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Tsuchiya

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(54) **INFORMATION PROCESSING DEVICE AND INFORMATION PROCESSING SYSTEM FOR MERCHANDISE REGISTRATION**

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G06Q 30/0601 (2023.01)

(52) **U.S. Cl.**
CPC ***G06V 10/17*** (2022.01); ***G06Q 30/0601*** (2013.01); *G06V 2201/07* (2022.01)

(58) **Field of Classification Search**
CPC G06V 10/17; G06V 2201/07
See application file for complete search history.

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(57) **ABSTRACT**

An information processing device for a retail merchandise registration system includes a communication interface configured to connect to product scanners and processing requests and image data from the scanners. The processor compares a present device load value to a threshold and sends a positive response when the present device load is less than the threshold and a negative response when the present device load is equal to or greater than the threshold load. An image processing unit is configured to perform recognition processing on the image data from the scanner devices to detect an object depicted in the image data. The processor sends a recognition result to the scanner after the recognition processing has been performed by the image processing unit.

20 Claims, 6 Drawing Sheets

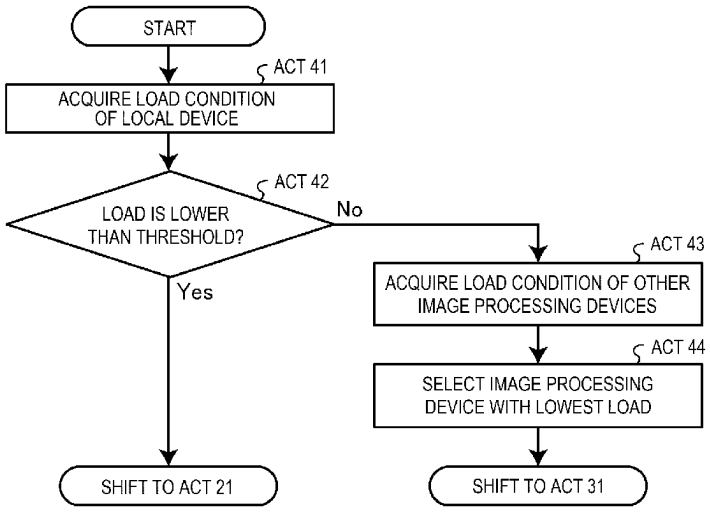


FIG. 1

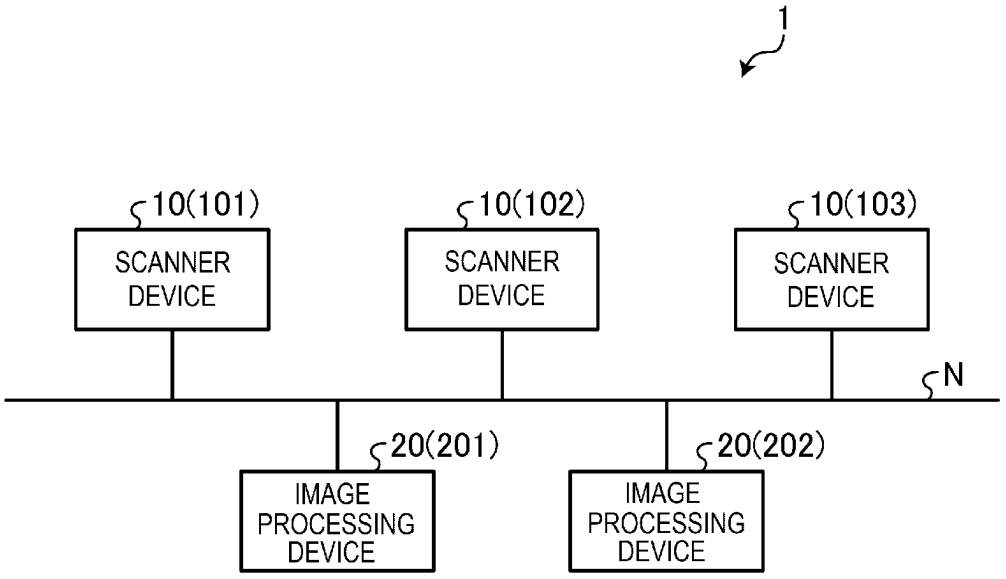

1
10(101)
SCANNER DEVICE
10(102)
SCANNER DEVICE
10(103)
SCANNER DEVICE
N
20(201)
IMAGE PROCESSING DEVICE
20(202)
IMAGE PROCESSING DEVICE

FIG. 2

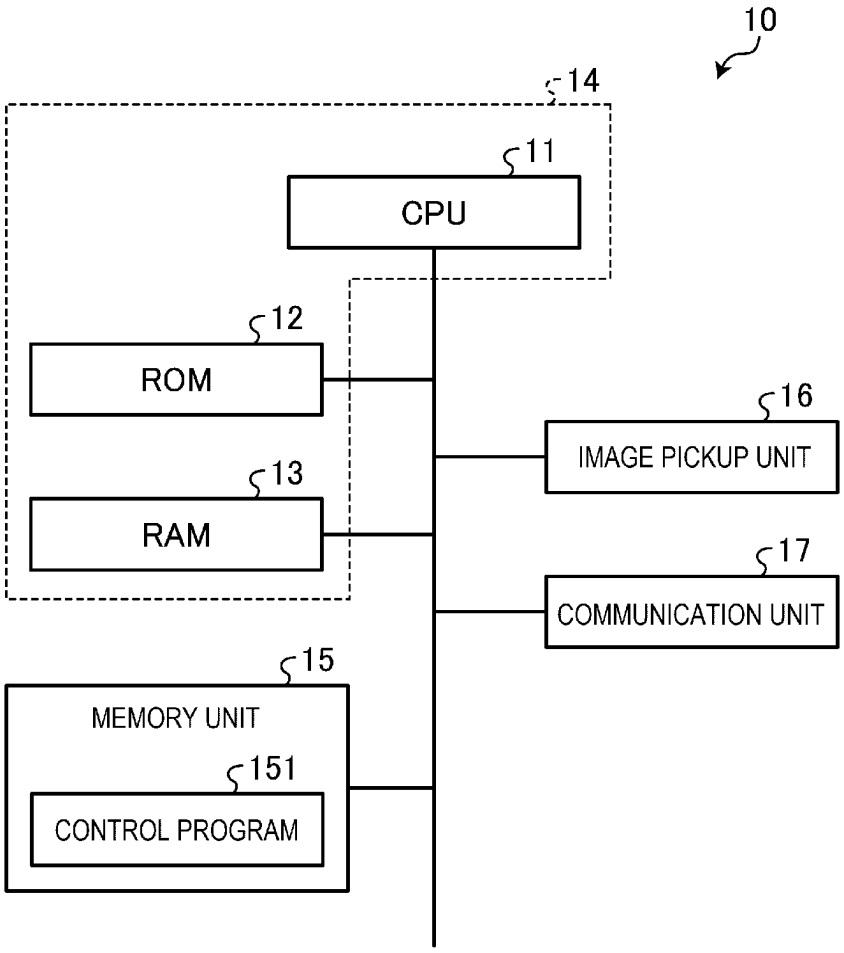

10
14
11
CPU
12
ROM
13
RAM
16
IMAGE PICKUP UNIT
17
COMMUNICATION UNIT
15
MEMORY UNIT
151
CONTROL PROGRAM

FIG. 3

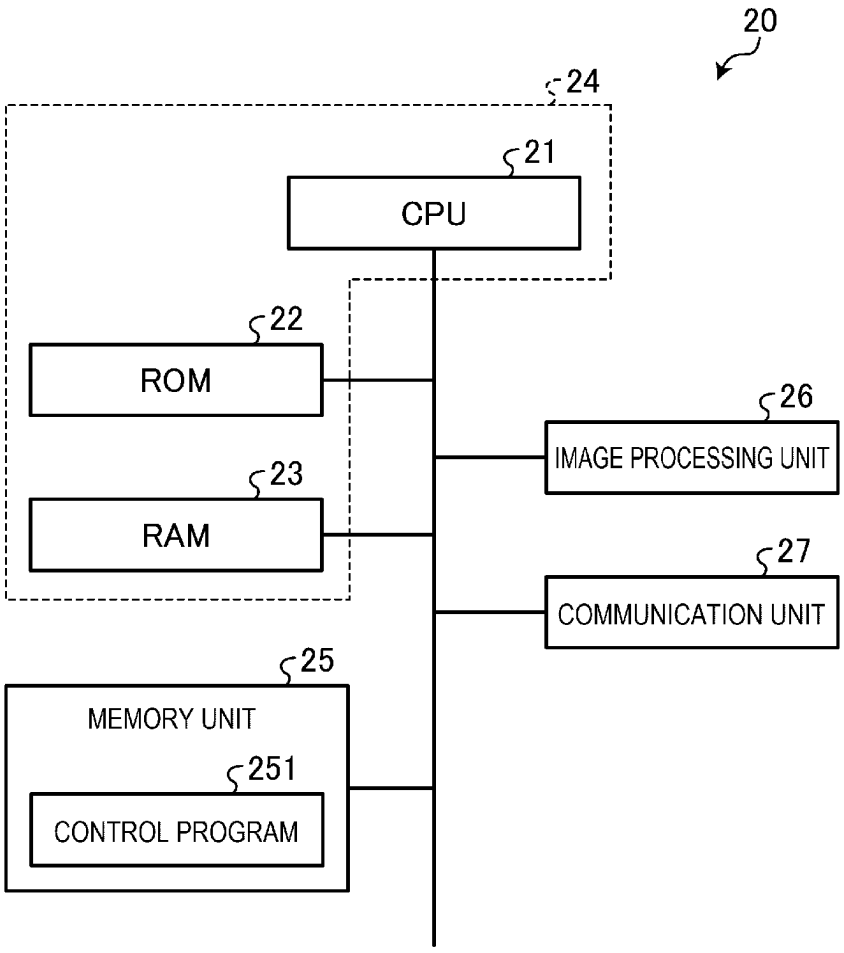

20
24
21
CPU
22
ROM
26
IMAGE PROCESSING UNIT
23
RAM
27
COMMUNICATION UNIT
25
MEMORY UNIT
251
CONTROL PROGRAM

FIG. 4

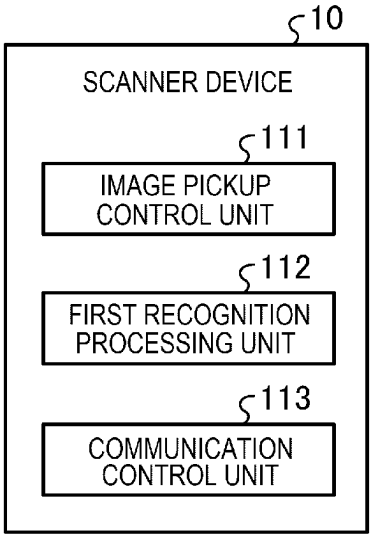

10
SCANNER DEVICE
111
IMAGE PICKUP CONTROL UNIT
112
FIRST RECOGNITION PROCESSING UNIT
113
COMMUNICATION CONTROL UNIT

FIG. 5

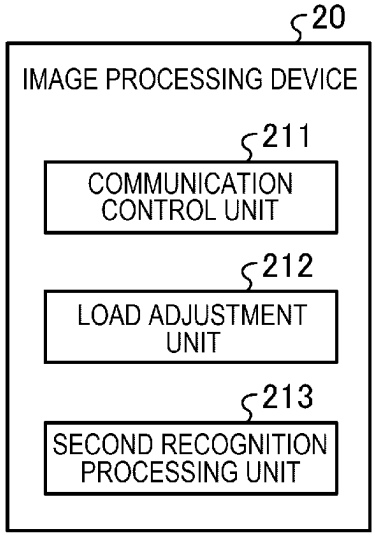

20
IMAGE PROCESSING DEVICE
211
COMMUNICATION CONTROL UNIT
212
LOAD ADJUSTMENT UNIT
213
SECOND RECOGNITION PROCESSING UNIT

FIG. 6

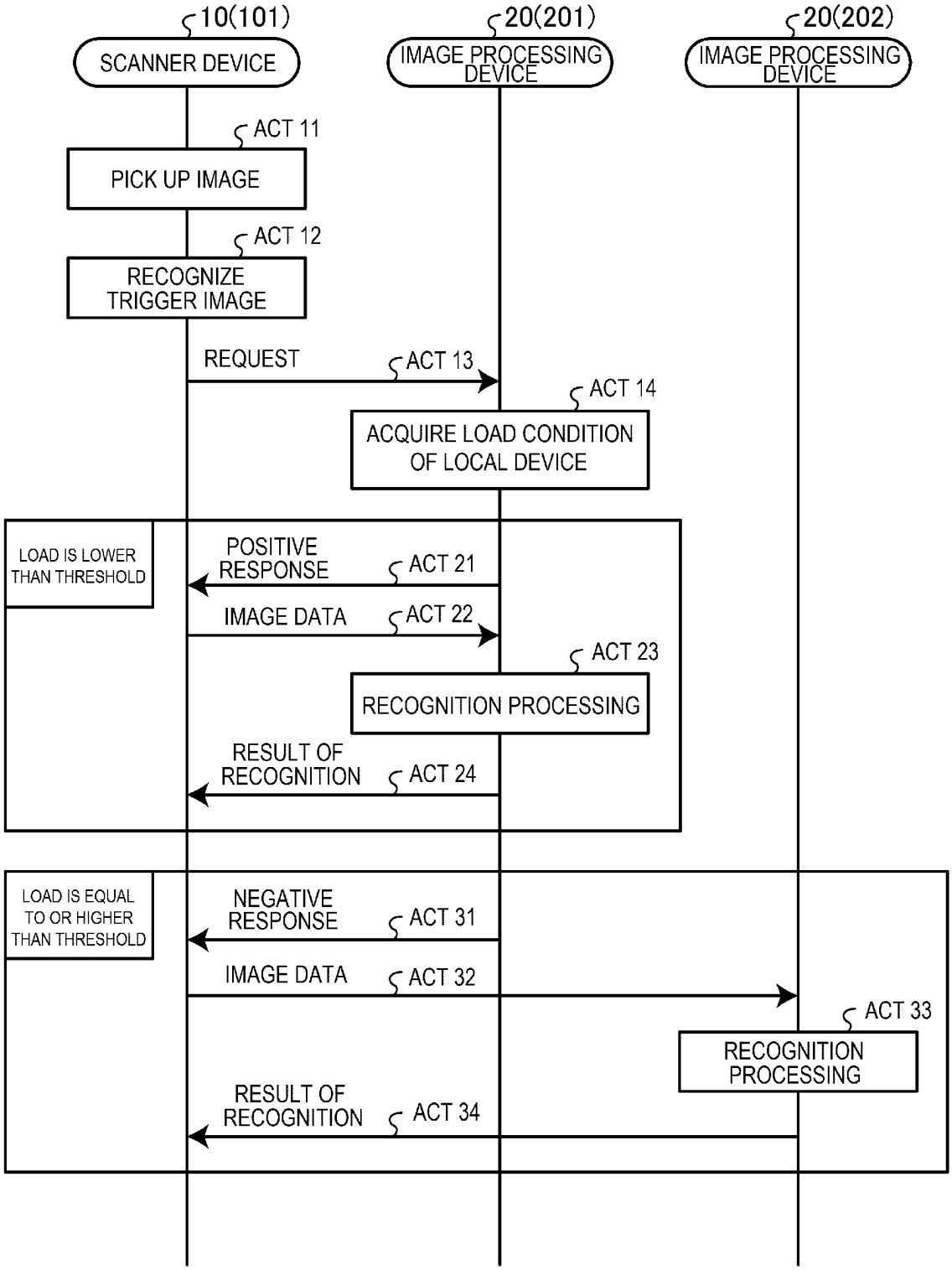
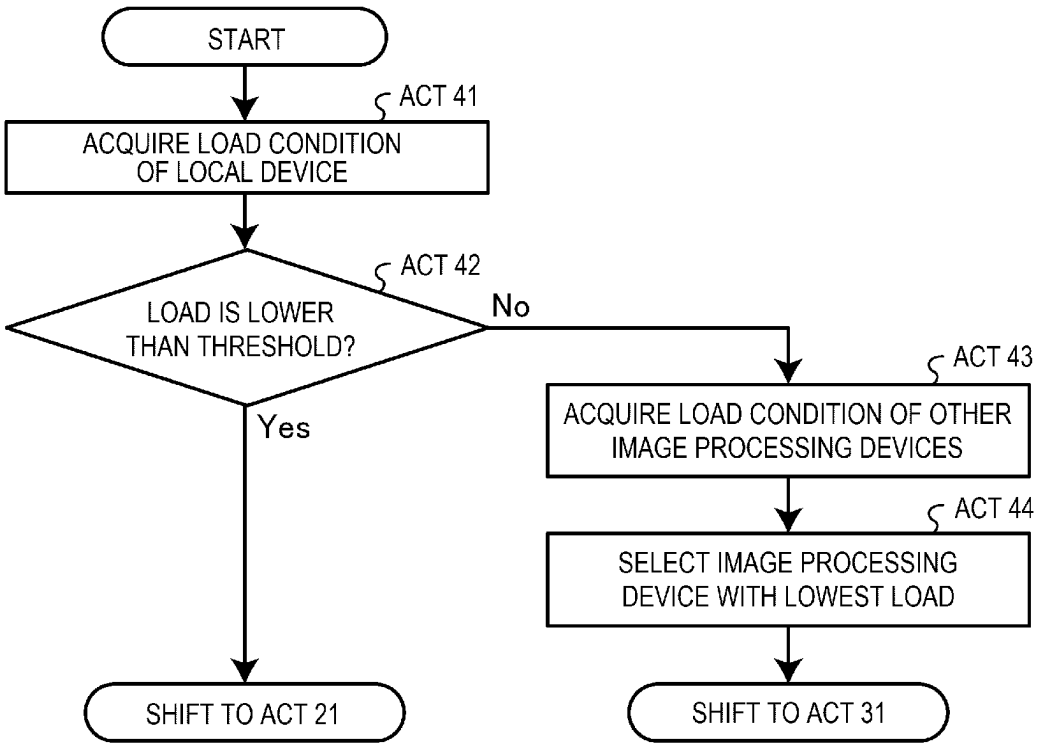

10(101)
SCANNER DEVICE
20(201)
IMAGE PROCESSING DEVICE
20(202)
IMAGE PROCESSING DEVICE
ACT 11
PICK UP IMAGE
ACT 12
RECOGNIZE TRIGGER IMAGE
REQUEST
ACT 13
ACT 14
ACQUIRE LOAD CONDITION OF LOCAL DEVICE
LOAD IS LOWER THAN THRESHOLD
POSITIVE RESPONSE
ACT 21
IMAGE DATA
ACT 22
ACT 23
RECOGNITION PROCESSING
RESULT OF RECOGNITION
ACT 24
LOAD IS EQUAL TO OR HIGHER THAN THRESHOLD
NEGATIVE RESPONSE
ACT 31
IMAGE DATA
ACT 32
ACT 33
RECOGNITION PROCESSING
RESULT OF RECOGNITION
ACT 34

FIG. 7


START
ACT 41
ACQUIRE LOAD CONDITION OF LOCAL DEVICE
ACT 42
LOAD IS LOWER THAN THRESHOLD?
No
Yes
ACT 43
ACQUIRE LOAD CONDITION OF OTHER IMAGE PROCESSING DEVICES
ACT 44
SELECT IMAGE PROCESSING DEVICE WITH LOWEST LOAD
SHIFT TO ACT 21
SHIFT TO ACT 31

INFORMATION PROCESSING DEVICE AND INFORMATION PROCESSING SYSTEM FOR MERCHANDISE REGISTRATION

CROSS-REFERENCE TO RELATED APPLICATION

This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2022-008753, filed Jan. 24, 2022, the entire contents of which are incorporated herein by reference.

FIELD

Embodiments described herein relate generally to an information processing device and an information processing system for merchandise registration and the like.

BACKGROUND

In the related art, a scanner device can be used in a retail store or the like to recognize a code symbol, such as a barcode, placed on an item of a merchandise that has been selected by a customer for purchase. Such a scanner device may take a picture (image) of the item to obtain a merchandise code corresponding to the code symbol from the image in order to register the item by merchandise code in a sales transaction. The scanner device may also recognize other information about the merchandise besides the code symbol from an image of the item.

For example, a sticker (a price reduction sticker) showing that the item is a target of a price reduction may be attached to the item. In this case, the price reduction sticker may be recognized from an image of the item obtained with the scanner device and the price reduction amount corresponding to the price reduction sticker can be applied to the item in the sales transaction. In some examples of the related art, the item type or classification may be recognized by generic objection recognition, deep learning models, or the like applied to an image of the item obtained by the scanner device.

The processing associated with recognition of a price reduction sticker tends to involve a higher system load than the processing associated with just recognizing a code symbol. Therefore, if a scanner device whose main task is to recognize a code symbol is used to execute other recognition processing (such as the recognition processing associated with the presence of a price reduction sticker), the processing load increases and this may hinder the code symbol recognition processing and this may result in a slower or delayed response in basic product scanning operations.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows an example of the configuration of a checkout system according to an embodiment.

FIG. **2** shows an example of the hardware configuration of a scanner device.

FIG. **3** shows an example of the hardware configuration of an image processing device.

FIG. **4** depicts a functional configuration of a scanner device.

FIG. **5** depicts a functional configuration of an image processing device.

FIG. **6** is a sequence diagram showing an example of processing executed by a scanner device and an image processing device.

FIG. **7** is a flowchart of processing executed by a load adjustment unit.

DETAILED DESCRIPTION

Certain embodiments described herein provide an information processing device and an information processing system that support recognition processing by a scanner device.

In general, according to one embodiment, an information processing device for retail merchandise registration systems or the like includes a communication interface to connect to a plurality of scanner devices and receive a processing request and image data from a scanner device in the plurality of scanner devices. A processor in the information processing device is configured to compare a present device load value to a threshold load value and send, via the communication interface, a positive response to the processing request when the present device load is less than the threshold load value or a negative response when the present device load is equal to or greater than the threshold load value. An image processing unit of the information processing device is configured to perform recognition processing on the image data from the scanner device to detect an object, such as a price reduction sticker or an item of merchandise being registered in a sales transaction, depicted in the image data. The processor is further configured to send a recognition result to the scanner device via the communication interface after the recognition processing is performed by the image processing unit.

Certain example embodiments of an information processing device and an information processing system will now be described with reference to the drawings. The example embodiments described below relate to a checkout system that may be introduced in a retail store such as a supermarket, but such examples and particular applications do not limit the possible configurations, specifications, and applications of other embodiments of the present disclosure.

FIG. **1** shows an example of the configuration of a checkout system **1** according to an embodiment. The checkout system **1** has at least one scanner device **10** and at least one image processing device **20**.

The scanner devices **10** and the image processing devices **20** are connected to a network N via a wire or wirelessly. The network N is, for example, a LAN (local area network) or the like provided in the store.

While three scanner devices **10** (scanner device **101**, a scanner device **102**, and a scanner device **103**) are illustrated in FIG. **1**, the number of scanner devices **10** is not limited to this. Likewise, while two image processing devices **20** (an image processing device **201** and an image processing device **202**) are illustrated in FIG. **1**, the number of image processing devices **20** is not limited to this. In general, it is preferable to utilize a plurality of scanner devices **10** and a plurality of image processing devices **20**.

A scanner device **10** picks up an image of an item of merchandise to be purchased by a customer and thus acquires image data of the item. The scanner device **10** then acquires information about the item from the image data. For example, the scanner device **10** recognizes a code symbol, such as a barcode attached to the item, from the image data and then decodes (or otherwise recognizes) a merchandise code, such as a JAN (Japanese Article Number) code, from the code symbol. In the following, the processing associated with the recognition ("reading") of a merchandise code from

a code symbol in an image of an item of merchandise as executed by the scanner device **10** can be referred to as first recognition processing.

The scanner device **10** outputs the merchandise code that has been read to a merchandise sales data processing device such as a POS (point of sale) terminal. Based on a merchandise identifier or the like sent from the scanner device **10**, the merchandise sales data processing device performs registration and ultimately payment processing for the item corresponding the merchandise identifier and thus executes data processing relating to the sales of merchandise.

The scanner device **10** may be integrated with the merchandise sales data processing device or may be connected to the merchandise sales data processing device via a wire or wirelessly. In the latter case, the merchandise sales data processing device may be connected to the network N. The scanner device **10** may be installed in a checkout area in the store or may be attached to a moving object such as a shopping cart.

The image processing device **20** is an example of the information processing device. The image processing device **20** receives image data transmitted from the scanner device **10** and performs processing to recognize information about an item of merchandise from the image data. Specifically, in the present example, the image processing device **20** attempts to recognize a price reduction sticker in the image data associated with an item of merchandise and then transmits information corresponding to the recognized price reduction sticker (e.g., a reduction of 50 yen or the like) to the scanner device **10**. In the following, the processing associated with the recognition processing for a price reduction sticker or the like as executed by the image processing device **20** can be referred to as second recognition processing.

In this present embodiment, it is assumed that, of the two image processing devices **20**, the image processing device **201** is set as a primary device and the image processing device **202** is set as a secondary device. It is also assumed that each of the scanner devices **10** has the address of the image processing device **201** stored as the destination for transmission of image data.

In the checkout system **1**, an operator operating a scanner device **10** turns a code symbol attached to an item of merchandise toward an image pickup unit **16** and the scanner device **10** picks up (acquires) an image thereof. The scanner device **10** ultimately outputs a merchandise code read from image data along with information about any price reduction amount to the merchandise sales data processing device. The information regarding the price reduction amount may be acquired from an image processing device **20** after image data has been transmitted from the scanner device **10** to the image processing device **20**.

When the merchandise code is sent to the merchandise sales data processing device, the merchandise sales data processing device specifies the corresponding merchandise name and listed price and executes registration processing on the item to be purchased. If price reduction information is sent along with the merchandise code, the merchandise sales data processing device registers the merchandise name of and the listed price minus the amount of price reduction. In general, the merchandise sales data processing device identifies the merchandise item corresponding to the provided merchandise code based on a merchandise master database that includes the merchandise code of each type of merchandise to be sold at the store in association with merchandise information such as the merchandise name and price (listed price) of the merchandise.

Upon receiving an instruction to end the registration process, the merchandise sales data processing device executes payment processing (transaction settlement processing) for the registered items.

FIG. **2** shows an example of the hardware configuration of a scanner device **10**. As shown in FIG. **2**, scanner device **10** has a CPU (central processing unit) **11**, a ROM (read-only memory) **12**, and a RAM (random-access memory) **13**.

The CPU **11** manages and controls operations of the scanner device **10**. The ROM **12** stores various programs. The RAM **13** is a work space where programs and various data can be loaded. The CPU **11**, the ROM **12**, and the RAM **13** are connected to each other via a bus or the like and form a control unit **14**. In the control unit **14**, the CPU **11** operates according to a control program **151** stored in the ROM **12** or a memory unit **15** and loaded in the RAM **13** and thus executes various kinds of processing.

The CPU **11** is also connected to the memory unit **15**, the image pickup unit **16**, and a communication unit **17** via a bus or the like.

The memory unit **15** is a memory device such as an HDD (hard disk drive), an SSD (solid-state drive) or a flash memory, and holds stored content even if the power is turned off. The memory unit **15** in this example stores the control program **151** and various kinds of setting information.

The image pickup unit **16** is an electronic camera having an image sensor such as a CCD (charge-coupled device) or a CMOS (complementary MOS). The image pickup unit **16**, under the control of the CPU **11**, acquires an image of an object such as an item of merchandise, thus generates image data. The image pickup unit **16** outputs the generated image data to control unit **14**.

The communication unit **17** is a communication interface connectable to the network N. The communication unit **17** communicates with the image processing device(s) **20** via the network N.

FIG. **3** shows an example of the hardware configuration of the image processing device **20**. As shown in FIG. **3**, the image processing device **20** has a CPU **21**, a ROM **22**, and a RAM **23**.

The CPU **21** controls operations of the image processing device **20**. The ROM **22** stores various programs. The RAM **23** is a work space where programs and various data are loaded. The CPU **21**, the ROM **22**, and the RAM **23** are connected to each other via a bus or the like and form a control unit **24**. In the control unit **24**, the CPU **21** operates according to a control program **251** stored in the ROM **22** or a memory unit **25** and loaded in the RAM **23** and thus executes various kinds of processing.

The CPU **21** is also connected to the memory unit **25**, an image processing unit **26**, and a communication unit **27** via a bus or the like.

The memory unit **25** is a memory device such as an HDD, an SSD or a flash memory, and holds the stored content even if the power is turned off. The memory unit **25** in this example stores the control program **251** and various kinds of setting information.

The image processing unit **26** is a computing circuit specialized for image processing. For example, the image processing unit **26** is implemented as a GPU (graphics processing unit) or the like. The image processing unit **26**, under the control of the CPU **21**, executes processing for analyzing image data and extracting information such as a price reduction sticker or feature data from the image data. In this context, feature data refers to aspects related to object recognition or the like. In some examples, the image processing unit **26** may be implemented as a function of the

CPU **21** rather than a separate circuit/component. That is, image processing unit **26** may be integrated with the CPU **21**.

The communication unit **27** is a communication interface connectable to the network N. The communication unit **27** communicates with the scanner device(s) **10** and the other image processing device(s) **20** via the network N.

FIG. **4** shows an example of a functional configuration of the scanner device **10**. As shown in FIG. **4**, the scanner device **10** provides the functions of an image pickup control unit **111**, a first recognition processing unit **112**, and a communication control unit **113**.

These described functional units of the scanner device **10** may be implemented as a software configuration of the CPU **11** (or the like) by execution of the control program **151** (or the like). In some examples, these described functional units may be implemented, in whole or in part, as a hardware configuration such as a dedicated circuit or the like installed in the scanner device **10**.

The image pickup control unit **111** controls an operation relating to the image pickup (image acquisition) by the image pickup unit **16**. Specifically, the image pickup control unit **111** causes the image pickup unit **16** to operate under a predetermined image pickup condition and acquires the image data from the image pickup unit **16**. For example, the image pickup control unit **111** causes the image pickup unit **16** to operate at a frame rate of 30 fps (frames per second) or the like and may acquire a dynamic image (video) as image data.

The first recognition processing unit **112** executes first recognition processing on the image data picked up by the image pickup unit **16**. Specifically, the first recognition processing unit **112** recognizes a code symbol on merchandise in the image data acquired by the image pickup control unit **111**. The first recognition processing unit **112** also decodes the recognized code symbol, thus acquires a merchandise code encoded in the code symbol, and outputs the acquired merchandise code to the merchandise sales data processing device or the like.

The information to be recognized in the first recognition processing unit **112** is not limited to a code symbol. For example, an item with a price reduction sticker attached thereto may also be provided with a flag sticker (or flag symbol) that indicates that the price reduction sticker has been attached. Generally, such a flag sticker has a simple geometric shape, such as a double circle, and is attached near the code symbol on the item. Such a flag sticker is used in the context to prevent a failure to read or otherwise account for the price reduction sticker in the merchandise registration process. The flag sticker is thus placed to be recognized, or at least imaged, at the same time as the code symbol.

The first recognition processing unit **112** may be, for example, configured to recognize the presence of the flag sticker in the same image(s) used to recognize the code symbol. Specifically, when the first recognition processing unit **112** recognizes a code symbol, the first recognition processing unit **112** can also recognize the geometric shape corresponding a flag sticker near the code symbol. When the first recognition processing unit **112** recognizes a flag sticker is present on the item, the first recognition processing unit **112** waits until the result of the recognition of the price reduction sticker is received (returned) from the image processing device **20**. Upon receiving the price reduction information (information corresponding to the recognized price reduction sticker), the first recognition processing unit **112** outputs the price reduction information along with the merchandise code to the merchandise sales data processing device or the like. Hereinafter, the images of the code symbol, the flag sticker and the like recognized in the first recognition processing by the first recognition processing unit **112** are referred to as a "trigger image".

The communication control unit **113** transmits the image data from the image pickup unit **16** to the image processing device **20**. The communication control unit **113** also receives the result of the recognition of the image data that has been processed by the image processing device **20**.

Specifically, the communication control unit **113** transmits a request to send image data acquired by the image pickup control unit **111** to the image processing device **201**, which is the primary device in this example.

On receiving a positive response to the request from the image processing device **201**, the communication control unit **113** transmits the image data to the image processing device **201**. The communication control unit **113** then receives a recognition result from the image processing device **201**.

In general, it is preferable that the communication control unit **113** limits the transmission of the image data in order to reduce the load on the image processing device **20**. For example, if the image processing device **20** is being used to recognize a price reduction sticker, the communication control unit **113** sends image data only after the first recognition processing unit **112** recognizes the trigger image and continues to transmit image data (e.g., images in time series) for some predetermined maximum period of time (for example, for several seconds) or otherwise until the recognition processing is completed. Thus, the time during which the resources of the image processing device **20** are used can be reduced and therefore a reduction in the load on the image processing device **20** can be achieved.

If a negative response to the request is transmitted from the image processing device **201**, the communication control unit **113** does not transmit the image data to the image processing device **201** but rather transmits the image data to the image processing device **202**, which is the secondary device.

If the image processing device **20** to be the destination of transmission of image data is designated in the negative response, the communication control unit **113** may transmit the image data to the designated image processing device **20**.

FIG. **5** shows an example of a functional configuration of an image processing device **20**. As shown in FIG. **5**, the image processing device **20** provides the functions of a communication control unit **211**, a load adjustment unit **212**, and a second recognition processing unit **213**.

These described functional units of the image processing device **20** may be implemented as a software configuration of the CPU **21** (or the like) by execution of the control program **251** (or the like). In some examples, these described functional units may be implemented, in whole or in part, as a hardware configuration such as a dedicated circuit or the like installed in the image processing device **20**.

The communication control unit **211** receives image data transmitted from the scanner device **10**. The communication control unit **211** also transmits the result of the recognition processing on the image data to the scanner device **10**.

The load adjustment unit **212** acquires information indicating a present load (local load) on the image processing device **20** related to the execution of the second recognition processing and adjusts the number of processes in the second recognition processing being executed locally based on the acquired load information. The load information may be any indicator quantitatively or otherwise indicating the

present load condition of the image processing device **20** and may be, for example, the CPU utilization value, the number of active threads, the number of individual second recognition processings, the number separate of separate images (or otherwise an amount of image data) queued to be processed in second recognition processing, or the like.

Thus, if the load on the image processing device **20** is below a threshold, the load adjustment unit **212** controls the communication control unit **211** to return a positive response to the request transmitted from the scanner device **10** which then transmits the image data.

If the load on the image processing device **20** is at or above the threshold, the load adjustment unit **212** controls the communication control unit **211** to return a negative response to the request transmitted from the scanner device **10** and thus the scanner device **10** does not transmit new image data to the responding image processing device **20**, which causes the scanner device **10** to attempt to transmit image data to another image processing device **20**.

The load adjustment unit **212** may be provided in one of the image processing devices **20** such as the image processing device **201**, which is the primary device. The load adjustment unit **212** in image processing device **201** may designate the image processing device **202**, which is the secondary device, as the destination for image data, via the negative response. In this case, the load adjustment unit **212** may transmit the negative response including the address or the like of the image processing device **202**.

The second recognition processing unit **213** executes second recognition processing for recognizing other information about the merchandise beyond the trigger image from the image data from the image pickup unit **16**, in cooperation with the image processing unit **26** and the like. The second recognition processing unit **213** also transmits the processing result of the second recognition processing to the scanner device **10**.

Specifically, the second recognition processing unit **213** executes processing for recognizing a price reduction sticker from the image data transmitted from the scanner device **10**. On recognizing the price reduction sticker in the image data, the second recognition processing unit **213** transmits information such as the amount of price reduction corresponding to the price reduction sticker to the scanner device **10**.

In general, the second recognition processing as executed by the second recognition processing unit **213** is assumed to involve a higher load than the first recognition processing as executed by the first recognition processing unit **112** of the scanner device **10**. For example, generally, the price reduction sticker is a more complex shape than a code symbol or a flag sticker. Therefore, the load involved in the processing tends to be higher. Also, typically, the code symbol is specifically turned toward the image pickup unit **16** by the customer in such a way that the entirety of the code symbol fits within an acquired image when the item is being scanned. Therefore, the code symbol can usually be easily recognized in an image. In contrast, the price reduction sticker be imaged while the code symbol is being searched for. Therefore, the price reduction sticker may only fleetingly or partially appear in the image data. Thus, for the price reduction sticker recognition, the entirety of a series of image data might have to be processed and the load involved in the recognition processing increases.

In this way, in this embodiment, the scanner device **10** is able to execute the first recognition processing with a relatively low load and relies on an image processing device **20** to execute the higher load second recognition processing when necessary. Thus, the image processing device **20** supports recognition processing for the scanner device **10**.

An example operation of a scanner device **10** and an image processing device **20** in this embodiment will now be described. FIG. **6** is a sequence diagram showing an example of the processing executed by a scanner device **10** and an image processing device **20** in this example embodiment. In FIG. **6**, only the processing of the scanner device **101** is illustrated as representative for other scanner devices **10** (**102**, **103**), which could execute similar operations in other examples.

First, in the scanner device **101**, the image pickup unit **16** starts image acquisition ("pick up") under the control of the image pickup control unit **111** (ACT **11**). The first recognition processing unit **112** executes the first recognition processing for recognizing a trigger image in the image data from the image pickup unit **16** (ACT **12**). When the first recognition processing unit **112** recognizes a trigger image, the communication control unit **113** transmits a request to an image processing device **20** (primary image processing device **201**) (ACT **13**).

In the image processing device **201**, on receiving the request from the scanner device **101**, the load adjustment unit **212** acquires the load condition of the local device (that is, the image processing device **201** itself) (ACT **14**) and checks whether the local load is lower than a threshold or not.

If the load is lower than the threshold, the load adjustment unit **212** controls the communication control unit **211** to transmit a positive response to the scanner device **101** (ACT **21**). On receiving the positive response from the image processing device **201**, the communication control unit **113** of the scanner device **101** transmits image data to the image processing device **201** (ACT **22**). The second recognition processing unit **213** of the image processing device **201** then executes the second recognition processing for recognizing a price reduction sticker in the image data transmitted from the scanner device **101** (ACT **23**). The second recognition processing unit **213** then transmits the result of the second recognition processing to the scanner device **101** (ACT **24**).

If the local load is at or above the threshold because, for example, the image processing device **201** is already processing image data transmitted from scanner device **102** and/or scanner device **103** (or for some other reason), the load adjustment unit **212** controls the communication control unit **211** to transmit a negative response to the scanner device **101** (ACT **31**). In conjunction with the negative response, the load adjustment unit **212** may notify the scanner device **101** to use the image processing device **202** as the destination for image data transmission.

On receiving the negative response from the image processing device **201**, the communication control unit **113** of the scanner device **101** refrains from transmitting image data to the image processing device **201** and instead transmits image data to the image processing device **202**, which is the designated secondary device (ACT **32**). If the negative response designates another image processing device **20** (e.g., image processing device **202**) as the destination for image data transmission, the communication control unit **113** may then transmit image data to the designated image processing device **202**.

When image data is output from the scanner device **101** to the image processing device **202**, the second recognition processing unit **213** of the image processing device **202** executes second recognition processing on the provided image data (ACT **33**). The second recognition processing

unit **213** then transmits the second recognition processing results to the scanner device **101** (ACT **34**).

In FIG. **6**, when the scanner device **101** transmits image data to the image processing device **202** as the secondary device, a separate request (such as sent in ACT **13**) is omitted. However, in other examples, the scanner device **110** may transmit a request to the secondary image processing device **202** after receiving of a negative response from the primary image processing device **201** and wait for a positive response from the secondary image processing device **202** before transmitting image data to the secondary image processing device **202**.

In a checkout system **1** according to this embodiment, image data from the scanner device **10** after recognizing a trigger image is transmitted to an image processing device **20** for recognition processing for a price reduction sticker. In this way, the image processing device **20** can take partial responsibility for the recognition processing associated with an item of merchandise and therefore can support the recognition processing by the scanner device **10**. Also, since it is the image processing device **20** that executes the higher load second recognition processing, the processing load of the scanner device **10** can be prevented from entering a high-load state. Thus, the scanner device **10** can operate more stably and achieve smoother execution of tasks as associated with merchandise registration.

If the load on an image processing device **20** is equal to or higher than a threshold, the image data to be transmitted to another image processing device **20** for performance of second recognition processing. Thus, an individual image processing device **20** can prevent itself from entering a high-load state and therefore can achieve a more stable operation.

Various modifications of the example aspects described above can be made. These modifications described below may be separately implemented or may be suitably combined together.

Modification Example 1

In an embodiment, the image processing devices **20** are divided into a primary device and a secondary device. In other examples, all of the image processing devices **20** may be set as primary devices. In this case, the scanner devices **10** may be configured to transmit a request randomly to one of the plurality of image processing devices **20**.

Modification Example 2

In an embodiment, the load adjustment unit **212** is configured to monitor the load condition of just the local device (the receiving image processing device **20**). However, in other examples, the load adjustment unit **212** may also monitor the load condition of the other image processing device(s) **20**. For example, the load adjustment units **212** provided in each individual image processing device **20** may function to transmit and receive load condition information to and from each other via the network N and thus monitor the load conditions of each available image processing device **20**.

In such a modification, when the load on the local device is equal to or higher than the threshold, the load adjustment unit **212** may select another image processing device **20** having a load lower than the threshold. The image processing device **20** presently in the high-load state may then indicates the address of the selected low-load state image processing device **20** to the scanner device **10** via a negative response.

The method of selecting the image processing device **20** for either the initial transmission request or the subsequent destination if the initial destination is in a high-load state when there is a plurality of image processing devices **20** available is not particularly limited. An image processing device **20** in either case may be selected randomly or by a round robin method. In some examples, the image processing device **20** with the lowest present load may be preferentially selected.

FIG. **7** is a flowchart showing an example of the processing executed by the load adjustment unit **212** in this modification example. This processing can be executed in place of the processing of ACT **14** as described with reference to FIG. **6**.

First, the load adjustment unit **212** acquires the load condition of the local device (ACT **41**). In this context, the "local device" is the particular image processing device **20** associated with the load adjustment unit performing the present processing. The load adjustment unit **212** then determines whether the local load is lower than a threshold or not (ACT **42**). If the local load is lower than the threshold (Yes in ACT **42**), the load adjustment unit **212** shifts to the processing associated with ACT **21** in FIG. **6**.

However, if the load on the local device is equal to or higher than the threshold (No in ACT **42**), the load adjustment unit **212** acquires the load condition of the other image processing devices **20** (ACT **43**). The load adjustment unit **212** then selects one image processing device **20** from the other image processing devices **20** that has a present load that is lower than the threshold or is the lowest from among the available image processing devices **20** (ACT **44**).

The load adjustment unit **212** then shifts to the processing associated with ACT **31** in FIG. **6** and transmits the address of the image processing device **20** that was selected in ACT **44** to the scanner device **10** via a negative response or the like.

The image processing device **20** according to this modification example selects an image processing device **20** to be the destination for image data based on the load conditions of the image processing devices **20** whenever the load on the local device is equal to or higher than the threshold. Thus, the image processing device **20** according to this modification example can execute the second recognition processing in consideration of not only the load on itself (local load) but also the load on all the other image processing devices **20** and therefore can achieve more stable operations of all the image processing devices **20**.

The load adjustment unit **212** is configured to select one image processing device **20** from among the other image processing devices **20** if the load on the local device is equal to or higher than the threshold. However, the load adjustment unit **212** may also be configured in other examples to select the image processing device **20** with the lowest load from among all the image processing devices **20** including the local device.

Modification Example 3

In an embodiment, the image processing device **20** recognizes a price reduction sticker attached to an item of merchandise. However, the object to be recognized by the image processing device **20** is not limited to this. For example, the second recognition processing unit **213** of the image processing device **20** may execute second recognition

processing for extracting feature data related to the appearance of item in image data and then recognizing (identifying) the item (object) in the image based on the extracted feature data rather than a code symbol reading or the like. In this case, the second recognition processing can incorporate object recognition technologies often referred to as generic object recognition, deep learning models, or the like. Also, if an item is to be recognized (identified) by the second recognition processing, the scanner device **10** may be configured not to execute the first recognition processing.

The programs executed by each device in the above embodiments can be stored in a ROM, a memory unit or the like in advance and provided to an end user in this form. The programs executed by each device in the above embodiments may be recorded as a file in an installable format or an executable format in a non-transitory, computer-readable recording medium such as a CD-ROM, flexible disk (FD), CD-R, or DVD (digital versatile disk) and provided in this form.

The programs executed by each device in the above embodiments may be stored on a computer connected to a network such as the internet and downloaded, accessed, or otherwise provided via such a network.

While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the present disclosure. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the present disclosure. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the present disclosure.

What is claimed is:

1. An information processing device for retail merchandise registration systems, the device comprising:

a communication interface configured to connect to a plurality of scanner devices and receive a processing request and image data from a scanner device in the plurality of scanner devices;

an image processing unit configured to perform recognition processing on the image data from the scanner device to detect an object depicted in the image data; and

a processor configured to:

upon the processing request being received via the communication interface, compare a present local device load value to a threshold load value,

send, via the communication interface, a positive response to the processing request when the present local device load value is less than the threshold load value and a negative response when the present local device load value is equal to or greater than the threshold load value,

receive, via the communication interface, the image data only after sending the positive response,

provide the received image data to the image processing unit for the recognition processing, and

send a recognition result to the scanner device via the communication interface after the recognition processing is performed by the image processing unit.

2. The information processing device according to claim **1**, wherein the present local device load value is acquired by the processor from the image processing unit.

3. The information processing device according to claim **1**, wherein the processor is further configured to send, via the communication interface, an address of another information processing device to the scanner device if the present local device load value is equal to or greater than the threshold load value.

4. The information processing device according to claim **3**, wherein the address is included in the negative response.

5. The information processing device according to claim **1**, wherein the object depicted in the image data is a price reduction sticker affixed to an item of merchandise.

6. The information processing device according to claim **1**, wherein the object depicted in the image data is an item of merchandise being registered in a sales transaction.

7. The information processing device according to claim **1**, wherein the image processing unit is a graphics processing unit.

8. The information processing device according to claim **1**, wherein the image processing unit is implemented by the processor.

9. The information processing device according to claim **1**, wherein the processor is further configured to acquire a device load value from another information processing device via the communication interface.

10. A merchandise registration system, comprising:

a plurality of product scanner devices for registering merchandise in a sales transaction; and

an information processing device including:

a communication interface configured to connect to the plurality of product scanner devices and receive a processing request and image data from a product scanner device in the plurality of product scanner devices;

an image processing unit configured to perform recognition processing on the image data from the product scanner device to detect an object depicted in the image data; and

a processor configured to:

upon the processing request being received via the communication interface, compare a present local device load value to a threshold load value,

send, via the communication interface, a positive response to the processing request when the present local device load value is less than the threshold load value and a negative response when the present local device load value is equal to or greater than the threshold load value,

receive, via the communication interface, the image data only after sending the positive response,

provide the received image data to the image processing unit for the recognition processing, and

send a recognition result to the scanner device via the communication interface after the recognition processing is performed by the image processing unit.

11. The merchandise registration system according to claim **10**, wherein the present local device load value is acquired by the processor from the image processing unit.

12. The merchandise registration system according to claim **10**, wherein the processor is further configured to send, via the communication interface, an address of another information processing device in the merchandise registration system to the scanner device if the present local device load value is equal to or greater than the threshold load value.

13. The merchandise registration system according to claim **12**, wherein the address is included in the negative response.

14. The merchandise registration system according to claim 10, wherein the object depicted in the image data is a price reduction sticker affixed to an item of merchandise.

15. The merchandise registration system according to claim 10, wherein the object depicted in the image data is an item of merchandise being registered in a sales transaction.

16. The merchandise registration system according to claim 10, wherein the image processing unit is a graphics processing unit.

17. The merchandise registration system according to claim 10, wherein the image processing unit is implemented by the processor.

18. The merchandise registration system according to claim 10, wherein the processor is further configured to acquire a device load value from another information processing device via the communication interface.

19. A merchandise registration system, comprising:

a plurality of product scanner devices for registering merchandise in a sales transaction; and

a plurality of information processing devices, each including:

a communication interface configured to connect to the plurality of product scanner devices and receive a processing request and image data from a product scanner device in the plurality of product scanner devices;

an image processing unit configured to perform recognition processing on the image data from the product scanner device to detect an object depicted in the image data; and

a processor configured to:

upon the processing request being received via the communication interface, compare a present local device load value to a threshold load value,

send, via the communication interface, a positive response to the processing request when the present local device load value is less than the threshold load value and a negative response when the present local device load value is equal to or greater than the threshold load value,

receive, via the communication interface, the image data only after sending the positive response,

provide the received image data to the image processing unit for recognition processing, and

send a recognition result to the scanner device via the communication interface after the recognition processing is performed by the image processing unit.

20. The merchandise registration system according to claim 19, wherein the processor of each information processing device is further configured to send, via the communication interface, an address of another information processing device in the merchandise registration system to the product scanner device if the present local device load value is equal to or greater than the threshold load value.

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