

INFORMATION PROCESSING APPARATUS, INFORMATION PROCESSING
METHOD, AND PROGRAM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to information processing apparatuses, information processing methods, and programs, and, more particularly, to an information processing apparatus and an information processing method capable of using power generation elements such as dye-sensitized solar cells to which colors can be applied as not only power sources but also as user interfaces, and a program.

2. Description of the Related Art

If user interfaces such as operation buttons are disposed in an electronic apparatus so that each of the operation buttons uniquely corresponds to a single command, users can easily operate the electronic apparatus.

Furthermore, the coloring of the operation buttons with different colors can enhance the usability of the electronic

apparatus.

However, the one-to-one correspondence between operation buttons and commands leads to an increase in the number of operation buttons. This makes the miniaturization of electronic apparatuses difficult and leads to the operation of electronic apparatuses being complicated for users.

Some electronic apparatuses use a light sensor as a user interface. For example, Japanese Unexamined Patent Application Publication No. 2000-181602 discloses an invention in which, when light transmitted from a light-emitting unit to a light-receiving unit is interrupted by a user, it is determined that the electronic apparatus has been operated.

SUMMARY OF THE INVENTION

If a solar cell is disposed in a miniaturized electronic apparatus, the solar cell and operation buttons are required to be disposed on the outer surface of a housing of the electronic apparatus together. Accordingly, sufficient space may not be provided for both of them.

It is desirable to achieve space saving and enhance usability in an electronic apparatus by using power generation elements such as dye-sensitized solar cells to which colors can be applied as user interfaces.

In accordance with a first aspect of the present invention, there is provided an information processing apparatus provided with a plurality of different colored power generation elements, comprising: displaying means for displaying a plurality of pieces of information each denoting processing that is performed when one of the plurality of power generation elements is selected by a user using the same color as that of the selected power generation element; a plurality of voltage detecting means each for detecting a voltage of power generated by a corresponding one of the plurality of power generation elements; determining means for specifying at least one of the plurality of power generation elements whose power generation efficiency is different from that of the other power generation elements on the basis of the detected voltage of power generated by each of the plurality of power generation elements, and determining that the specified power generation element is a target power generation element that has been selected and operated by the user; and processing means for performing processing corresponding to the target power generation element.

In accordance with a second aspect of the present invention, there is provided an information processing apparatus provided with a plurality of different colored

power generation elements, comprising: a display unit configured to display a plurality of pieces of information each denoting processing that is performed when one of the plurality of power generation elements is selected by a user using the same color as that of the selected power generation element; a plurality of voltage detection units each configured to detect a voltage of power generated by a corresponding one of the plurality of power generation elements; a determination unit configured to specify at least one of the plurality of power generation elements whose power generation efficiency is different from that of the other power generation elements on the basis of the detected voltage of power generated by each of the plurality of power generation elements, and determine that the specified power generation element is a target power generation element that has been selected and operated by the user; and a processing unit configured to perform processing corresponding to the target power generation element.

The display unit may be electronic paper.

The plurality of different colored power generation elements may be dye-sensitized solar cells.

The plurality of different colored power generation elements may be solar cells covered with different colored filters.

In accordance with a third aspect of the present invention, there is provided an information processing method of an information processing apparatus provided with a plurality of different colored power generation elements, the information processing method comprising the steps of:

displaying a plurality of pieces of information each denoting processing that is performed when one of the plurality of power generation elements is selected by a user using the same color as that of the selected power generation element; detecting a voltage of power generated by each of the plurality of power generation elements; specifying at least one of the plurality of power generation elements whose power generation efficiency is different from that of the other power generation elements on the basis of the detected voltage of power generated by each of the plurality of power generation elements, and determining that the specified power generation element is a target power generation element that has been selected and operated by the user; and performing processing corresponding to the target power generation element.

In accordance with a fourth aspect of the present invention, there is provided a control program for an information processing apparatus provided with a plurality of different colored power generation elements, the program

causing a computer to perform processing including the steps of: displaying a plurality of pieces of information each denoting processing that is performed when one of the plurality of power generation elements is selected by a user using the same color as that of the selected power generation element; detecting a voltage of power generated by each of the plurality of power generation elements; specifying at least one of the plurality of power generation elements whose power generation efficiency is different from that of the other power generation elements on the basis of the detected voltage of power generated by each of the plurality of power generation elements, and determining that the specified power generation element is a target power generation element that has been selected and operated by the user; and performing processing corresponding to the target power generation element.

Thus, a plurality of pieces of information each denoting processing that is performed when one of the plurality of power generation elements is selected by a user are displayed using the same color as that of the selected power generation element. A voltage of power generated by each of the plurality of power generation elements is detected. At least one of the plurality of power generation elements whose power generation efficiency is different from

that of the other power generation elements is specified on the basis of the detected voltage of power generated by each of the plurality of power generation elements, and is then determined to be a target power generation element that has been selected and operated by the user. Processing corresponding to the target power generation element is performed.

According to an embodiment of the present invention, the space saving of an electronic apparatus and the enhancement of usability thereof can be achieved by using power generation elements such as dye-sensitized solar cells to which colors can be applied as user interfaces.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic diagram of a portable information processing apparatus according to an embodiment of the present invention;

Fig. 2 is a block diagram showing a first exemplary configuration of a portable information processing apparatus according to an embodiment of the present invention;

Fig. 3 is a diagram showing power generation characteristics of solar cells;

Fig. 4 is a diagram showing power generation characteristics of solar cells;

Fig. 5 is a diagram showing power generation

characteristics of solar cells;

Fig. 6 is a flowchart describing user's operation handling processing;

Fig. 7 is a block diagram showing a second exemplary configuration of a portable information processing apparatus according to an embodiment of the present invention; and

Fig. 8 is a block diagram showing an exemplary configuration of a load stabilization section shown in Fig. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following, embodiments of the present invention will be described in detail with reference to the accompanying drawings.

Fig. 1 is a schematic diagram of a portable information processing apparatus according to an embodiment of the present invention. A portable information processing apparatus 10 is, for example, a credit-card-sized IC (Integrated Circuit) card. A plurality of (four in Fig. 1) dye-sensitized solar cells 11-A to 11-D and a color display 12 for displaying predetermined information are disposed on the outer surface of the portable information processing apparatus 10.

The portable information processing apparatus 10 has a limited surface area. As shown in Fig. 1, if the color

display 12 is disposed in addition to the dye-sensitized solar cells 11-A to 11-D, it is difficult to dispose other components such as user interface keys in the limited surface area. In particular, the current trend toward smaller size will make it more difficult to obtain space for components.

Accordingly, in the case of such portable information processing apparatuses, it is required to consider how to dispose an input unit for users. In the portable information processing apparatus 10 according to an embodiment of the present invention, the following method is employed.

That is, at least one command is associated with each of the different colored dye-sensitized solar cells 11-A to 11-D. Each command is specified on the basis of the power generation states of the dye-sensitized solar cells 11-A to 11-D. Furthermore, the relationships between the colors of the dye-sensitized solar cells 11-A to 11-D and the commands associated therewith are displayed on the color display 12.

For example, when a user puts the user's finger over one of the dye-sensitized solar cells 11-A to 11-D so as to input a certain command, processing corresponding to the certain command is performed. Thus, the dye-sensitized solar cells 11-A to 11-D are used as user interfaces. Accordingly, specific buttons or the likes are not required

to be disposed on the portable information processing apparatus.

Here, an arbitrary number of commands may be associated with each of the dye-sensitized solar cells 11-A to 11-D. For example, a single command may be associated with a single dye-sensitized solar cell. Alternatively, a plurality of commands may be associated with a single dye-sensitized solar cell. In this case, it is determined which command is selected in accordance with the number of input operations performed by a user.

Furthermore, a single command may be associated with a plurality of dye-sensitized solar cells. If a combination of a small number of the dye-sensitized solar cells 11 corresponds to a single command, a number of commands equal to or larger than the number of cells can be set.

In the following, the configuration and operation of the portable information processing apparatus 10 according to an embodiment of the present invention will be described.

The dye-sensitized solar cells 11-A to 11-D function as user interfaces that are individually colored with blue, red, green, and yellow as well as converting received light into power. More specifically, if any one of the different colored dye-sensitized solar cells 11-A to 11-D is covered with a user's finger, this covering operation is detected as a selection operation performed by the user and processing

corresponding to the selection operation is performed.

In the following, if it is not required to discriminate between the dye-sensitized solar cells 11-A to 11-D that convert received light into power, the dye-sensitized solar cells 11 are simply referred to. Power generation elements for converting heat generated from received light into power may be used instead of the dye-sensitized solar cells 11. The number of dye-sensitized solar cells 11 is not limited to four. The colors of the dye-sensitized solar cells 11 are not limited to blue, red, green, and yellow.

Here, the characteristics of general dye-sensitized solar cells used as the dye-sensitized solar cells 11 will be described.

Dye-sensitized solar cells are inferior to known silicon (Si) solar cells in power generation efficiency. However, dye-sensitized solar cells have the following advantages: the cost of manufacturing thereof is low since silicon is not used; the mass-production efficiency thereof is high since the manufacturing process thereof is the same as that of liquid crystal displays; the coloring thereof is easy since organic dyes are used; the optical absorption property thereof can be controlled by selecting an organic dye used; they can be bent since glass substrates are not used; and the thickness thereof can be reduced.

A phenylxanthene dye, a phthalocyanine dye, a coumarin

dye, cyanine dye, a merocyanine dye, a porphyrin dye, a proflavine dye are known as organic dyes. The optical absorption properties and color forming properties of these organic dyes are different from each other. These organic dyes may be used singly or in combination so as to form a characteristic optical absorption property or control coloring. It is expected that a dye having a more limited wavelength range will be invented in the future research and development. Accordingly, the optical absorption property and the color forming property can be controlled by using such organic dyes.

Using the above-described method of controlling the optical absorption property and the color forming property, for example, the dye-sensitized solar cell 11-A is colored with a blue dye. The blue dye-sensitized solar cell 11-A has a poor optical absorption property for blue light whose wavelength is in the vicinity of 450 nm, and is configured to convert light other than blue light into power. The dye-sensitized solar cell 11-B colored with a red dye has a poor optical absorption property for red light whose wavelength is in the vicinity of 650 nm, and is configured to convert light other than red light into power. The dye-sensitized solar cell 11-C colored with a green dye has a poor optical absorption property for green light whose wavelength is in the vicinity of 550 nm, and is configured to convert light

other than green light into power. The dye-sensitized solar cell 11-D colored with a yellow dye has a poor optical absorption property for yellow light whose wavelength is in the vicinity of 590 nm, and is configured to convert light other than yellow light into power.

For example, electronic paper or a liquid crystal panel can be used as the color display 12.

Fig. 2 is a diagram showing a first exemplary configuration of the portable information processing apparatus 10. The portable information processing apparatus 10 is provided with the dye-sensitized solar cells 11 and the color display 12, which are disposed on the outer surface of the housing thereof as described previously, a power supply section 23 for stably supplying power obtained from the dye-sensitized solar cells 11 to the subsequent stage and a control section 25 for performing processing corresponding to the user's operation of the dye-sensitized solar cells 11 that function as user interfaces.

The dye-sensitized solar cell 11-A is provided with a power generation module 21-A for receiving light and converting the received light into power and a voltage detection unit 22-A for detecting the voltage of the power generated by the power generation module 21-A. The power generation module 21-A outputs the generated power to the power supply section 23. The voltage detection unit 22-A

performs the analog-to-digital conversion of the detected voltage and notifies an operation determination unit 27 included in the control section 25 of the conversion result of the detected voltage.

The configuration of the dye-sensitized solar cells 11-B to 11-D is the same as that of the dye-sensitized solar cell 11-A, and the description thereof will be therefore omitted.

The power supply section 23 is connected to the power lines of the power generation modules 21-A to 21-D in series or parallel as appropriate so as to obtain a desired voltage therefrom. The power supply section 23 stores the obtained power in a power storage unit 24 composed of a built-in rechargeable battery or a capacitor, and then supplies the power to the color display 12 and the control section 25 at the subsequent stage.

The control section 25 causes the operation determination unit 27, a signal processing unit 28, and a display control unit 29 to perform processing by executing programs stored in an internal memory 26. The operation determination unit 27 determines which one of the dye-sensitized solar cells 11-A to 11-D has been operated by a user (which one of them has been covered with the user's finger) on the basis of the detection results of the voltage detection units 22-A to 22-D, and transmits the

determination result to the signal processing unit 28. The signal processing unit 28 performs processing corresponding to the transmitted determination result, and outputs the processing result to the display control unit 29.

The processing of the signal processing unit 28 may be performed by hardware or software. For example, if the processing of the signal processing unit 28 is performed by software, a plurality of applications may be implemented so that processing to be performed is changed in accordance with an executed application.

For example, if a plurality of applications are implemented in a portable information processing apparatus, the portable information processing apparatus can provide various services such as an electronic money payment service and a weather forecasting service.

Thus, if a service to be provided for a user is changed in accordance with an executed application, it is required that a command be changed in accordance with a service to be provided for a user. In this case, a command assigned to each of the dye-sensitized solar cells 11 may be changed in accordance with an application to be executed. In addition, no command may be assigned to a part of the dye-sensitized solar cells 11. Alternatively, a single command may be assigned to a combination of the dye-sensitized solar cells 11. Furthermore, processing to be performed may be changed

in accordance with the input operation of a user (for example, the number of times the same dye-sensitized solar cell has been covered, or the order in which the dye-sensitized solar cells have been covered).

The above-described change of the command assignment to the dye-sensitized solar cells 11 may be performed by changing the hardware configuration of the signal processing unit 28 or may be performed in accordance with the processing performed by an implemented application.

Subsequently, the display control unit 29 controls the color display 12 so that the processing result input from the signal processing unit 28 is displayed on the display screen of the color display 12.

Here, the general power generation characteristics of solar cells used as the dye-sensitized solar cells 11 will be described. Fig. 3 shows a relationship between the illumination level of received light and a current i and a relationship between the illumination level of received light and a voltage v . In Fig. 3, the horizontal axis denotes the illumination level of received light, the left vertical axis denotes the current i , and the right vertical axis denotes the voltage v .

As shown in Fig. 3, the voltage v sharply increases if the illumination level exceeds a predetermined value. After that, however, the voltage v only slightly increases even if

the illumination level increases. On the other hand, the current i increases in proportional to the increase in the illumination level.

Fig. 4 shows the correlation among the voltage v , the current i , and power p , which is the product of the voltage v and the current i , with respect to a load change at a subsequent stage. In Fig. 4, the horizontal axis denotes the voltage v , the left vertical axis denotes the current i , and the right vertical axis denotes the power p . Here, the load change at a subsequent stage corresponds to, for example, the change in the charge state of the power storage unit 24 included in the power supply section 23, or the change in the power consumption of the control section 25 or the color display 12.

As described previously, the voltage v , the current i , and the power p change in accordance with the illumination level. Furthermore, they change in accordance with the load change of a circuit at a subsequent stage. Consequently, the voltage v , the current i , and the power p are described by a transition curve shown in Fig. 4. A point on the transition curve at which the power p is the maximum value is usually determined as a power generation operating point P of the solar cell.

However, as described previously, the dye-sensitized solar cells 11-A to 11-D have different optical absorption

properties. Accordingly, transition curves thereof are not always the same.

Fig. 5 shows the correlations between the voltage v and the current i with respect to the load change at a subsequent stage at three different illumination levels of received light. In Fig. 5, the horizontal axis denotes the voltage v , and the vertical axis denotes the current i . As is apparent from Fig. 5, if the illumination level changes, the current i markedly changes.

Using the above-described power generation characteristics of solar cells, the portable information processing apparatus 10 according to an embodiment of the present invention uses the different colored dye-sensitized solar cells 11 as user interfaces by detecting the change in illumination level, which occurs, for example, when one of the dye-sensitized solar cells 11 is covered with a user's finger, as a voltage change.

Next, processing for handling the user's operation of the dye-sensitized solar cells 11-A to 11-D included in the portable information processing apparatus 10 (hereinafter referred to as user's operation handling processing) will be described with reference to a flowchart shown in Fig. 6.

In step S1, the display control unit 29 displays on the color display 12 character strings or symbols each denoting processing that is performed when a user operates one of the

dye-sensitized solar cells 11 (for example, return, leftward movement, or the like) using the same color as that the operated one of the dye-sensitized solar cells 11 as shown in Fig. 1.

In step S2, the voltage detection units 22A to 22D of the dye-sensitized solar cells 11A to 11D detect voltages generated by the power generation modules 21A to 21D, respectively, perform the analog-to-digital conversions of the detected voltages, and transmit the values of the conversion results to the operation determination unit 27. In step S3, the operation determination unit 27 receives the values of the conversion results of the detected voltages (hereinafter referred to as detected voltage values) from the dye-sensitized solar cells 11A to 11D, detects the amounts of change between the received detected voltage values and corresponding former detected voltage values, and compares the detected amounts of change so as to determine whether the amounts of change are the same. However, the power generation efficiencies of the dye-sensitized solar cells 11-A to 11-D are different from each other. Accordingly, after each of the detected voltage values has been standardized using a conversion table prepared in advance, the above-described determination is performed.

If it is determined that the amounts of change between the detected voltage values and the corresponding former

detected voltage values are the same in step S3, the process proceeds to step S4.

In step S4, the operation determination unit 27 specifies a power generation operating point $P(i, v)$ of each of the dye-sensitized solar cells 11 at that time. Subsequently, the process returns to step S2 and the subsequent step is repeated. If it is determined that the amounts of change between the detected voltage values transmitted from the dye-sensitized solar cells 11 and the corresponding former detected voltage values are not the same in step S3, the process proceeds to step S5.

In step S5, the operation determination unit 27 determines whether the power generation operating points P of the dye-sensitized solar cells 11 have already been specified (that is, the processing of step S4 has been performed). If it is determined that the power generation operating points P of the dye-sensitized solar cells 11 have not yet been specified in step S5, the process returns to step S2 and the subsequent steps are repeated. On the other hand, if it is determined that the power generation operating points P of the dye-sensitized solar cells 11 have already been specified in step S5, the process proceeds to step S6.

In step S6, the operation determination unit 27 determines whether the detected voltage values received from

the dye-sensitized solar cells 11 are smaller than the voltage values of corresponding last specified power generation operating points P. If it is determined that there is no detected voltage value smaller than the voltage value of the corresponding last specified power generation point P in step S6, the process returns to step S1 and the subsequent steps are repeated. On the other hand, if it is determined that there is a detected voltage value smaller than the voltage value of the corresponding last specified power generation point P in step S6, the process proceeds to step S7.

In step S7, the operation determination unit 27 determines that one of the dye-sensitized solar cells 11 having the detected voltage value smaller than the voltage value of the corresponding last specified power generation operating point P is a target dye-sensitized solar cell for the user (a dye-sensitized solar cell covered with the user's finger), and transmits the determination result to the signal processing unit 28.

In step S8, the signal processing unit 28 performs processing corresponding to the determination result transmitted from the operation determination unit 27, and outputs the processing result to the display control unit 29. The display control unit 29 controls the display of the color display 12 on the basis of the received processing

result.

Subsequently, the process returns to step S1 and the subsequent steps are repeated. This ends the description of the processing for handling a user's operation which is performed by the portable information processing apparatus 10.

As described previously, in the portable information processing apparatus 10, it is determined whether the dye-sensitized solar cells 11 having different optical absorption properties have been operated on the basis of the power generation operating points that have been individually specified for the dye-sensitized solar cells 11. Accordingly, as compared with the case in which detected voltage values are merely compared with a threshold value, a user's operation can be more accurately detected.

Furthermore, since color character strings each denoting processing are displayed on the color display 12, the operability of the portable information processing apparatus 10 can be improved.

In the above-described portable information processing apparatus 10, the voltage values of the dye-sensitized solar cells 11 change in accordance with the load change at the subsequent stage. In order to reduce the change in voltage value, a load stabilization section for preventing the dye-sensitized solar cells 11 from being affected by the load

change at the subsequent stage is added in the portable information processing apparatus 10. An exemplary configuration of the portable information processing apparatus 10 in which the load stabilization section is added will be described with reference to Fig. 7.

Fig. 7 is a diagram showing a second exemplary configuration of a portable information processing apparatus according to an embodiment of the present invention. In the case of the second exemplary configuration, a load stabilization section 41 is added between the dye-sensitized solar cells 11 and the power supply section 23 in the first exemplary configuration shown in Fig. 2. The load stabilization section 41 stabilizes the load change at the subsequent stage of the power supply section 23 which affects the dye-sensitized solar cells 11. In Fig. 7, the same reference numerals are used for components having the same functions as those in the first exemplary configuration so as to avoid repeated explanation.

The exemplary configuration and operation of the load stabilization section 41 will be described with reference to Fig. 8.

The load current for a voltage V_P of the dye-sensitized solar cells 11 is the sum of a current I_S passing through a resistance (RS) 51 and a current I_Z passing through a resistance (RZ) 52.

$$\text{Load current} = I_S + I_Z$$

If a comparator (CM) 54 has an adequately high input impedance, the current I_Z passing through the resistance (RZ) 52 corresponds to a constant current passing through a Zener diode (DZ) 53.

$$I_Z = \text{constant}$$

On the other hand, the current I_S passing through the resistance (RS) 51 is the sum of a current I_L passing through a circuit load (RL) 55 corresponding to the subsequent stage of the power supply section 23 and a current I_T passing through a transistor (TR) 56.

$$I_S = I_L + I_T$$

Accordingly, if a voltage V_S occurring at the resistance (RS) 51 is held constant, the current I_S is also held constant, whereby the load current for the voltage V_P of the dye-sensitized solar cells 11 can be held constant.

More specifically, a breakdown voltage V_Z of the Zener diode (DZ) 53 is set so that $V_Z = V_P - V_S$ is satisfied. Here, since $V_S = R_S \cdot I_S$, the breakdown voltage V_Z is calculated as follows.

$$V_Z = V_P - (R_S \cdot I_S)$$

For example, if the current I_S passing through the resistance (RS) 51 becomes smaller than a desired constant current value by only ΔI_L due to the decrease in the load of the circuit load (RL) 55, the relationship between the

breakdown voltage V_Z of the Zener diode (DZ) 53 and the voltage of the resistance (RS) 51 is as follows.

$$V_Z < V_P - (R_S \cdot (I_S - \Delta I_L))$$

On the basis of this relationship, the output of the comparator (CM) 54 increases, the current I_T passing through the transistor (TR) 56 increases, and the current I_S passing through the resistance (RS) 51 increases. The output operation of the comparator (CM) 54 continues until $V_Z = V_P - (R_S \cdot I_S)$ is satisfied. As a result, the current I_S passing through the resistance (RS) 51 returns to the state prior to the occurrence of the current variation ΔI_L and is then held constant. Accordingly, the load current for the voltage V_P of the dye-sensitized solar cells 11 is also held constant.

On the other hand, for example, if the current I_S passing through the resistance (RS) 51 becomes larger than a desired constant current value by only ΔI_L due to the increase in the load of the circuit load (RL) 55, the relationship between the breakdown voltage V_Z of the Zener diode (DZ) 53 and the voltage of the resistance (RS) 51 is as follows.

$$V_Z > V_P - (R_S \cdot (I_S + \Delta I_L))$$

On the basis of this relationship, the output of the comparator (CM) 54 decreases, the current I_T passing through the transistor (TR) 56 decreases, and the current I_S passing through the resistance (RS) 51 decreases. The output

operation of the comparator (CM) 54 continues until $V_Z = V_P - (R_S \cdot I_S)$ is satisfied. As a result, the current I_S passing through the resistance (RS) 51 returns to the state prior to the occurrence of the current variation ΔI_L and is then held constant. Accordingly, the load current for the voltage V_P of the dye-sensitized solar cells 11 is also held constant.

Here, the load stabilization section 41 can be used to stabilize a load for a power generation element that uses, for example, a temperature difference, a force of wind, or a pressure as well as stabilize a load for a solar cell as described previously.

As described previously, in the portable information processing apparatus 10 according to an embodiment of the present invention, the dye-sensitized solar cells 11-A to 11-D are not only used for power generation but also used as different colored user interfaces. Accordingly, extra space saving can be achieved as compared with a case in which a solar cell and a user interface such as an operation switch are separately disposed.

In this embodiment, it is determined whether the dye-sensitized solar cells 11-A to 11-D have been operated (covered with a user's finger), that is, which of two operation steps has been performed. However, for example, it may be determined which of two operation steps or more has been performed on the basis of the degree of covering of

a dye-sensitized solar cell with the user's finger.

Furthermore, in the above-described description, the voltages of the dye-sensitized solar cells are detected, and then the analog-to-digital conversions of the detection results are performed. However, the detection results may be compared with a plurality of threshold values in accordance with the detection accuracy.

Furthermore, a plurality of solar cells having the same color absorption property may be disposed instead of the dye-sensitized solar cells 11. In this case, the solar cells are individually covered with color filters such as blue, red, green, and yellow filters.

The present invention can be applied to, for example, a remote controller for a digital broadcasting receiver which is provided with blue, red, green, and yellow operation buttons. Furthermore, the present invention may be applied to not only a portable information processing apparatus 10 according to an embodiment of the present invention but also any types of electronic apparatuses provided with a power generation element such as a solar cell.

It should be understood by those skilled in the art that various modifications, combinations, sub-combinations and alterations may occur depending on design requirements and other factors insofar as they are within the scope of the appended claims or the equivalents thereof.

WHAT IS CLAIMED IS:

1. An information processing apparatus provided with a plurality of different colored power generation elements, comprising:

displaying means for displaying a plurality of pieces of information each denoting processing that is performed when one of the plurality of power generation elements is selected by a user using the same color as that of the selected power generation element;

a plurality of voltage detecting means each for detecting a voltage of power generated by a corresponding one of the plurality of power generation elements;

determining means for specifying at least one of the plurality of power generation elements whose power generation efficiency is different from that of the other power generation elements on the basis of the detected voltage of power generated by each of the plurality of power generation elements, and determining that the specified power generation element is a target power generation element that has been selected and operated by the user; and

processing means for performing processing corresponding to the target power generation element.

2. The information processing apparatus according to

Claim 1, wherein the displaying means is electronic paper.

3. The information processing apparatus according to Claim 1 or 2 , wherein the plurality of different colored power generation elements are dye-sensitized solar cells.

4. The information processing apparatus according to Claim 1, 2 or 3, wherein the plurality of different colored power generation elements are solar cells covered with different colored filters.

5. An information processing method of an information processing apparatus provided with a plurality of different colored power generation elements, the information processing method comprising the steps of:

displaying a plurality of pieces of information each denoting processing that is performed when one of the plurality of power generation elements is selected by a user using the same color as that of the selected power generation element;

detecting a voltage of power generated by each of the plurality of power generation elements;

specifying at least one of the plurality of power generation elements whose power generation efficiency is different from that of the other power generation elements

on the basis of the detected voltage of power generated by each of the plurality of power generation elements, and determining that the specified power generation element is a target power generation element that has been selected and operated by the user; and

performing processing corresponding to the target power generation element.

6. A control program for an information processing apparatus provided with a plurality of different colored power generation elements, the program causing a computer to perform processing including the steps of:

displaying a plurality of pieces of information each denoting processing that is performed when one of the plurality of power generation elements is selected by a user using the same color as that of the selected power generation element;

detecting a voltage of power generated by each of the plurality of power generation elements;

specifying at least one of the plurality of power generation elements whose power generation efficiency is different from that of the other power generation elements on the basis of the detected voltage of power generated by each of the plurality of power generation elements, and determining that the specified power generation element is a

target power generation element that has been selected and operated by the user; and

performing processing corresponding to the target power generation element.

7. An information processing apparatus provided with a plurality of different colored power generation elements, comprising:

a display unit configured to display a plurality of pieces of information each denoting processing that is performed when one of the plurality of power generation elements is selected by a user using the same color as that of the selected power generation element;

a plurality of voltage detection units each configured to detect a voltage of power generated by a corresponding one of the plurality of power generation elements;

a determination unit configured to specify at least one of the plurality of power generation elements whose power generation efficiency is different from that of the other power generation elements on the basis of the detected voltage of power generated by each of the plurality of power generation elements, and determine that the specified power generation element is a target power generation element that has been selected and operated by the user; and

a processing unit configured to perform processing

corresponding to the target power generation element.