second detection plate **176b** to the inner wall of the dropping slot **114**, the optical sensor **178** may be attached directly to the inner wall of the dropping slot **114**, causing a portion of the inner wall to function as a "detector".

[0058] On the second detection plate **176b**, 50 light-emitting elements **178b** (optical sensors **178**)

are arranged in a single line at 7-mm intervals. On the first detection plate **176a**, 50 light-receiving elements **178a** (optical sensors **178**) are arranged in a single line at 7-mm intervals. That is, the light-receiving elements **178a** and the light-emitting elements **178b** are a pair or the like, and the light emitted from the nth light-emitting element **178b** is received by the nth light-receiving element **178a**, which is located opposite to this light-emitting element **178b**. From now on, the nth light-receiving element **178a** will be written as “light-receiving element **178a(n)**”. The same is true for the light-emitting elements **178b**.

[0059] The 50 light-emitting elements **178b** arranged on the second detection plate **176b** emit light one by one, from the light-emitting element **178bs** (1) at one end of the second detection plate **176b** to the light-emitting elements **178b** (60) at the other end. Therefore, the 50 light-receiving elements **178a** arranged on the first detection plate **176a** also receive light in sequence. The method in which light is emitted sequentially from the light-emitting element **178b** (1) to the light-emitting element **178b** (60), followed by light being received sequentially from light-receiving element **178a** (1) to the light-emitting element **178b** (60) is called the “scan method”.

[0060] When a prize **172** or a color ball **174** passes through the dropping slot **114**, because the article will block or shield the light from the light-emitting element **178b**, part of the light-receiving element **178a** will be unable to detect the light at the timing when it should be receiving the light. The blocking or shielding of light to the light-receiving elements **178a** by an article is called a “passage reaction”. The number of light-receiving elements **178a** that detect a passage reaction is called the “number of passage reactions”. In one or more embodiments, because the scanning speed is sufficiently high compared to the falling speed of an article, a passage reaction occurs in a plurality of light-receiving elements **178a** during the article's passage.

[0061] The acquisition determination unit **156** controls the emission of the light-emitting elements **178b** by the scanning method. In addition, the acquisition determination unit **156** detects the number of passage reactions from the light-receiving elements **178a**, and determines whether an article has passed through the dropping slot **114**, and whether the article that has passed through the dropping slot **114** is a prize **172** or a color ball **174** based on the number of passage reactions. As mentioned above, because the optical sensors **178** are arranged at 5-mm intervals, in theory it should be possible to detect the passage of articles with a width of 7 mm or more. However, in one or more embodiments, it is assumed that objects with a width of 30 mm or more will be detected.

[0062] FIG. 7 is a schematic diagram for explaining a method for detecting the prize **172** and the color ball **174**.

[0063] In one or more embodiments, the diameter of the color balls **174** is assumed to be 30 mm. In addition, the width of the prize **172** is assumed to be at least 80 millimeters.

[0064] When an article such as a prize **172** passes through the dropping slot **114**, a passage reaction is detected by some of the light-receiving elements **178a**. When a passage reaction is detected, the acquisition determination unit **156** recognizes that a prize **172** or a colored ball **174** has passed in front of the optical sensors **178**.

[0065] Since the diameter of the color balls **174** is 30 mm, it is estimated that the number of passage reactions when the color balls **174** pass through the dropping slot **114** is about 4 to 5. On the other hand, since the width of the prize **172** is more than 80 mm, the number of passage reactions when the prize **172** falls into the dropping slot **114** will be 11 or more. When a passage reaction is detected by any of the optical sensors **178**, if the number of passage reactions is 5 or less, the acquisition determination unit **156** determines that the color balls **174** have dropped, and if the number is 11 or more, the acquisition determination unit **156** determines that the prize **172** has dropped.

[0066] With this type of control method, it is possible to recognize whether the prize **172** or a color ball **174** has dropped based on the number of passage reactions detected by the plurality of optical sensors **178** by using a simple configuration.

[0067] Since the shapes of the prizes **172** are various, the detection criteria based on the number of

passage reactions need to be set flexibly depending on the prize. The number of passage reactions also differs depending on the direction in which the prizes **172** fall. In addition to the color balls **174**, there are also other articles that are not eligible for collection (hereafter referred to as “unwanted articles”) that are sometimes put into the prize storage part **104**. Therefore, the criteria for detecting unwanted articles must be adjusted according to the type of unwanted article.

[0068] FIG. **8** is a screen diagram of the settings screen **180**.

[0069] In the settings mode, the display unit **162** displays a settings screen **180**. The settings screen **180** is displayed on the settings display unit **120**. The settings screen **180** includes a sensor on button **182** and a size settings area **184**. When the sensor ON button **182** is set to ON, the prize sensor **176** becomes enabled. The size settings area **184** is the area for setting the size of the prize **172**. The operator sets the size of the prizes **172** to be inserted into the crane game machine **100** in the size settings area **184**. The size of the prize **172**, or in other words, the width, depends on the orientation of the prize **172**. Therefore, it is best to set the size based on the minimum width of the prize **172**. In FIG. **8**, it is set to “40 mm or more”.

[0070] The settings unit **158** sets the range of the number of passage reactions corresponding to the prize **172** (hereinafter referred to as the “acquisition range”) corresponding to “40 mm”. For example, the option “40 mm or more” is pre-assigned to the acquisition range “5 or more passage reactions ($7 \times 5 = 35$ mm or more)”. Therefore, when the setting is “40 mm or more” as shown in FIG. **8**, the acquisition determination unit **156** determines that the prize **172** has been acquired if the number of passage reactions when an article passes through the dropping slot **114** is five or more. On the other hand, if the number of passage reactions is outside the acquisition range, i.e., if it is four or less, the article that passed through the dropping slot **114** is determined to be an unwanted article such as color balls **174**.

[0071] FIG. **9** is a flowchart showing the processing process when an article passes through the dropping slot **114**.

[0072] When a passage reaction is detected in any of the light-receiving elements **178a** on the first detection plate **176a**, the processing shown in FIG. **9** is started. If the number of responses is within the acquisition range (Y in **S10**), the acquisition determination unit **156** determines that a prize has been acquired. If the number of passage reactions is outside the acquisition range (N in **S10**), the acquisition determination unit **156** determines that color balls **174** have fallen instead of the prize **172**.

[0073] If a prize is obtained (**S10** Y), the acquisition determination unit **156** instructs the output unit **150** to execute a performance corresponding to the prize acquisition (hereinafter referred to as “success performance”) (**S12**). As a success performance, for example, an image on the display of the settings display unit **120**, etc. can be displayed to congratulate the player on winning a prize, or a sound can be output. In addition, the prize acquisition determination unit **156** updates the so-called “payout rate”, that is, the rate of the number of times the prize was successfully acquired relative to the number of attempts at the crane game, whenever a prize is acquired.

[0074] The number of prizes **172** in stock is set in advance whenever the operator inserts a prize **172** into the crane game machine **100**. The prize acquisition determination unit **156** updates the remaining number of prizes **172** each time a prize acquisition is detected (**S14**). When the remaining number falls below the threshold T (Y in **S16**), the replenishment request unit **166** instructs the communication unit **160** to send a replenishment request to the store terminal (**S18**). The replenishment request includes the ID of the crane game machine **100** and the type of prize **172**. When the operator receives a replenishment request, the operator replenishes prizes **172**. In other words, whenever the number of prizes **172** remaining decreases due to prize acquisition, a replenishment request is automatically sent to the operator, which prevents the crane game machine **100** from running out of prizes **172**. If the remaining number is greater than the threshold T, that is, if there are enough prizes left in the crane game machine **100** (N in **S16**), the processing in **S18** is skipped.

[0075] Whenever a prize is successfully acquired (Y in **S10**), the game will end even if the time limit has not yet been reached (**S20**). If a prize is not acquired (N in **S10**), the game will continue until the time limit expires or until success in acquiring a prize has been achieved.

[0076] The crane game machine **100** has been described above based on one or more embodiments. In one or more embodiments, the placement area **112** is covered with multicolored color balls **174**, and the prizes **172** are placed on the layer of color balls **174**. For this reason, it is also possible that the color balls **174**, rather than prizes **172**, fall into the dropping slot **114**. A prize sensor **176** formed on the inner wall of the dropping slot **114** is equipped with a plurality of optical sensors **178**. Depending on the number of responses from the optical sensor **178**, the acquisition determination unit **156** can determine whether a prize **172** or a color ball **174** has dropped.

[0077] The operator sets the size of the prize **172** in the settings screen **180**, and the acquisition determination unit **156** sets the acquisition range according to the set size. The operator can flexibly set an appropriate acquisition range to match the wide variety of prizes **172**.

[0078] Whenever a prize is won, the inventory management unit **164** updates the remaining number of prizes **172**. The replenishment request unit **166** sends a replenishment request to the store terminal when the remaining number becomes low. With this kind of control, the operator can replenish the prizes **172** in the crane game machine **100** at the appropriate time so that the number of remaining prizes **172** does not become too low.

[0079] The present invention is not limited to the above embodiments or modifications, and the constituent elements can be modified and embodied within a scope that does not deviate from the idea of the invention. Various inventions may be formed by combining the plurality of components disclosed in the abovementioned embodiments and modifications as appropriate. In addition, some of the components shown in the abovementioned embodiments and modifications may be deleted.

Modifications

[0080] In one or more embodiments, the prizes **172** and colored balls **174** are discriminated by the prize sensor **176**. As an example of a modification, a plurality of types of prizes **172** of different sizes may be placed in the placement area **112**. Depending on the number of responses from the optical sensor **178** in the prize sensor **176**, the acquisition determination unit **156** may determine which of the plurality of types of prizes **172** has fallen into the dropping slot **114**.

[0081] FIG. **10** is a schematic diagram showing the relationship between the size of the unwanted articles and the prizes **172** in the modification.

[0082] A plurality of types of unnecessary articles may alternatively be placed on the crane game machine **100**. For example, let's assume that unwanted articles C1 and C2, which are different sizes, and a prize **172** are inserted into the crane game machine **100**. The horizontal axis in FIG. **10** indicates size, with the right side corresponding to the largest size and the left side corresponding to the smallest.

[0083] The width of the unwanted article C1 is greater than B1 and less than B2, and $W2=B2-B1$ is the size range of the unwanted article C1. The operator may set the size of not only the prizes **172** but also unwanted articles. The settings units **158** sets the range of the number of passage reactions corresponding to the size range W2 of the unwanted article C1 (hereinafter referred to as the "unwanted range"). Unwanted article C2 is larger than unwanted article C1, and its width is B3 or more and B4 or less. The size range W3 for unwanted article C2 is "B3-B4". The settings unit **158** also sets the unwanted range for the unwanted article C2.

[0084] Similarly, the width of the prize **172** is greater than or equal to P1 and less than or equal to P2, and its size range is W1. In FIG. **10**, because W1, W2, and W3 do not overlap with each other, the acquisition determination unit **156** can distinguish between prizes **172** and unwanted articles C1 and C2.

[0085] More specifically, the acquisition determination unit **156** determines that the unwanted article C1 has fallen if the number of passage reactions is within the unwanted range (C1), and determines that the unwanted article C2 has fallen if the number of passage reactions is within the

unwanted range (C2). In addition, if the number of passage reactions is within the acquisition range, the acquisition determination unit **156** determines that the prize **172** has been dropped, that is, that a prize has been successfully acquired.

[0086] The operator may have the crane game machine **100** memorize the unwanted range and the acquisition range by actually dropping prizes **172**, etc. into the dropping slot **114** rather than by using the settings screen **180**. For example, in the settings mode, the operator inputs “Unwanted article C1”. At this time, the display unit **162** will display “Please drop the unwanted article C1 into the dropping slot **114** ten times”. The operator will then drop the unwanted article C1 into the dropping slot **114**, and the acquisition determination unit **156** will detect the number of passage reactions at that time. The settings unit **158** may set the unwanted range (C1) as the range of the number of passage reactions whenever the unwanted article C1 is dropped a plurality of numbers of times.

[0087] The unwanted range of unwanted items C2 and the acquisition range for prizes **172** can be set in the same way. With this type of control method, the operator can make the crane game machine **100** memorize an appropriate unwanted range and acquisition range simply by dropping various articles into the dropping slot **114**, without having to manually enter the size on the settings screen **180**.

[0088] With the settings unit **158**, it is acceptable to set the minimum and maximum numbers of passage reactions whenever an article is dropped as the unwanted range or the acquisition range or to set a range with a specified width centered on the average value of the passage reactions as the unwanted range or the acquisition range.

[0089] There are various shapes of the unwanted items and prizes **172** that are fed into the crane game machine **100**. As mentioned above, the number of reactions that occur when an article that is not spherical, such as a rectangular prism, falls also changes depending on the angle of fall. If the unwanted range and the acquisition range overlap, or if the boundary values of the unwanted range and the acquisition range are less than a specified number, the output unit **150** may warn the operator that “there is a possibility that the prize cannot be recognized correctly with this combination of items”.

[0090] FIG. **11** is a perspective view of the prize sensor **176** in a modified example.

[0091] In one or more embodiments, the first detection plate **176a** and the second detection plate **176b** are opposed, and the articles passing through the dropping slot **114** are detected by the light emitted by the light-emitting element **178b** when it is received by the light-receiving element **178a**. As a modification, prize sensors **176** may be placed on all four sides of the dropping slot **114**.

[0092] In the present modification, as shown in FIG. **11**, not only is the first detection plate **176a** (third side) disposed in a position opposite to the second detection plate **176b** (first side), but also the third detection plate **176c** (fourth side) is disposed in a position opposite to the fourth detection plate **176d** (second side). The fourth detection plate **176d** has a plurality of light-emitting elements **178d** arranged thereon, and the third detection plate **176c** has a plurality of light-receiving elements **178c** arranged thereon. When articles pass through the dropping slot **114**, a passage reaction is detected by the light-receiving elements **178a** arranged on the first detection plate **176a** and the light-receiving elements **178c** arranged on the third detection plate **176c**.

[0093] The acquisition determination unit **156** determines whether a prize has been acquired based on whether the total number of passage reactions detected by the light-receiving element **178a** (first detection plate **176a**) and the light-receiving element **178c** (third detection plate **176c**) are within the predetermined acquisition range. Alternatively, the acquisition determination unit **156** may alternatively determine that a prize has been acquired when the number of passage reactions of the light-receiving element **178a** is within a first acquisition range and the number of passage reactions of the light-receiving element **178c** is within a second acquisition range.

[0094] FIG. **12** is a graph showing the changes in time in the number of passage reactions in the case of a modified example.

[0095] In the case of a high-speed scanning method, when an article is dropped through the dropping slot **114**, the light-emitting element **178b** scans the object a plurality of numbers of times while it is falling. For this reason, the number of passage reactions also changes over time. FIG. **12** shows the changes in time in the number of responses when the prizes **172** and color balls **174** pass through the dropping slot **114**. The horizontal axis indicates time, and the vertical axis indicates the number of passage reactions. Time **t0** indicates the point at which the first passage reaction is detected due to an article falling, and time **t4** indicates the point at which the last passage reaction is detected.

[0096] The acquisition determination unit **156** determines whether the article that has been dropped is a prize **172** or a color ball **174** (unwanted item) based on the pattern of changes in the number of passage reactions when the articles fall. For example, the acquisition determination unit **156** may determine whether the prize acquisition was successful based on whether the total number of passage reactions at each point from the time **t0** when the first passage reaction occurred to the time **t4** when the last passage reaction was detected is within the predetermined acquisition range. The same is also applies to the color balls **174**. In addition, the acquisition determination unit **156** may determine whether a prize has been acquired based on the maximum or average number of passage reactions from time **t0** to time **t4**.

[0097] The acquisition determination unit **156** may determine the type of article that has passed through the dropping slot **114** using artificial intelligence (AI). For example, it is possible to create a learning model in advance where the number of passage reactions at time **t0** (**K(0)**), the number of passage reactions at time **t1** (**K(1)**), etc. are set as input nodes, and the value that identifies prizes **172** or color balls **174** is set as the output node. During the operation phase, the acquisition determination unit **156** may determine whether the article that has passed is a prize **172** or a color ball **174** by setting the number of passage reactions for each time **t0** to time **t4** as the input node of the learning model.

[0098] FIG. **13** is a front side view of the prize sensor **176** in a modified example.

[0099] In the modification, the light-receiving elements **178a** may be arranged in a plurality of rows **L1** to **L5** on the first detection plate **176a**. The same applies to the second detection plate **176b**. When an article passes through the dropping slot **114**, a passage reaction is detected in each of the light-receiving elements **178a** in rows **L1** to **L5**. The acquisition determination unit **156** may determine whether the article that has fallen is a prize **172** or a color ball **174** (unwanted item) based on the number of passage responses in each row when the article falls.

[0100] The acquisition determination unit **156** may determine whether a prize has been acquired based on the number of passage responses detected by all light-receiving elements **178a** when the article falls. Alternatively, the acquisition determination unit **156** may determine whether a prize has been acquired based on the number of passage reactions of the light-receiving element **178a** in each row. For example, the acquisition determination unit **156** may determine that a prize has been acquired when the following conditions are met: the maximum number of passage reactions in the first row **L1** is 5 or more, and the maximum number of passage reactions in the second row **L2** is also 5 or more, and so on.

[0101] FIG. **14** is a first top view of the prize placement table **106**, which is composed of a plurality of panels **188**.

[0102] As a modified example, the prize placement table **106** may be constructed by fitting a plurality of panels **188** into it. The prize placement table **106** shown in FIG. **14** is configured so that nine panels **188** (panels **188a** to **188i**) can be inserted. Here, only panel **188h** has been removed, so the dropping slot **114** is formed in the area corresponding to panel **188h**. The operator can configure various dropping slots **114** by freely fitting the panel **188**.

[0103] The operator places the sensor unit **190** at the dropping slot **114**. The sensor unit **190** includes a first sensing plate **176a** and a second sensing plate **176b**. The sensor unit **190** is configured so that the light from the light-emitting elements **178b** arranged on the second detection

plate **176b** is received by the light-receiving elements **178a** arranged on the first detection plate **176a**. The first detection plate **176a** and the second detection plate **176b** are connected to the power supply **186** of the crane game machine **100**. In addition, the acquisition determination unit **156** controls the emission of light from the second detection plate **176b** and detects the number of passage reactions on the first detection plate **176a**.

[0104] In the same way as in one or more embodiments, the acquisition determination unit **156** identifies the article that passed through the dropping slot **114** based on the number of passage reactions in the sensor unit **190**.

[0105] FIG. **15** is a second top view of the prize placement table **106**, which is composed of a plurality of panels **188**.

[0106] As shown in FIG. **15**, the prize placement table **106** has five panels **188** removed from it to form a relatively large dropping slot **114**. The operator inserts a sensor unit **190** that matches the shape of the dropping slot **114** instead of the five panels **188**. In the sensor unit **190** shown in FIG. **15**, the light from the second detection plate **176b** is received by the first detection plate **176a** and the light from the fourth detection plate **176d** is received by the third detection plate **176c**. In addition, the light from the sixth detector plate **176f** is received by the fifth detector plate **176e**.

[0107] The acquisition determination unit **156** identifies the article that passed through the dropping slot **114** based on the number of passage reactions in the first detection plate **176a**, third detection plate **176c**, and fifth detection plate **176e**.

Other Modifications

[0108] The acquisition range is set as the range of the number of passage reactions. The number of passing reactions corresponding to the acquisition range may be a single value, such as “5”, or it may be a plurality of values that include an upper and lower limit, such as “3 or more” or “5 or less”, or it may be a setting that does not include an upper or lower limit, such as “3 or more” or “5 or less”.

[0109] It is not necessary for the crane game machine **100** to display the settings screen **180**. The store terminal may alternatively display the settings screen **180**. The operator may set the prize range of the crane game machine **100** remotely by setting the prize range together with the ID of the crane game machine **100** on the settings screen **180** of the store terminal. The same applies to the unwanted range.

[0110] The inventory management unit **164** may count the number of unwanted articles such as the color balls **174** that have fallen. When the total number of unwanted articles that have fallen exceeds a predetermined threshold, the replenishment request unit **166** may send a removal instruction to the store terminal to remove the unwanted items that have accumulated in the prize storage part **104**. With this type of control method, because the operator can remove the unwanted articles from the storage box at the time when a large amount of unwanted articles have accumulated in the storage box below the dropping slot **114**, this reduces the workload of the operator.

[0111] The “light” in the prize sensor **176** may be visible light or invisible light. For example, the passage of an article may be detected using infrared rays, laser light, or the like. In addition, the prize sensor **176** may also detect the passage of an article using radio waves or ultrasonic waves.

[0112] In the settings screen **180**, while only one type of prize size is set in one or more embodiments, a plurality of sizes can be alternatively set in the size settings area **184** to select a plurality of different prize sizes. For example, by setting the size of prize **172A** and the size of prize **172B**, it is possible to identify which of the two prizes passed through the dropping slot **114**.

[0113] In the abovementioned example, although an explanation was provided concerning a method that assumes a crane game machine as an example of an article-winning game device, the prize detection method shown in one or more embodiments can also be implemented in an article-winning game device for acquiring prizes using a mechanism other than a crane. For example, we can imagine an article-winning game device in which the prize placement table **106** is divided into

a plurality of levels and placed on the back of the prize storage part **104**, rather than on a floor, whereon the prizes **172** are placed or hung. This type of article-winning game device is not equipped with a crane **108**, but with a “article-winning unit” that grabs the prize **172** or the hanging area of the prize **172**. The article-winning unit (acquisition mechanism) is driven by a movement control unit **154**. The player moves the article-winning unit up, down, left and right using a control unit **118**. The player moves the prize-winning unit up, down, left and right using the control unit **118** to determine the position, and then moves the prize-winning unit in the depth direction to make it grab the prize **172** or the hanging area of the prize **172**, where after the prize **172** is dropped to win the prize. In this case, while almost the entire prize storage part **104** becomes the dropping slot **114** but since the prizes **172** are on the back side, the prize sensors **176** may alternatively be installed only on the far side of each side of the dropping slot **114**. In the case of this type of article-winning game device, the number of sensors can be kept to a small number because the area where the passage of the prizes **172** is expected is limited, whereby the cost of the sensors can be kept low.

[0114] Although the disclosure has been described with respect to only a limited number of embodiments, those skilled in the art, having benefit of this disclosure, will appreciate that various other embodiments may be devised without departing from the scope of the present invention. Accordingly, the scope of the invention should be limited only by the attached claims.

Description of Reference Numerals

[0115] **100** crane game machine, **102** base table, **104** prize storage part, **106** prize placement table, **108** crane, **110** door, **112** placement area, **114** dropping slot, **116** prize removal opening, **118** control unit, **120** settings display unit, **122** control stick, **124** grabbing button, **126** arm, **128** shielding plate, **130** crane driver, **132** design cover, **134** display bar, **140** user interface processing unit, **142** mechanism driving unit, **144** data processing unit, **146** data storage unit, **148** input unit, **150** output unit, **152** group of sensors, **154** movement control unit, **156** acquisition determination unit, **158** settings unit, **160** communication unit, **162** display unit, **164** inventory management unit, **166** replenishment request unit, **172** prize, **174** color ball, **176** prize sensor, **176a** first detection plate, **176b** second detection plate, **176c** third detection plate, **176d** fourth detection plate, **176e** fifth detection plate, **176f** sixth detection plate, **178** optical sensor, **178a** light-receiving element, **178b** light-emitting element, **178c** light-receiving element, **178d** light-emitting element, **180** settings screen, **182** sensor ON button, **184** size settings area, **186** power supply, **188** panel, **190** sensor unit

Claims

1. An article-winning game device comprising: a game field that is disposed in a play space and includes: a placement area where articles are placed; and a dropping slot through which at least one of the articles may pass; a crane that comprises an arm for acquiring at least one of the articles; an operating panel that receives an operation by a player; sensors that are arranged in the dropping slot and detect passage of the at least one of the articles; and a data processor that: drives the crane in response to the operation, determines whether the at least one of the articles passing through the dropping slot is a first article to be acquired, and sets, based on a user instruction, an acquisition range with respect to the first article, where the acquisition range indicates a range of a number of passage reactions, and the number of passage reactions indicates a number of sensors, among the sensors, that react to an article passing through the dropping slot, wherein upon determining that the number of passage reactions with respect to the at least one of the articles passing through the dropping slot is within the acquisition range, the data processor determines that the at least one of the articles is the first article.
2. The article-winning game device according to claim 1, further comprising: a user interface processor that causes the operating panel to display a settings screen, wherein the data processor receives, on the settings screen, an input of a size of the first article, and sets the acquisition range

depending on the size of the first article.

3. The article-winning game device according to claim 2, wherein: the data processor further: receives, on the settings screen, an input of a size of a second article that is not to be acquired, and sets an unwanted range that indicates a range of a number of passage reactions with respect to the second article depending on the size of the second article, and upon determining that the number of passage reactions with respect to the at least one of the articles passing through the dropping slot is within the unwanted range, determines that the at least one of the articles is the second article.

4. The article-winning game device according to claim 1, wherein: the first article and a second article that is not to be acquired are placed on the placement area of the game field, and upon determining that the number of passage reactions with respect to the at least one of the articles passing through the dropping slot is outside the acquisition range, the data processor determines that the at least one of the articles is the second article.

5. The article-winning game device according to claim 1, wherein the data processor sets, in a settings mode, the acquisition range based on the number of passage reactions with respect to the first article at a time when the user drops the first article into the dropping slot.

6. The article-winning game device according to claim 1, wherein: the dropping slot has a rectangular shape having first to fourth sides, first light-emitting elements are arranged on the first side of the dropping slot, first light-receiving elements that detect light from the light-emitting elements are arranged on the third side opposing the first side in a position opposite to the first light-emitting elements; second light-emitting elements are arranged on the second side of the dropping slot, second light-receiving elements that detect light from the light-emitting elements are arranged on the fourth side opposing the second side in a position opposite to the second light-emitting elements, and the data processor identifies, as the number of passage reactions with respect to the at least one of the articles passing through the dropping slot, a number of the first and second light-receiving elements on the third and fourth sides that are shielded from light by the at least one of the articles passing through the dropping slot.

7. The article-winning game device according to claim 1, wherein: the sensors execute measurements a plurality of numbers of times whenever the at least one of the articles pass through the dropping slot, and the data processor determines whether the at least one of the articles passing through the dropping slot is the first article based on the number of passage reactions with respect to the at least one of the articles passing through the dropping slot at each of the measurements.

8. The article-winning game device according to claim 1, wherein the data processor further: updates a remaining number of the first article on the game field in response to detection of the passage of the first article, and requests replenishment of the first article in response to the remaining number falling below a predetermined threshold.

9. The article-winning game device according to claim 1, wherein: the placement area of the game field comprises one or more panels, the dropping slot is configured to be uncovered by the panels, a first detector and a second detector are installed in the dropping slot, wherein light-emitting elements are arranged in the first detector, and light-receiving elements are arranged to face the light-emitting elements, in the second detector; and the data processor identifies, as the number of passage reactions, a number of light-receiving elements that are shielded from light by the at least one of the articles passing through the dropping slot.
