

TITLE OF THE INVENTION

IMAGE DISPLAY DEVICE, METHOD FOR CONTROLLING
OPERATION OF SAME, AND PROGRAM

TECHNICAL FIELD

[0001] The present invention relates to an image display device, a method for controlling its operation, and a program, and in particular relates to a game device, a method for controlling its operation, and a game program.

BACKGROUND ART

[0002] In recent years, numerous image display devices utilizing touch panels have been in use. Such image display devices are capable of detecting touch operations performed by users. However, these image display devices lack the ability to distinguish which touch element was used to perform the touch operation. Consequently, they were unable to provide different functions depending on a type of touch element. Therefore, there is a need for an image display device that addresses these issues.

[0003] On the other hand, game devices that run battle or cooperative games are known as examples of the image display devices (e.g., Patent Document 1). In such game devices, players operate a small screen. Consequently, gameplay lacks dynamism. Furthermore, these game devices are designed for single-player use. As a result, friends and/or family cannot participate in the gameplay on these devices, making it impossible to share the enjoyment of the game. Therefore, there is a need for a game device that addresses these issues.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0004] Patent Document 1: JP 2020-18745 A

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0005] The object of the present invention is to provide an image display device capable of determining a type of touch element when the touch element contacts a screen.

[0006] Another object of the present invention is to provide an image display device capable of providing a sense of dynamic operation on a single screen. In particular, the object is to provide a game device in which third parties other than a player can also participate in a game.

[0007] Furthermore, the other object of the present invention is to provide a method for controlling the operation of an image display device and a program used therefor, specifically a method for controlling the operation of a game device and a game program.

MEANS FOR SOLVING THE PROBLEMS

[0008] These objects are achieved by the present invention as described in (1) to (11) below.

(1) An image display device comprising:

an operation display unit for displaying a predetermined image and receiving touch information by a touch element; and

a control unit for controlling display of the predetermined image,

wherein the operation display unit has a surface and a layer having a plurality of pixels, the layer provided beneath the surface, and

wherein the plurality of pixels includes an overlapping pixel on which the touch element overlaps, and when the touch element is in contact with the surface of the operation display unit, the control unit calculates an area of the overlapping pixel from the touch information in the overlapping pixel in the plurality of pixels and determines a type of the touch element based on the area.

[0009] (2) The image display device as described in (1) above, wherein the touch information includes sizes of a height and a width of the overlapping pixel.

[0010] (3) The image display device as described in (2) above, wherein the control unit determines a center of gravity of the touch element based on the sizes of the height and the width of the overlapping pixel and the area of the touch element.

[0011] (4) The image display device as described in (3) above, wherein the control unit assigns a pixel area for recognizing contact of the touch element and the surface to the touch element centered on the center of gravity, depending on the type of the touch element.

[0012] (5) The image display device as described in (4) above, wherein the control unit generates a predetermined effect in the pixel area.

[0013] (6) The image display device as described in (3) above, wherein the plurality of pixels includes a center of gravity-pixel on which the center of gravity positions, the control unit generates a predetermined effect in the center of gravity-pixel in the plurality of pixels.

[0014] (7) The image display device as described in (1) above, wherein the touch element includes a first touch element and a second touch element different from the first touch element, and

wherein the control unit groups the first touch element and the second touch element when the first touch element and the second touch element are in a range of a group setting distance.

[0015] (8) The image display device as described in (7) above, wherein the control unit releases the grouping of the first touch element and the second touch element when the first touch element and the second touch element are beyond a group release distance which is larger than the group setting distance.

[0016] (9) The image display device as described in (4) above, wherein the control unit is configured to ignore contact to the pixel area with another touch element which is different from the touch element.

[0017] (10) A method for controlling an operation of an image display device, the method comprising:

displaying a predetermined image on a touch-screen display unit having a plurality of pixels;

acquiring touch information in an overlapping pixel in the plurality of pixels when the touch element is in contact with the touch-screen display unit, the overlapping pixel overlapping with the touch element;

calculating an area of the overlapping pixel from the touch information; and

determining a type of the touch element based on the area.

[0018] (11) A program for causing a computer to function as:

a step of displaying a predetermined image on a touch-screen display unit having a plurality of pixels;

a step of acquiring touch information in an overlapping pixel in the plurality of pixels when the touch element is in contact with the touch-screen display unit, the overlapping pixel overlapping with the touch element;

a step of calculating an area of the overlapping pixel from the touch information; and

a step of determining a type of the touch element based on the area.

EFFECT OF THE INVENTION

[0019] According to the present invention, it is possible to determine what type of touch element has come into contact with the screen. Furthermore, according to the present invention, it is possible to provide a sense of dynamic operation on the single screen. In particular, it is possible to provide the game device in which the third party other than a player can participate in the game. Moreover, according to the present invention, it is possible to provide the method for controlling the operation of the image display device and a program used therefor, particularly the method for controlling the operation of the game device and the game program.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Fig. 1 is a perspective view schematically illustrating a game device according to a first embodiment of the present invention.

Fig. 2 is a block diagram illustrating a configuration of the game device according to the first embodiment of the present invention.

Fig. 3 is a block diagram illustrating the configuration of processing means of the game device according to the first embodiment of the present invention.

Fig. 4 is a partial enlarged view showing an operation unit and a display unit of the game device according to the first embodiment of the present invention.

Fig. 5 is an enlarged view showing an operation field image of the display unit of the game device according to the first embodiment of the present invention.

Fig. 6 is a character table stored in a storage unit of the game device according to the first embodiment of the present invention.

Fig. 7 is a reference information table stored in the storage unit of the game device according to the first embodiment of the present invention.

Fig. 8 is a touch element table stored in the storage unit of the game device according to the first embodiment of the present invention.

Fig. 9 is a display area table stored in the storage unit of the game device according to the first embodiment of the present invention.

Fig. 10 is an enlarged view showing the operation field image of the display unit of the game device according to the first embodiment of the present invention.

Fig. 11 is an enlarged view showing a configuration of the display unit of the game device according to the first embodiment of the present invention.

Fig. 12 is an enlarged view showing the configuration of the display unit of the game device according to the first embodiment of the present invention.

Fig. 13 is an enlarged view showing the configuration of the display unit of the game device according to the first embodiment of the present invention.

Fig. 14 is an enlarged view showing configurations of pixels in the game device according to the first embodiment of the present invention.

Fig. 15 is an enlarged view showing a center of gravity of a touch element of the game device according to the first embodiment of the present invention.

Fig. 16 is an enlarged view showing pixel areas of the touch element of the game device according to the first embodiment of the present invention.

Fig. 17 is a schematic diagram illustrating grouping of the game device according to the first embodiment of the present invention.

Fig. 18 is a schematic diagram illustrating the grouping of the game device according to the first embodiment of the present invention.

Fig. 19 is a schematic diagram illustrating the grouping of the game device according to the first

embodiment of the present invention.

Fig. 20 is a schematic diagram illustrating a first mini-game of the game device according to the first embodiment of the present invention.

Fig. 21 is a schematic diagram illustrating a second mini-game of the game device according to the first embodiment of the present invention.

Fig. 22 is a flowchart illustrating a game processing flow of the game device according to the first embodiment of the present invention.

Fig. 23 is a flowchart illustrating a battle flow of the game device according to the first embodiment of the present invention.

Fig. 24 is a flowchart illustrating flow of mini-game processing in the game device according to the first embodiment of the present invention.

Fig. 25 is a flowchart illustrating flow of touch element grouping in the game device according to the first embodiment of the present invention.

Fig. 26 is a partially enlarged schematic view showing a display unit and an operation unit of a game device according to a second embodiment of the present invention.

Fig. 27 is an enlarged plan view schematically illustrating a game device according to a third embodiment of the present invention.

Fig. 28 is a front view schematically illustrating

an image display device according to a fourth embodiment of the present invention.

DESCRIPTION OF THE EMBODIMENTS

[0021] The image display device, the method for controlling its operation, and the program of the present invention will be described in detail below.

[0022] <<First Embodiment>>

A. Image Display Device

The image display device of the present invention is not particularly limited as long as it is capable of displaying images. Such an image display device includes, for example, desktop computers, laptop computers, mobile phones, smartphones, televisions, game consoles, and liquid crystal displays.

[0023] For ease of understanding, the image display device will be described in detail below based on preferred embodiments shown in the attached drawings, assuming that the image display device is a game device. For the sake of convenience in the description, the top of each figure is referred to as "top", the bottom as "bottom", the left side as "left", the right side as "right", the side closest to a viewer as "front", and the side farthest from the viewer as "back".

[0024] Fig. 1 is a perspective view schematically illustrating a game device according to a first embodiment of the present invention, Fig. 2 is a block diagram illustrating a configuration of the game device according to the first embodiment of the present invention, and Fig. 3 is a block diagram illustrating the configuration of processing means of the game device according to the first embodiment of the present invention.

[0025] 1. Overview of the Game

First, the game executed on the game device 1 of this embodiment will be described. The game device 1 can execute, for example, a battle game or role-playing game using a storage medium 11. Specifically, the game is executed (implemented) by placing the storage medium 11 in an operation unit 3. Images corresponding to character information (hereinafter referred to as "character information") recorded on the storage medium 11 are displayed on a display unit (device) 6. Thus, the game device 1 can execute the battle game in which the character and an opponent character battle each other. Note that the games executed by this game device 1 are not limited to the games as described above.

[0026] 2. Storage Medium

The storage medium 11 used in the game device 1 of this embodiment is not particularly limited, provided that it can store the character information. Such a storage medium 11 is formed, for example, in a card-like shape as shown in Fig. 4. This storage medium 11 has a two-dimensional code on which character information, item information, and the like are stored (recorded). Examples of such two-dimensional codes include QR code (registered trademark) and Zcode (registered trademark). In the case of the Zcode, the aforementioned information is recorded so that it can be identified under invisible light (infrared light). Furthermore, the storage medium 11 may be a game IC card that stores player information and the character information.

[0027] 3. Game Device

Next, the game device 1 will be described. As shown in Fig. 1, the game device 1 of this embodiment includes two game devices (a first sub-game device 1A

and a second sub-game device 1B) arranged adjacent to one another. This game device 1 has a single display unit 6 and is controlled by a single control unit 8. Consequently, the overall size of the game device 1 can be reduced. This allows for a reduction in the overall cost of the game device 1. The game device 1 of this embodiment is not limited to a configuration in which two game devices are arranged adjacently (a 2-in-1 configuration), but may also be a configuration in which three or more game devices are arranged adjacently.

[0028] At first glance, the game device 1 of this embodiment appears to consist of two game devices arranged side by side. However, the game device 1 is actually formed by connecting the two game devices with each other to constitute a single game device 1. Therefore, each player can play on their respective sub-game devices, or they can cooperate to play a single game. As shown in Figs. 1 and 2, this game device 1 comprises a housing 2, the operation (manipulation) unit 3, a reading unit 4, a speaker 5, the display unit 6, a storage unit 7, a control unit 8, and a communication unit 9. The configuration of each component is described below.

[0029] Note that the operation unit 3, reading unit 4, and speaker 5 of the game device 1 include a sub-operation unit 3A, a sub-reading unit 4A, and a speaker 5A for the first sub-game device 1A, and a sub-operation unit 3B, a sub-reading unit 4B, and a speaker 5B for the second sub-game device 1B. Since they have the same configuration, they will be described below as the operation unit 3, the reading unit 4, and the speaker 5 of the game device 1.

[0030] <Housing>

The housing 2 serves to accommodate or house the various components of the game device 1. As shown in Fig. 1, the housing 2 is formed in a rectangular prism shape, but is not limited thereto. The housing 2 may be configured from a single housing (twin housing) or may be configured by connecting sub-housings for each sub-game device. In the case of the twin housing, the housing 2 is formed symmetrically left and right.

[0031] <Operation Unit>

Fig. 4 is a partial enlarged view showing an operation unit and a display unit of the game device according to the first embodiment of the present invention. The operation unit (first operation section) has a function of receiving input commands (inputs) from the player to execute the game. The operation unit 3 is configured from two push buttons 31 and an operation field 32. The push buttons 31 are arranged symmetrically left and right around the operation field 32 on an upper surface of the housing 2. The operation field 32 is located approximately at the center of the upper surface of the housing 2. The shape of the operation field 32 is not particularly limited, but may be formed as a rectangle, square, circle, or ellipse. Such an operation field 32 may be configured to allow the player to place the storage medium 11 on it and move the storage medium. The operation field 32 is configured so that the reading unit 4, described later, can read the storage medium 11.

[0032] The operation field 32 includes a plurality of lanes 321 for placing the storage media 11. In this embodiment, as shown in Figs. 1 and 4, three lanes 321 are arranged on the side of the display unit 6 of the operation field 32. Each lane 321 is formed in an elongated shape extending toward the display unit 6.

Furthermore, each lane 321 is arranged perpendicular to the display unit 6 and parallel to one another. Note that the number of lanes 321 is not limited to three, there may be one, or four or more. Furthermore, each lane 321 may have a size corresponding to the size of the storage medium 11, a length sufficient to allow the placed storage medium 11 to be moved in the longitudinal direction, or a length greater than the length of the storage medium 11. Furthermore, the width of each lane 321 corresponds to the width of the storage medium 11.

[0033] <Reading Unit>

The reading unit 4 has a function of reading information from the storage medium 11 placed on the operation field 32. The reading unit 4 is provided inside the housing 2, at the lower portion of the operation field 32. Such a reading unit 4 is configured, for example, with an imaging device (camera) and an infrared light source. The infrared light source of the reading unit 4 irradiates infrared light onto the two-dimensional code 111 of the storage medium 11 from below the operation field 32. In this state, by having the imaging device capture the two-dimensional code 111 of the storage medium 11, the information recorded in the two-dimensional code 111 of the storage medium 11 can be read. Note that the reading unit 4 may be located anywhere within the housing 2 as long as the imaging device can capture the operation field 32. Furthermore, the reading unit 4 may be constituted solely of the imaging device.

[0034] <Speaker>

The speaker 5 has a function of outputting various sounds. Speaker 5 is provided at the upper front portion of the housing 2. The number of speakers 5 is not particularly limited, and there may be one or two or

more. In this embodiment, the single speaker 5 is provided at the upper front portion of the housing 2 corresponding to each sub-game device 1A and 1B. The sounds output by the speaker 5 includes music and sound effects stored in the storage unit 7.

[0035] <Display Unit>

Fig. 5 is an enlarged view showing an operation field image of the display unit of the game device according to the first embodiment of the present invention. The display unit 6 displays game images (predetermined images) and also has a function of receiving operation inputs from the player. Therefore, the display unit 6 functions as an operation display unit. The display unit 6 may be constituted of a touch panel or may include the touch panel in part. As shown in Fig. 1, such a display unit 6 comprises a sub-display (first display unit) 61 which is mounted at an angle on the top surface of the housing 2, and a main display (second display unit) 62 which is mounted vertically from the upper end of the sub-display 61.

[0036] (Sub-Display)

The sub-display 61 is inclined upward from the operation unit 3 toward the top of the game device 1. It is preferable that the sub-display 61 is positioned at a first angle θ_1 relative to the operation unit 3 within the range of 90 to 180 degrees, preferably 130 to 180 degrees. This ensures that the player can clearly see the images displayed on the sub-display 61 even when the player seated in front of the game device 1.

[0037] The sub-display 61 is capable of displaying the images for the first sub-game device 1A and the images for the second sub-game device 1B. Furthermore, the sub-display 61 can display the images across its

entire area, for example, when the player is engaging in cooperative play with other players. As shown in Figs. 4 and 5, the sub-display 61 functions as a second operation section which displays the image of the operation field 32 (operation field image 63) adjacent to the operation unit 3. The operation field image 63 includes three lane images 631, connection images 632, and character images 633. The operation field image 63 may be displayed across the entire area of the sub-display 61 or only in an area (second display region) adjacent to the operation unit 3. When the operation field image 63 is displayed in the area adjacent to the operation unit 3, a different image may be displayed in the area of the main display 62.

[0038] The lane images 631 are formed in an elongated shape corresponding to the lanes 321 of the operation unit 3. Furthermore, each lane image 631 is arranged parallel to one another along a direction (Y direction) perpendicular to the longitudinal direction (X direction) of each lane 321 (Fig. 4). The number of lane images 631 does not depend on the number of lanes 321 and may be one or four or more. In this embodiment, as shown in Fig. 4, three lane images 631 correspond to the three lanes 321 of the operation unit 3. Therefore, the lanes 321 are configured such that, together with the lane images 631, they form a single lane. As a result, the player can experience the sensation of having moved the storage medium 11 onto the lane image 631 through the movement of the image of the storage medium 11 on the lane image 631.

[0039] Each connection image 632 is an image indicating that the lane 321 corresponds to a lane image 631. The connection image 632 is formed in a straight line, but is not limited thereto. The connection image

632 extends from the center of the lower edge of the lane image 631 to the center of the upper edge of the lane 321. The position at which the connection image 632 is displayed is not particularly limited. Note that the connection image 632 need not be displayed. Alternatively, it may be displayed such that the lane image 631, connection image 632, and lane 321 are arranged in a straight line.

[0040] As shown in Fig. 5, the character images 633 are respectively displayed on the lane images 631 together with the images of the storage medium 11. The character image 633 is an image corresponding to the character information recorded on the storage medium 11. Since the lane image 631 corresponds to the lane 321, the length and width of the lane image 631 are sized to correspond to the length and width of the lane 321. However, the length and width of the lane image 631 are not limited to this, and may be set to dimensions different from those of the lane 321.

[0041] If the length of the lane image 631 is longer than that of the lane 321, there is a distance over which character image 633 slides. Consequently, this gives the player the impression that the player has operated the storage medium 11 over a longer distance. Furthermore, if the width of the lane image 631 is greater than that of the lane 321, a larger character image 633 can be displayed on the lane image 631. Consequently, this allows the character image 633 to be presented more prominently to the player.

[0042] Here, the touch element T has a function of touching the surface of the display unit 6. The touch element T is not particularly limited, provided that the control unit 8 can receive touch information from the

touch element T. For example, the touch element T includes a finger, a palm, a stylus pen, and the like. These may be covered by a cover member capable of detecting capacitance.

[0043] The sub-display 61 has a plurality of pixels 69 as shown in Fig. 14. The plurality of pixels 69 have a function of detecting whether the touch element T has touched the surface of the sub-display 61. The plurality of pixels 69 are provided beneath the surface layer of the sub-display 61. The plurality of pixels 69 may be provided corresponding to the entire area of the sub-display 61, at a position on the sub-display 61 adjacent to the operation unit 3, or at any position on the sub-display 61. As a result, the sub-display 61 functions as an operation display section and can provide mini-games as described below.

[0044] The plurality of pixels 69 may be arranged in a grid pattern, a striped pattern, or a dotted pattern. Furthermore, the plurality of pixels 69 may be randomly arranged in the XY plane of a layer, or they may be arranged in a regular pattern to form a coordinate plane. When the plurality of pixels 69 are arranged in the grid pattern or form the coordinate plane, the contact position of the touch element T on the sub-display 61 can be accurately determined.

[0045] (Main Display)

The main display 62 is erected vertically upward from the upper end of the sub-display 61. It is preferable that the main display 62 is positioned at a second angle θ_2 relative to the sub-display 61 within the range of 90 to 180 degrees, preferably 130 to 180 degrees. This ensures that the player can clearly view the images displayed on the main display 62 even when

the player seated in front of the game device 1.

[0046] The main display 62 overlaps with the surface of the upper edge of the sub-display 61. In this case, it is preferable that the image displayed on the lower edge (within a predetermined range) of the main display 62 is the same as the image displayed on the upper edge (within a predetermined range) of the sub-display 61. This allows the image displayed on the main display 62 to be seamlessly connected to the image displayed on the sub-display 61 without any sense of uncomfortableness. Furthermore, like the sub-display 61, the main display 62 can display the images for the first sub-game device 1A and the images for the second sub-game device 1B, and it can also display the images across the entire area thereof (first display region).

[0047] The main display 62 may, like the sub-display 61, comprise a plurality of pixels 69. The plurality of pixels 69 have functions similar to those of the plurality of pixels 69 in the sub-display 61. Furthermore, the plurality of pixels 69 may be arranged across the entire area of the main display 62 at the position corresponding to those of the sub-display 61 or at any position within the main display 62, just as in the sub-display 61. Consequently, the main display 62 functions as an operation display section and can provide the mini-games as described below. Note that the main display 62 need not have plurality of pixels 69. In this case, the main display 62 functions merely as the display unit 6.

[0048] <Storage Unit>

Next, the storage unit 7 will be described. Fig. 6 shows a character table stored in a storage unit of the game device according to the first embodiment of the

present invention, Fig. 7 shows a reference information table stored in the storage unit of the game device according to the first embodiment of the present invention, Fig. 8 shows a touch element table stored in the storage unit of the game device according to the first embodiment of the present invention, and Fig. 9 shows a display area table stored in the storage unit of the game device according to the first embodiment of the present invention.

[0049] The storage unit 7 stores the game program, the game data, and the effect data. The game program is a program that causes the game device 1 to execute the game and is implemented in cooperation with the hardware. Furthermore, the game data includes data related to the game, including character data, image data, and sound effect data.

[0050] The character data includes information such as the character's name, size, special moves, weapons, and strength. As shown in Fig. 6, this data is stored in a character table in correspondence with a lane ratio. The lane ratio in the character table indicates the ratio of the width and height of the lane image 631 to the size of the character image 633. When this ratio is large, the width and height of the lane image 631 are adjusted as described later. Note that the lane ratio of 1 signifies a standard width and height of the lane image 631 (a default value), meaning that the lane image 631 remains unchanged.

[0051] Furthermore, the character data includes, for example, reference information indicating attributes or properties (e.g., strength) of character A relative to the opponent character, and appeal information related to the reference information. The reference information

includes text information, image information, and the like. The appeal information includes audio or sound information, image information, and the like. As shown in Fig. 7, this data is stored in a reference information table for character A, where the reference information and the appeal information are associated with each opponent character (B, C, D).

[0052] The text information in the reference information is information regarding the strength characteristics of the player's character relative to the opponent's character, such as "seems likely to attack first". The image information in the reference data is a simplified visual representation of the text information, including images that include the text such as "Excellent". The sound information in the appeal information includes the player's character's cry (vocalizations), which are used to appeal to the player to select the character. The image information in the appeal information includes circular images (double circular rings and triple circular rings), which are used to appeal to the player to select the character by varying the size of the circular image.

[0053] The image data refers to game image data and includes, for example, character images, background images, and various effect images. The sound effect data refers to sound data played during the gameplay and is distinct from music data. The sound effect data includes, for example, evaluation sound data that plays in response to the player's actions.

[0054] The effect data includes data indicating the type of touch element T and data displayed when the mini-game is executed. As shown in Fig. 8, this data is stored in a touch element table, where pixel area and

effects are mapped to each type of the touch elements T. For example, when the type of the touch element T is a single finger or a stylus pen, it is associated with the pixel area ranging from 1 to 9999 and an effect 1 represented by a "o". As described later, this enables the control unit 8 to identify the touch element T that has come into contact with the surface of the display unit 6.

[0055] Furthermore, the touch element table stores the pixel area assigned to the touch element T in correspondence with the pixel area, such as "1×1". This is used in the mini-games described later. Note that it is preferable to set the pixel area to different ranges depending on the types. This allows for detailed determination of the type of the touch element T. In this embodiment, considering the simplicity and speed of game processing, three ranges of the pixel area have been set in a simplified manner (Fig. 8).

[0056] Furthermore, as shown in Fig. 9, the storage unit 7 stores information corresponding to the display region for character A, for each opponent character, based on the properties or attributes of character A and the opponent character's exhaust level. For example, the properties of character A include speed and power, and are indicated by terms such as "fast", "slow", "good", "none" or "same". The exhaust level is information updated in real time during the game play and indicates whether the opponent character is more exhausted than character A. For example, if the character A's speed is faster than that of opponent character 1, the character A's display region is set to 62d + 61e + 61f + 61g. Furthermore, if the opponent character 1's exhaust level is "Yes", the display area is set to 62c + 62d + 61e + 61f + 61g.

[0057] <Control Unit>

Next, the control unit 8 will be described. Fig. 10 is an enlarged view showing the operation field image of the display unit of the game device according to the first embodiment of the present invention, and Figs. 11 to 13 are enlarged views showing the configuration of the display unit of the game device according to the first embodiment of the present invention.

[0058] The control unit 8 controls all functions related to the execution of the game. As shown in Fig. 2, this control unit 8 comprises information acquisition means 81, processing means 82, display control means 83, size change means 84, information provision means 85, display area change means 86, and sound output control means 87.

[0059] (Information Acquisition Means)

The information acquisition means 81 has a function of acquiring information regarding the player's operational inputs, as well as the character information and the game information from the storage medium 11. The information acquisition means 81 acquires information regarding the operational inputs through the player's pressing to the push button 31. Furthermore, the information acquisition means 81 acquires information regarding touch operation inputs (touch information) through contact of the touch element T with the surface of the display unit 6. Such information regarding the touch operation inputs includes, for example, information regarding character selection, numerical values of pixels 69 overlapped (overlaid) by the touch element T, and touch position information. The numerical values of pixels 69 are the height (vertical) and width (horizontal) values or XY coordinates (width,

height) of the pixels 69 overlapped by the touch element T. Furthermore, the information acquisition means 81 acquires the character information, etc., read by the reading unit 4. In addition, the information acquisition means 81 acquires various types of information obtained via the communication unit 9, which will be described later.

[0060] (Processing Means)

The processing means 82 has a function of processing the information acquired by the information acquisition means 81 and the progress of the game. For example, the processing means 82 determines the game image information stored in the storage means 7 and provides it to the display control means 83. Furthermore, the processing means 82 refers to the character table shown in Fig. 6 based on the character information acquired by the information acquisition means 81 and determines the lane ratio corresponding to the character information. Additionally, the processing means 82 determines the sound information and provides the sound information to the sound output control means 87.

[0061] (Display Control Means)

The display control means 83 has a function of controlling the display of all images related to the game. Specifically, the display control means 83 controls the main display 62 and the sub-display 61 to display the game image data provided by the processing means 82. Furthermore, the display control means 83 controls the sub-display 61 to display the operation field image 63. For example, the display control means 83 controls the display of the operation field image 63 on the sub-display 61 as shown in Fig. 4, and the display of the game image on the main display 62 as shown in

Fig. 11. In this way, the display control means 83 can either control the display of predetermined images separately on the sub-display 61 and the main display 62, or the display of the predetermined images separately for each sub-game device.

[0062] (Size Change Means)

The size changing means 84 has a function of changing the size of the lane image 631 according to the size of the character image 633 corresponding to the character information recorded on the storage medium 11. Specifically, when the storage medium 11 is placed on the lane 321, the processing means 82 determines the lane ratio information corresponding to the character information of the storage medium 11. Then, the size changing means 84 changes the size of the lane image 631 corresponding to the lane 321 where the storage medium 11 is placed, based on the lane ratio information.

[0063] For example, when the display control means 83 displays the image of character A in the lane image 631, the processing means 82 refers to Fig. 6 and determines the lane ratio (width) information (1.4) and the lane ratio (length) information (1.4) for the character A. The size change means 84 changes the size of the lane image 631 based on this lane ratio information. In this embodiment, as shown in Fig. 10, the size change means 84 changes the width of the lane image 631 to 1.4 times the width of the lane image 631 in its default state. This ensures that the large character image 633 can be reliably displayed on the lane image 631. Consequently, the large character image 633 can be displayed in a prominent manner.

[0064] Similarly, the size change means 84 can also change the width ratio of the lane image 631 to 0.8 times

the default value based on the lane ratio (width) information (Fig. 6). This allows the lane image 631 to be adjusted to fit the small character image 633. Consequently, the lane image 631 can be effectively displayed within the operation field image 63 according to the size of the character image 633. Note that the size change means 84 may choose without considering the lane ratio (length) information in advance. Furthermore, the size change means 84 may change both the width and length of the lane image 631 by considering both the lane ratio (width) information and the lane ratio (length) information. Note that the left and right lane images 631 shown in Fig. 10 are default images, and their widths are set to the default value of 1.

[0065] Furthermore, when the processing means 82 determines the lane ratio information for the mega-sized character Z, the size change means 84 can fuse (combine) the adjacent lane images 631 based on this lane ratio information. As a result, two lane images 631 appear on the operation field image 63, and the character image 633 of the mega-sized character Z can be displayed on the fused lane image 631. In this way, since it is possible to display the image that fuses the characters corresponding to the two storage media 11 on the lane 321, a sense of excitement can be provided to the player. Furthermore, the size change means 84 can similarly fuse all lane images 631.

[0066] (Information Provision Means)

The information provision means 85 has a function of providing reference information images 64 and appeal information images 65 related to the character image 633 on the lane image 631. Specifically, when the player touches the character image 633, the information provision means 85 refers to the reference information

table for that character stored in the storage unit 7. The information provision means 85 then determines the reference information and/or the appeal information corresponding to the opponent's character image displayed on the main display 62. Then, as shown in Fig. 11, for example, the sub-display 61 displays the "Excellent" reference information image 64 near the character image 633 outside the operation field image 63. This provides the player with information indicating that the character has excellent compatibility (is strong) against the opponent character image displayed on the main display 62.

[0067] Furthermore, as shown in Fig. 11, the sub-display 61 displays an appeal information image 65 in the form of a triple circular ring on the character image 633. This provides the player with information indicating that the player's character image 633 is well-matched (strong) against the opponent's character image displayed on the main display 62. Similarly, the information provision means 85 can provide the text information such as "Seems likely to attack first" as shown in Fig. 7, instead of the image information for the reference information described above. Furthermore, the information provision means 85 can provide the sound information such as a "cry" as shown in Fig. 7 to the sound output control means 87 instead of the image information for the appeal information described above.

[0068] In addition to the information described above, the information provision means 85 can also provide the appeal information that causes the character image 633 on the lane image 631 to vibrate, as well as the reference information images 64 indicating the order of play against the opponent's character.

[0069] Furthermore, when the storage medium 11 is not set on the lane 321, the information provision means 85 may provide information regarding a character (a helper character) to be displayed on the lane image 631. The helper character is not specifically limited, but includes characters that participated in cooperative play during past gameplay or characters that appeared in the mini-games. The information provision means 85 can provide information of the helper character when the storage medium 11 has not been placed on the lane 321 for a certain period of time, or when the player inputs an operation input requesting information. This allows the player to enjoy the game using the helper character even if the player does not possess the storage medium 11.

[0070] Furthermore, based on the helper character information, the player can decide whether or not the player should participate in battle using the helper character. Therefore, the display control means 83 can control to display the image of the helper character on the sub-display 61 in response to the player's operation input. Furthermore, the display control means 83 can also control the display of the image of the helper character on the sub-display 61 automatically based on the helper character's information, without requiring the player's input. With this configuration, the player can enjoy the game not only with the characters from the storage medium 11 but also with the characters that appeared in the past game play.

[0071] (Display Area Change Means)

The display area change means 86 has a function of changing the area in which the character image 633 is displayed between the main display 62 and the sub-display 61. Normally, as shown in Fig. 12, the opponent's

character image is displayed on the main display 62, and the player's character image 633 is displayed on the sub-display 61. Here, the main display 62 comprises, from the top down, a first display area 62a indicating the game's progress, and second through fourth display areas 62b-62d for displaying the opponent's character image. On the other hand, the sub-display 61 includes fifth to seventh display areas 61e-61g for displaying the character image 633, and an eighth display area 61h for displaying the control field image 63.

[0072] In this case, when the character image 633 is selected by the player, the display area change means 86 refers to the display area table stored in the storage unit 7. The display area change means 86 then determines the display area for the character image 633 corresponding to the opponent's character. For example, if the player's character possesses a fast attribute relative to the opponent's character, the display area change means 86 changes the display area so that the player's character image 633 is displayed in the fifth to seventh display areas 61e to 61g of the sub-display 61 and in the fourth display area 62d of the main display 62, as shown in Fig. 13(a).

[0073] Furthermore, if the opponent's character has an exhaust level, the display area change means 86 further changes the display area so that the player's character image 633 is displayed in the third display area 62c of the main display 62, as shown in Fig. 13(b). The changing the display area in this manner can gradually indicate to the player that the player's character has a high probability of defeating the opponent's character. As a result, the player can efficiently defeat the opponent's character without engaging in unnecessary battles.

[0074] Similarly, if the player's character has a slow attribute relative to the opponent's character, the display area change means 86 changes the display area so that the player's character image 633 is displayed in the sixth and seventh display areas 61f-61g of the sub-display 61, as shown in Fig. 13(c). Furthermore, if the player's character has an exhaust level, the display area change means 86 further changes the display area so that the player's character image 633 is displayed only in the seventh display area 61g of the sub-display 61, as shown in Fig. 13(d). By changing the display area in this manner, it is possible to gradually indicate to the player that there is a high probability that the player's character will be defeated by the opponent's character. As a result, the player can fight the opponent's character efficiently without engaging in the unnecessary battles.

[0075] (Sound Output Control Means)

The sound output control means 87 controls the output of all sounds and music related to the game. Specifically, the sound output control means 87 controls the output of the music and the sounds determined by the processing means 82. By providing the sounds and the music information to the speaker 5, the sound output means 87 enables the speaker 5 to output the sounds and the music.

[0076] Incidentally, as described above, the game device 1 of this embodiment includes the display unit 6, specifically a sub-display 61 which is configured as a touch panel. Therefore, the game device 1 can provide various mini-games using the sub-display 61. The mini-games may be executed across the entire area of the sub-display 61 or in any of the fifth to eighth display areas

61e to 61h.

[0077] The following describes the configuration of the control unit 8 for providing the mini-games. Fig. 14 is an enlarged view showing configurations of pixels in the game device according to the first embodiment of the present invention, Fig. 15 is an enlarged view showing a center of gravity of a touch element of the game device according to the first embodiment of the present invention, Fig. 16 is an enlarged view showing pixel areas of the touch element of the game device according to the first embodiment of the present invention, and Figs. 17 to 19 are schematic diagrams illustrating the grouping of the game device according to the first embodiment of the present invention.

[0078] As shown in Fig. 3, the processing means 82 includes an area calculation means 821, a determination means 822, an effect generation means 823, a center of gravity-determination means 824, an assignment means 825, and a grouping means 826. The configuration of each component is described in detail below.

[0079] (Area Calculation Means)

The area calculation means 821 is configured to calculate the area (pixel area) of the pixels 69 overlapped by the touch element T based on the pixel values acquired by the information acquisition means 81. For example, when the touch element T is three fingers, the information acquisition means 81 acquires the width and height coordinates of all pixels 69 overlapped by the three fingers. In this case, the area calculation means 821 calculates a difference between the largest width value and the smallest width value among the acquired coordinates. Similarly, the area calculation means 821 calculates a difference between the largest

height value and the smallest height value among the acquired coordinates. The area calculation means 821 may multiply the calculated difference in width of the pixels 69 by the calculated difference in height to calculate the pixel area of the pixels 69 where the three fingers are overlapped.

[0080] Not limited to this, the area calculation means 821 may calculate the pixel area based on the difference in width and the difference in height of the pixels 69, as well as the values in the pixel table described below. Note that the pixel table is stored in advance in the storage unit 7.

	Ratio of H/W	Number of 4K pixels	Value of one pixel
WIDTH	16	3840	8.5
HEIGHT	9	2160	15.2

[0081] Specifically, when the area calculation means 821 calculates a width difference value of 2560 and a height difference value of 4096, the area calculation means 821 uses the value of one pixel in the aforementioned pixel table to convert the calculated width difference value and height difference value as follows.

- Width value : $2560 \div 8.5 = 301$ pixels
- Height value: $4096 \div 15.2 = 270$ pixels

[0082] Then, the area calculation means 821 calculates the pixel area as $301 \times 270 = 81,270$ pixels using the converted values for the difference in width and the difference in height. As a result, the area of the pixels overlapped by the three fingers is set to 81,270 pixels. Note that the area calculation means 821 may also calculate the pixel area directly from the pixel

values acquired by the information acquisition means 81.

[0083] (Determination Means)

The determination means 822 has a function of determining the type of pixel element based on the pixel area calculated by the area calculation means 821. The determination means 822 refers to the touch element table shown in Fig. 8. Then, the determination means 822 identifies a range of the pixel area that includes the calculated pixel area and determines the type of touch element T. If the pixel area is 81,270 pixels, the determination means 822 identifies the range of pixel areas containing the pixel area as 10,000 to 149,999. The determination means 822 then determines the touch element T to be three fingers or a child's palm. Similarly, if the pixel area is between 1 and 9,999, the determination means 822 determines that the touch element T is the stylus pen or the finger.

[0084] The contact areas on the display unit 6 caused by the child's palm and caused by the three fingers are statistically nearly equivalent. Therefore, in this embodiment, the child's palm and the three fingers are classified as the same touch element T. This simplifies the processing performed by the determination means 822. Thus, the game device 1 of this embodiment can determine which touch element T has touched the display 6. Consequently, it can provide various mini-games, such as a coloring game described below.

[0085] Furthermore, in the touch element table of Fig. 8, the range of pixel area can be set to different ranges corresponding to the type of touch element T. In this case, the determination means 822 can determine a single touch element T as the type of touch element T. Consequently, the determination means 822 can determine

the type of touch element T touched on the sub-display 61 in detail, such as the finger, the child's palm, or the adult's palm. Consequently, the mini-games corresponding to the type of touch element T can be provided.

[0086] (Effect Generation Means)

The effect generation means 823 has a function of generating an effect corresponding to the touch element T based on the type of touch element T determined by the determination means 822. For example, if the determination means 822 determines that the touch element T is the three fingers, the effect generation means 823 refers to the touch element table shown in Fig. 8. Then, the effect generation means 823 determines the effect either randomly or in sequence. For example, if effect 1 is determined, the effect generation means 823 controls the display of the effect 1 image 68 in a position close to the touch element T (hand) or the character image 633 (Fig. 14(b)).

[0087] Similarly, if the touch element T is the finger, the image of effect 1 shown in Fig. 8 is displayed in the position close to the finger or the character image 633 (Fig. 14(a)). By displaying the effect image 68 in this manner, the type of touch element T can be visually indicated to the player. Therefore, even if, for example, a parent and a child touch the display unit 6 simultaneously, it is possible to clearly indicate to the player which touch element T produced the effect.

[0088] Furthermore, the effect generation means 823 has a function to generate effects related to the mini-game described later. For example, when the touch element T touches the display unit 6, the effect

generation means 823 generates a predetermined mark from the touched area (Fig. 20) or controls the display of the character image 633 to change. Furthermore, the effect generation means 823 can control the display to change the color of the image at the touched area (Fig. 21). Additionally, the effect generation means 823 can vary the effects depending on the movement of the touch element T or the manner in which the player operates the touch element T.

[0089] (Center of Gravity-Determination Means)

When the touch element T touches the display unit 6, the touch element T may come into contact with the display unit 6 at multiple contact points. At this time, the information acquisition means 81 acquires the pixel values of the multiple contact points. In this case, the center of gravity-determination means 824 has the function of determining the center of gravity 67 of a touch element T from the multiple contact points. For example, when the display unit 6 is touched with the palm, as shown in Fig. 15, the palm may come into contact with the display unit 6 at five contact points. At this time, the center of gravity-determination means 824 determines the center of gravity 67 of the palm based on the pixel positions of the five contact points and pixel values such as their width and height. A determination method is performed using a general method. Note that the center of gravity-determination means 824 may determine the center of gravity 67 of the palm based solely on the pixel positions of the contact points or solely on the pixel values.

[0090] Furthermore, when the finger touches the display unit 6, the center of gravity-determination means 824 determines the center of gravity 67 of the finger based on the pixel values of the pixels 69 where

the finger overlaps. Specifically, the center of gravity-determination means 824 calculates the center of gravity 67 from the width and height values of the pixel values. Since it is clear at which point the touch element T is in contact with the display unit 6 with respect to the center of gravity 67, it is easy to understand which range of the pixel area the effect occurs.

[0091] Furthermore, the center of gravity-determination means 824 may determine any one of the multiple contact points as the center of gravity 67. That is, the center of gravity-determination means 824 may also determine the contact point with the largest contact area among the multiple contact points as the center of gravity 67. As described above, when the center of gravity 67 is determined, the effect generation means 823 may display a black dot at the center of gravity 67 of the palm as shown in Fig. 15. This allows the player to see which part of the display unit 6 the palm is centered on during contact.

[0092] (Assignment Means)

The assignment means 825 has a function of assigning a pixel area corresponding to the determined type of touch element T to the touch element T. For example, if the determination means 822 determines that the touch element T is the adult's palm, the assignment means 825 refers to Fig. 8 to identify the pixel area corresponding to the adult's palm. The assignment means 825 then assigns a "5×5" pixel area 693 to the touch element T. At this time, the assignment means 825 assigns the pixel area 693 to the adult palm such that the center of gravity 67 of the touch element T is positioned at the center of the pixel area 693. Consequently, when an adult's palm touches the surface

of the display unit 6, it is determined that a "5×5" = 25 pixel area 693 is in contact with the touch element T (Fig. 16(c)).

[0093] Furthermore, when the touch element T corresponds to the three fingers or the child's palm, the same pixel area corresponds to both (Fig. 8). Therefore, regardless of whether the touch element T corresponds to the three fingers or the child's palm, a "3×3" = 9 pixel area 692 is assigned to the touch element T (Fig. 16(b)). Similarly, when the touch element T corresponds to the finger, the assignment means 825 assigns a "1×1" = 1 pixel area 691 to the touch element T. Thus, the larger touch element T is, the larger the pixel area determined to be in contact with the display unit 6 at any given time is. Consequently, the player can enjoy the mini-games such as the coloring game, even more.

[0094] Furthermore, in the touch element table of Fig. 8, the pixel areas may be set to be different from one another depending on the type of touch element T. In this case, the assignment means 825 can assign different pixel areas for each type of touch element T. This makes it possible to support various mini-games, such as the coloring game that require touching a wide area of the display unit 6 or games that require touching a narrow area. Furthermore, the same pixel areas may be uniformly set regardless of the type of touch element T. Additionally, the assignment means 825 may assign the touch element T to any position on the touch element T without assigning its center of gravity 67 to the center of the pixel area.

[0095] (Grouping Means)

Since the display unit 6 of the game device 1 of

this embodiment has a surface area of a certain size, multiple touch elements T or different types of touch elements T may come into contact with the surface of the display unit 6. Furthermore, since the display unit 6 is configured as the touch panel, the player can perform slide or flick operations on the display unit 6. Figs. 17 to 19 illustrate a state in which the left palm (first touch element) and the right palm (second touch element) touch the display unit 6 as the multiple touch elements T.

[0096] The grouping means 826 has a function of grouping the multiple touch elements T when the distance between the centers of gravity 67 of such multiple touch elements T comes within a predetermined distance. Furthermore, the grouping means 826 has a function of setting a grouped touch element T as a single touch element T (grouped touch element). Here, the predetermined distance refers to a group setting distance for grouping the first touch element T and the second touch element T. The group setting distance is a distance of 1 to 5 pixels, preferably 1 to 3 pixels, from the center of gravity 67. In other words, the group setting distance is the distance within the range of 8.3 to 41.5 mm, preferably 8.3 to 24.9 mm, from the center of gravity 67. This forms a group setting circle 601 centered on the center of gravity 67. When the grouping distance is within this range, the touch elements T can be grouped appropriately without colliding with one another.

[0097] Specifically, as shown in Fig. 17, when the left palm is outside the group setting circle of the right palm and the right palm is outside the group setting circle 601 of the left palm, the control unit 8 recognizes that two touch elements T are touching the

display unit 6. From this state, as the left palm and the right palm approach each other, the group setting circle 601 of the left palm and the group setting circle 601 of the right palm intersect. At this time, as shown in Fig. 18, the grouping means 826 groups the left palm and the right palm together and sets the grouped touch element. Subsequently, the center of gravity-determination means 824 newly determines a center of gravity 671 of the grouped touch element. Then, the assignment means 825 assigns a new pixel area to the grouped touch element.

[0098] In this case, the pixel area is not specifically limited and may be a $5 \times 5 = 25$ pixel area or a $5 \times 5 \times 2 = 50$ pixel area. This increases the area that can be touched on the display unit 6 at once, allowing the mini-game described later to be played more advantageously. Furthermore, since multiple players can play the mini-game simultaneously, the fun can be shared with more players than with conventional game devices.

[0099] On the other hand, the grouping means 826 has a function to release or ungroup the multiple touch elements T when the distance between their respective centers of gravity 67 exceeds a predetermined distance. Furthermore, the grouping means 826 has a function of resetting the grouped touch element to their original touch elements T. Here, the predetermined distance refers to a group release distance required to release or ungroup the grouping between the first touch element T and the second touch element T. The group release distance is a distance of 2 to 6 pixels, preferably 2 to 4 pixels, from the center of gravity 67. In other words, the group release distance is the distance within the range of 16.6 to 49.8 mm, preferably 16.6 to 33.2 mm. This forms a group release circle 602 centered on the

center of gravity 67. When the group release distance is within this range, the grouping is not immediately released, allowing the player to afford.

[0100] As shown in Fig. 18, when the touch elements T are grouped, the control unit 8 recognizes that the grouped touch element is being touched. From this state, as the left palm and the right palm move away from each other, the group release circles 602 of the left palm and the right palm come into contact (Fig. 19). Then, as the left palm and the right palm move further apart, the grouping means 826 releases or ungroups them. This returns to the state shown in Fig. 17, and the control unit 8 recognizes the two touch elements T (Fig. 17). This allows the multiple players to freely slide on the display unit 6 independently, enabling them to advance the mini-games described later more effectively. Furthermore, since the multiple players can respectively play the game, the fun can be shared with more players than with the conventional game devices.

[0101] In this way, establishing the group setting circle 601 and the group release circle 602 creates a difference between group setting and group release. This difference allows the grouping to be maintained for a certain period of time or distance, even if the touch elements T move away from each other. As a result, the game can provide the players with a prolonged sense of excitement. Furthermore, by setting the group setting distance and the group release distance to be the same, the group setting circle 601 and the group release circle 602 may be combined.

[0102] In addition to the above configuration, the control unit 8 of the present invention may include direction detection means for detecting a movement

direction of the touch element T. For example, if the player performs the flick operation upward on the sub-display 61, the direction detection means detects the movement direction of the touch element T as upward. Consequently, the effect generation means 823 can generate a predetermined effect directed toward the main display 62 based on the detected upward direction. This allows the predetermined effect to be generated from the sub-display 61 toward the main display 62, thereby enabling the provision of the mini-game across the entire display unit 6.

[0103] Furthermore, the processing means 82 may have a function to ignore contact of the touch element T within a predetermined circle centered on the center of gravity 67. Specifically, the processing means 82 sets the circle centered on the center of gravity 67, with a radius equal to the distance from the center of gravity 67 to the farthest contact point. Next, the processing means 82 sets a threshold circle larger than said radius. In this state, even if another touch element T contacts the display unit 6 within the area inside the threshold circle, the processing means 82 can provide a function to ignore the contact of the another touch element T.

[0104] Furthermore, the processing means 82 may have a function to ignore contact by another touch element T within the pixel area. With such a function, since the contact by another touch element is not recognized, the center of gravity 67 of the touch element T can be fixed accurately and reliably. Note that the radius of the threshold circle is not particularly limited, for example a distance of 2 to 5 pixels is preferred, and a distance of 3 to 4 pixels is particularly preferred.

[0105] <Communication Unit>

The communication unit 9 has a function of communicating with external networks (LAN, WAN, the Internet, etc.) or devices via wired or wireless means. The game device 1 of the present invention may communicate the data with other devices such as other game devices or information terminals via the communication unit 9. For example, the communication unit 9 may communicate with other devices to obtain the music data or the game program. This allows the game program to be updated, enabling the provision of the latest games. Note that the game device 1 need not necessarily include the communication unit 9.

[0106] Although the image display device of the present invention has been described above as the game device 1, the game device 1 of this embodiment, in addition to the components described above, is also equipped with a coin slot, a coin return slot, and an ejection port for the storage medium 11 on the front of the housing 2.

[0107] Furthermore, the game device 1 can be connected to multiple game devices 1 via the network. In this case, a server (not shown) manages various types of information. This allows the server to determine which players are playing on the game device 1. By having that the server manages the player's touch element T, for example, if the determination means 822 identifies a child's palm as the touch element T, the server can provide the player with a predetermined benefit at a certain degree.

[0108] 4. Description of the Mini-Game

Next, the mini-games executed on the game device 1 of this embodiment will be described. Fig. 20 is a schematic diagram illustrating a first mini-game of the

game device according to the first embodiment of the present invention, and Fig. 21 is a schematic diagram illustrating a second mini-game of the game device according to the first embodiment of the present invention.

[0109] The mini-games may be executed at any time during the gameplay. For example, the mini-games may be executed at the end of the battle upon defeating the opponent character or randomly. Furthermore, the mini-games are provided by each component of the control unit 8 and each component of the processing means 82 (e.g., the mini-game provision means) described above. Such the mini-games are not particularly limited as long as they are provided by the touch element T coming into contact with the display unit 6. Examples include a mini-game that generates a predetermined image (first mini-game) and a coloring game (second mini-game).

[0110] <First Mini-Game>

When the touch element T comes into contact with the display unit 6, the effect generation means 823 controls the display of the image, such as a predetermined mark, at a pixel 695 where the center of gravity 67 of the touch element T overlaps (hereinafter, referred to as the "overlapping pixel"). For example, as shown in Fig. 20, at the overlapping pixel 695 where the center of gravity 67 of the touch element T overlaps, the effect generation means 823 generates an effect such as causing an image of a heart mark to appear (Fig. 20(a)). This effect may occur only once or may continue to occur as long as the touch element T remains in contact. In this state, if the touch element T moves, the effect at the overlapping pixel 695 disappears (Fig. 20(b)). On the other hand, at the overlapping pixel (hereinafter, referred to as the "next overlapping

pixel") 696 to which the touch element T has moved, the effect generation means 823 generates a similar effect (Fig. 20(b)).

[0111] In this state, when the touch element T returns to the overlapping pixel 695, the effect generation means 823 generates the aforementioned effect again at the overlapping pixel 695 after a predetermined time (Fig. 20(c)). Even if the touch element T returns to the overlapping pixel 695 before this predetermined time, the effect is not generated. The predetermined time (inactive period) is not specifically limited, but a duration of approximately 0.5 to 3 seconds is preferred. By setting this predetermined time, the effect does not continue even if the touch element T contacts the same pixel 69 on the display unit 6, thereby providing the player with an incentive to move the touch element T over a wide area of the display unit 6. This allows the effects to be generated across a wide range of the display unit 6.

[0112] The effect generation means 823 may also generate the aforementioned effect at the overlapping pixel 695 based on the number of pixels moved from the overlapping pixel 695, rather than the predetermined time. Specifically, if the touch element T moves a predetermined number (e.g., 1 to 10) of pixels away from the overlapping pixel 695, the effect generation means 823 may cancel the inactive period. Therefore, when the touch element T returns to the overlapping pixel 695 from the next overlapping pixel 696, the effect generation means 823 can restore the aforementioned effect. Since the effect does not occur unless the touch element T moves a predetermined distance on the display unit 6, this provides the player with the incentive to move the touch element T over the wide range of the

display unit 6. This allows the effects to be generated across the wide range of the display unit 6.

[0113] The effect generation means 823 may generate effects such as sound, image vibration, or image deflection instead of the images such as the predetermined mark. Furthermore, the effect generation means 823 may refer to the touch element table shown in Fig. 8 and adjust the magnitude of the generated effect according to the type of touch element T.

[0114] <Second Mini-Game>

When the touch element T comes into contact with the display unit 6, the effect generation means 823 controls the change in color of the displayed image at the overlapping pixel 695 where the center of gravity 67 of the touch element T overlaps. For example, as shown in Fig. 21, a water droplet image (mini-game image) is displayed (Fig. 21(a)). When the finger of touch element T comes into contact with the display unit 6, the effect generation means 823 generates an effect that changes the color of the image at the overlapping pixel 695. In this state, when the touch element T moves, the effect generation means 823 causes the color of the image to change at the next overlapping pixel 696 where the center of gravity 67 of the touch element T overlaps (Fig. 21(b)). In this case, since the assignment means 825 has assigned a "1×1" pixel area 692 to the finger, the effect generation means 823 can change the color of the image at the single pixel 69. By repeating this process, the effect generation means 823 can change the color of the water droplet image (Fig. 21(d)).

[0115] When the touch element T is three fingers, the effect generation means 823 generates the effect that changes the color of the water droplet image in the same

manner as when using a single finger. In this case, since the assignment means 825 assigns a "3×3" pixel area 692 to the three fingers, the color of the image in nine pixels 69 can be changed at once (Fig. 21(c)). Consequently, since the effect generation means 823 can change the color of a wider area than the touch element T of the finger in a single operation, it can provide the player with a sense of satisfaction and enable them to succeed in the game more quickly (Fig. 21(d)). Furthermore, the determination means 822 determines that the game has been successful when the color of the water droplet image has been changed by 80-100%. As a result, the effect generation means 823 can generate the predetermined effect such as a level-up.

[0116] Furthermore, the mini-game may be a game in which the appearance or expression of the character image 633 is changed when the touch element T comes into contact with the character image 633 displayed on the display unit 6. This is a game that changes the display of the character image 633 instead of changing the color as in the second mini-game.

[0117] B. Method for Controlling the Operation of the Image Display Device

<Game Device Processing>

Next, the method for controlling the operation of the image display device of the present invention will be described. For ease of understanding, the following explanation uses the example where the image display device is the game device. Fig. 22 is a flowchart illustrating a game processing flow of the game device according to the first embodiment of the present invention, Fig. 23 is a flowchart illustrating a battle flow of the game device according to the first embodiment of the present invention, and Fig. 24 is a flowchart

illustrating a flow of mini-game processing in the game device according to the first embodiment of the present invention.

[0118] First, when the player inserts a coin, the control unit 8 controls the display of the game image and the opponent character image. As a result, the main display 62 of the display unit 6 displays the opponent character image (S1). Simultaneously, the control unit 8 controls the display of the operation field image 63. As a result, the sub-display 61 of the display unit 6 displays the operation field image 63 (S2). In this state, the player sets the storage medium 11 onto the lane 321 of the operation field 32 (S3). Then, the reading unit 4 reads the character information stored in the storage medium 11.

[0119] The control unit 8 acquires the character information and determines whether or not the size of the character image 633 corresponding to the character information is the default (S4). If the control unit 8 determines that the character image 633 is not the default, it changes the size of the lane image 631 corresponding to the lane 321 on which the storage medium 11 is set (S5). Thereafter, the control unit 8 controls the display of the character image 633 on the lane image 631. As a result, the sub-display 61 of the display unit 6 displays the character image 633 on the lane image 631 (S6).

[0120] On the other hand, in step S4, if the control unit 8 determines that the character image 633 is the default, the process proceeds to step S6. Next, the control unit 8 determines whether or not all the storage medium 11 have been set on the lanes 321 (S7). If the control unit 8 determines that all storage medium 11 are

set on the lanes 321, the control unit 8 determines whether or not the helper character is set (S71). If the control unit 8 determines that the helper character is not set, the process returns to step S3. Consequently, the processing from steps S3 to S71 is repeated.

[0121] In step S71, if the control unit 8 determines that the helper character is set, the control unit 8 controls the display of the helper character's image on the lane image 631. As a result, the sub-display 61 of the display unit 6 displays the image of the helper character on the lane image 631 (S72). The process then proceeds to step S8.

[0122] In step S7, if it is determined that all the storage media 11 have been set on the lanes 321, the process proceeds to step S8. The control unit 8 receives the information indicating that the touch element T has touched the helper character image 633 on the lane image 631 (S8). Consequently, the control unit 8 controls the display to show the reference information for the touched character image 633 (S9). Next, the control unit 8 determines whether or not the touch element T has slid the character image 633 (S10). If it is determined that the touch element T has not slid the character image 633, the process returns to step S8. Consequently, the processing in steps S8 through S10 is repeated. On the other hand, if it is determined that the touch element T has slid the character image 633, the process proceeds to end through the battle (S11) and the mini-game (S12).

[0123] Next, using Fig. 23, descriptions will be made on the battle processing provided by the game device 1. First, in step S11 of Fig. 22, the control unit 8 compares the acquired character information with the

character information of the opponent character and determines whether or not their properties (attributes) are different values (S111). If it determines that the values of the properties are not different, the control unit 8 controls the display of the character image 633 of the player in the fifth to seventh display areas 61e-61g of the sub-display 61. As a result, the character image 633 of the player is displayed as shown in Fig. 12 (S112a).

[0124] On the other hand, if the control unit 8 determines that the properties are of different values, that is, if the value representing the property of the character image 633 of the player is greater than the value representing the property of the opponent character, the control unit 8 controls the display so that the character image 633 of the player is also enlarged and displayed into the fourth display area 62d of the main display 62. As a result, the character image 633 of the player is displayed as shown in Fig. 13(a) (S112b).

[0125] Furthermore, if the control unit 8 determines that the properties are of different values, that is, if the value representing the property of the character image 633 of the player is smaller than the value representing the property of the opponent character, the control unit 8 controls the display so that the character image 633 of the player is displayed in a reduced size within the sixth and seventh display areas 61f-61g of the sub-display 61. As a result, the character image 633 of the player is displayed as shown in Fig. 13(c) (S112c).

[0126] Next, the control unit 8 determines whether or not the opponent character has suffered damage

(exhaustion) (S113). If the control unit 8 determines that the opponent character has taken the damage, the control unit 8 enlarges the display of the character image 633 of the player so that it is also displayed in the third display area 62c of the main display 62 (S114). As a result, the character image 633 of the player is displayed as shown in Fig. 13(b).

[0127] On the other hand, if, in step S113, the control unit 8 determines that the opponent character has suffered no damage, the process proceeds to step S115. Next, the control unit 8 determines whether or not the player's character has suffered damage (S115). If the control unit 8 determines that the player's character has sustained damage, the control unit 8 controls the display so that the character image 633 of the player is displayed in the reduced size in the seventh display area 61g of the sub-display 61. As a result, the opponent character image is displayed in an enlarged size as shown in Fig. 13(d) (S116). The process then terminates or ends.

[0128] On the other hand, if, in step S115, the control unit 8 determines that the opponent character has not suffered damage, the process ends. Note that the order of steps S113-S114 and S115-S116 may be reversed.

[0129] Next, using Fig. 24, the processing of the first mini-game provided by the game device 1 will be explained. In step S12 of Fig. 22, the control unit 8 starts the first mini-game. The control unit 8 controls the display of an arbitrary character image 633 (S121). In this state, the control unit 8 acquires the touch information from the touch element T at the predetermined (overlapping) pixel 695 (S122). The control unit 8

generates the effect at the overlapping pixel 695 (S123). Next, the control unit 8 determines whether or not the touch element T has moved (S124).

[0130] If the control unit 8 determines that touch element T has moved, it determines whether or not the predetermined period of time has elapsed (S125). Next, if it determines that the predetermined period has elapsed, the control unit 8 determines whether or not the touch element T has returned to the predetermined pixel and whether or not it has received the touch information from the touch element T again (S126). If the control unit 8 determines that it has received the touch information again, the control unit 8 generates the effect again at that predetermined pixel (S127). By this step, the process terminates or ends.

[0131] Furthermore, if it is determined in step S124 that the touch element T has moved, that is, if it is determined that the touch element T has moved to another pixel, the process returns to step S122, and steps S122 through S124 are repeated. On the other hand, if it is determined that the touch element T has not moved, the effect is not generated again, and the process terminates or ends.

[0132] In step S125, if it is determined that the predetermined time has not elapsed, the process returns to step S122, and steps S122 through S125 are repeated. Furthermore, in step S126, if it is determined that the touch information from the touch element T has not been received again, the process returns to step S122, and steps S122 through S125 are repeated.

[0133] On the other hand, the processing for the second mini-game is implemented by omitting steps S125

to S126. However, the processing for the second mini-game may be the same as that for the first mini-game. In this case, the effect in step S127 may involve the appearance of the predetermined mark or the like.

[0134] <Grouping Process>

Next, the grouping process for the touch elements T received by the display unit 6 of the game device 1 of the present invention will be explained. Fig. 25 is a flowchart illustrating a flow of the touch element grouping in the game device according to the first embodiment of the present invention. First, the control unit 8 receives the touch information from the multiple touch elements T (S21). Here, the multiple touch elements T are described as a touch element Ta and a touch element Tb.

[0135] The control unit 8 acquires the pixel value as the touch information from each touch element T (S22). The control unit 8 calculates the pixel area based on the acquired pixel value (S23). The control unit 8 determines the type of each touch element T based on the calculated pixel area (S24).

[0136] Next, the control unit 8 determines the center of gravity 67 of each touch element T based on the pixel value and pixel area (S25). Then, based on the type of each touch element T, the control unit 8 assigns (allocates) the pixel area to the touch element T centered on its center of gravity 67 (S26). In this state, the control unit 8 determines whether or not the center of gravity 67 of the touch element Ta and the center of gravity 67 of the touch element Tb are within the group setting distance (S27). If it is determined that the center of gravity 67 of the touch element Ta and the center of gravity 67 of the touch element Tb are

within the group setting distance, the touch element Ta and the touch element Tb are grouped (S28). This generates the grouped touch element T.

[0137] At this time, the control unit 8 determines a grouped center of gravity of the grouped touch element T based on the aforementioned pixel value and pixel area (S29). Then, the control unit 8 assigns (allocates) a new pixel area centered on this grouped center of gravity (S210). Next, the control unit 8 determines whether or not the center of gravity 67 of the touch element Ta and the center of gravity 67 of the touch element Tb are within the group release distance (S211). If it is determined that the center of gravity 67 of the touch element Ta and the center of gravity 67 of the touch element Tb are not within the group release distance, the grouping of the touch element Ta and the touch element Tb is released (S212). Then, the process terminates or ends.

[0138] On the other hand, if it is determined in step S211 that the center of gravity 67 of the touch element Ta and the center of gravity 67 of the touch element Tb are within the group release distance, the control unit 8 maintains the grouping (S213). Thereby, steps S211 to S213 are repeated. Furthermore, in step S27, if it is determined that the center of gravity 67 of the touch element Ta and the center of gravity 67 of the touch element Tb are not within the group setting distance, the process terminates or ends.

[0139] The processing methods described above can be implemented using a computer program. Such a program can be executed on a CPU (Central Processing Unit), a microprocessor, GPU (Graphics Processing Unit), RAM (Random Access Memory), ROM (Read-Only Memory), and

other components.

[0140] <<Second Embodiment>>

Next, a second embodiment of the image display device of the present invention will be described with reference to the attached drawings.

[0141] Fig. 26 is a partially enlarged schematic view showing a display unit and an operation unit of a game device according to a second embodiment of the present invention. The following description focuses on the differences from the first embodiment described above, and explanations of similar matters are omitted. Components identical to those in the first embodiment described above are denoted by the same reference numerals.

[0142] The game device 100 of this embodiment is the same as the game device 1 of the first embodiment, except that the arrangement of the lanes 321 on the operation field 32 of the operation unit 3 is different. Specifically, as shown in Fig. 26, the game device 100 of this embodiment is configured such that each lane 321 is arranged along the lane image 631 so as to form a straight line with the lane image 631. In other words, the lane image 631 and the lane 321 are formed into an elongated shape, resembling a single operation unit 3. Consequently, sliding the storage medium 11 forward along each lane 321 causes the character image 633 on the lane image 631 to be displayed as moving forward. This gives the player the impression that they have actually moved the storage medium 11 from the lane 321 to the lane image 631. Furthermore, the game device 100 of this embodiment has the same effects as the game device 1 of the first embodiment.

[0143] <<Third Embodiment>>

Next, a third embodiment of the image display device of the present invention will be described with reference to the attached drawings.

[0144] Fig. 27 is an enlarged plan view schematically illustrating a game device according to a third embodiment of the present invention. The following description focuses on the differences from the first embodiment described above, and explanations of similar matters are omitted. Note that the same reference numerals are used for components identical to those in the first embodiment described above.

[0145] The game device 200 of this embodiment differs from the game device 1 of the first embodiment and the game device 100 of the second embodiment in that it is formed entirely on a plane. Specifically, as shown in Fig. 27, the game device 200 of this embodiment is configured such that the display unit 6, the operation unit 3A of the first sub-game device 1A, and the operation unit 3B of the second sub-game device 1B are formed on the same plane. That is, a sub-operation unit 3A of the first sub-game device 1A and a sub-operation unit 3B of the second sub-game device 1B are arranged on longitudinal opposite sides of the display unit 6. As a result, the display unit 6 and the two sub-operation units 3A and 3B face opposite to each other. With this configuration, the players face each other while playing the game.

[0146] Consequently, since the players can play while looking at their opponent, it is possible to create an atmosphere as if the players are actually battling each other. Furthermore, because the display unit 6 faces upward, even children can easily touch the display

unit 6, and the multiple players can touch the display unit 6 simultaneously. Therefore, the multiple players including the children can enjoy playing the mini-games together. Furthermore, the game device 200 of this embodiment has the same effects as those possessed by the game device 1 of the first embodiment and the game device 100 of the second embodiment.

[0147] <<Fourth Embodiment>>

Next, a fourth embodiment of the image display device of the present invention will be described with reference to the attached drawings.

[0148] Fig. 28 is a front view schematically illustrating an image display device according to a fourth embodiment of the present invention. The following description focuses on the differences from the first embodiment described above, and explanations of similar matters are omitted. Note that the same reference numerals are used for components identical to those in the first embodiment described above.

[0149] The image display device 300 of this embodiment differs from the image display devices of the first to third embodiments in that it is configured as a smartphone. Specifically, as shown in Fig. 28, the image display device 300 of this embodiment includes the display unit 6 which is composed of the touch panel, as an operation display section. The image display device 300 is smaller in size compared to the game device 1 of the first embodiment. As a result, the players can enjoy the mini-games anytime, anywhere. Furthermore, as shown in Fig. 28, the image display device 300 allows the touch elements T to be appropriately grouped using the index finger and thumb of one hand. Note that the image display device 300 of this embodiment also provides the

same effects as those provided by the game device 1 of the first embodiment.

[0150] The image display device, the method for controlling the operation thereof, and the program of the present invention have been described above based on preferred embodiments. However, the present invention is not limited thereto. The configurations of each component may be replaced with any configuration having similar functions. Furthermore, any other means or components may be added to the present invention. Additionally, the present invention may comprise a combination of any two or more configurations (features) of the aforementioned embodiments.

INDUSTRIAL APPLICABILITY

[0151] The present invention provides an image display device. This image display device includes an operation display unit for displaying a predetermined image and receiving touch information by a touch element and a control unit for controlling display of the predetermined image. The operation display unit has a surface and a layer having a plurality of pixels. The layer is provided beneath the surface. The plurality of pixels includes an overlapping pixel on which the touch element overlaps. When the touch element is in contact with the surface of the operation display unit, the control unit calculates an area of the overlapping pixel from the touch information in the overlapping pixel in the plurality of pixels and determines a type of the touch element based on the area. This makes it possible to determine the type of the touch element when the touch element comes into contact with screens. Therefore, the present invention has industrial applicability.

What is claimed is:

1. An image display device comprising:
an operation display unit for displaying a predetermined image and receiving touch information by a touch element; and
a control unit for controlling display of the predetermined image,
wherein the operation display unit has a surface and a layer having a plurality of pixels, the layer provided beneath the surface, and
wherein the plurality of pixels includes an overlapping pixel on which the touch element overlaps, and when the touch element is in contact with the surface of the operation display unit, the control unit calculates an area of the overlapping pixel from the touch information in the overlapping pixel in the plurality of pixels and determines a type of the touch element based on the area.
2. The image display device as claimed in claim 1, wherein the touch information includes sizes of a height and a width of the overlapping pixel.
3. The image display device as claimed in claim 2, wherein the control unit determines a center of gravity of the touch element based on the sizes of the height and the width of the overlapping pixel and the area of the touch element.
4. The image display device as claimed in claim 3, wherein the control unit assigns a pixel area for recognizing contact of the touch element and the surface to the touch element centered on the center of gravity, depending on the type of the touch element.

5. The image display device as claimed in claim 4, wherein the control unit generates a predetermined effect in the pixel area.

6. The image display device as claimed in claim 3, wherein the plurality of pixels includes a center of gravity-pixel on which the center of gravity positions, the control unit generates a predetermined effect in the center of gravity-pixel in the plurality of pixels.

7. The image display device as claimed in claim 1, wherein the touch element includes a first touch element and a second touch element different from the first touch element, and

wherein the control unit groups the first touch element and the second touch element when the first touch element and the second touch element are in a range of a group setting distance.

8. The image display device as claimed in claim 7, wherein the control unit releases the grouping of the first touch element and the second touch element when the first touch element and the second touch element are beyond a group release distance which is larger than the group setting distance.

9. The image display device as claimed in claim 4, wherein the control unit is configured to ignore contact to the pixel area with another touch element which is different from the touch element.

10. A method for controlling an operation of an image display device, the method comprising:

displaying a predetermined image on a touch-screen display unit having a plurality of pixels;

acquiring touch information in an overlapping pixel

in the plurality of pixels when the touch element is in contact with the touch-screen display unit, the overlapping pixel overlapping with the touch element;

calculating an area of the overlapping pixel from the touch information; and

determining a type of the touch element based on the area.

11. A program for causing a computer to function as:

a step of displaying a predetermined image on a touch-screen display unit having a plurality of pixels;

a step of acquiring touch information in an overlapping pixel in the plurality of pixels when the touch element is in contact with the touch-screen display unit, the overlapping pixel overlapping with the touch element;

a step of calculating an area of the overlapping pixel from the touch information; and

a step of determining a type of the touch element based on the area.