A paper feeding device to sense various sizes of paper according to a sensing voltage output from a sensor and an image forming apparatus having the same includes a body to receive paper in which an image is printed thereon. The image forming apparatus further includes a paper feeding device to feed paper into the body. The paper feeding device includes a paper tray in which paper is loaded, and paper guides that are slidably installed to the paper tray to guide left and right ends of paper loaded in the paper tray in a paper feeding direction. A light reflector is installed to be moved in linkage with the paper guides and includes a stepped reflection surface. A sensor emits light to the light reflector and receives the light reflected by the light reflector to determine the sizes of paper.
FIG. 5

SENSING VOLTAGE (V)

3.00
2.50
2.00
1.50
1.00
0.50
0.00

DISTANCE BETWEEN SENSOR AND LIGHT REFLECTOR

3.5 3.8 4.1 4.4 4.7 5.0 5.3 5.6 5.9 6.2
FIG. 7

START

500  PAPER LOADED ON PAPER TRAY?

YES

510  EMIT LIGHT FROM SENSOR TO LIGHT REFLECTOR AND RECEIVE REFLECTED LIGHT

520  OUTPUT SENSING VOLTAGE CORRESPONDING TO QUANTITY OF RECEIVED LIGHT

530  CALCULATE PAPER SIZE ACCORDING TO SENSING VOLTAGE

540  STORE PAPER SIZE INFORMATION

END
PAPER FEEDING DEVICE AND IMAGE FORMING APPARATUS HAVING THE SAME AND CONTROL METHOD THEREOF

CROSS-REFERENCE TO RELATED APPLICATIONS


BACKGROUND

[0002] 1. Field of the Invention
[0003] Embodiments of the present general inventive concept relate to a paper feeding device functioning to sense a paper size and an image forming apparatus having the same and a control method thereof.

[0004] 2. Description of the Related Art
[0005] Generally, image forming apparatuses, such as copiers, printers and fax machines, include a paper feeding device in which a plurality of sheets of paper is received, the paper feeding device serving to sequentially feed the received paper into a body of an image forming apparatus.

[0006] The paper feeding device includes a paper tray in which paper is loaded, and paper guides arranged to come into contact with both ends of loaded paper so as to guide the paper in a paper feeding direction. The paper guides are slidably coupled to the paper tray to accommodate various sizes of paper. An image forming apparatus is generally connected to a computer. The computer designates the size of paper, on which an image is printed by the computer will be printed. The image forming apparatus receives information related to the designated paper size and prepares a printing operation corresponding to the designated paper size. If the size of paper loaded in the paper tray is inconsistent with the designated paper size, this causes printing defects. To prevent printing defects due to inconsistent paper size, a device to sense the size of paper loaded in the paper tray may be provided. There are various paper sizes of A4, A3, B5, B4, letter and other user designated sizes, and a photo sensor may be used to sense the size of a paper. To sense an arbitrary paper size value between an allowable upper limit and an allowable lower limit of a specific image forming apparatus, it may be necessary to install photo sensors on a per paper size basis. This increases manufacturing costs in proportion to the number of photo sensors and is uneconomical.

SUMMARY

[0007] Therefore, it is an feature of the present general inventive concept to provide a paper feeding device which may sense the size of paper according to a sensing voltage output from a single sensor and an image forming apparatus having the same and a control method thereof.

[0008] Additional features of the present general inventive concept will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the general inventive concept.

[0009] In accordance with one feature of the present general inventive concept, a paper feeding device includes a paper tray in which paper is loaded, at least one paper guide that guides a left or right end of the paper loaded in the paper tray in a paper feeding direction, a position of the paper guide being adjusted according to a width of the paper, a light reflector installed to be moved in linkage with the paper guide and having a stepped reflection surface, and a sensor that emits light to the light reflector and receives the light reflected by the light reflector and outputs a sensing voltage corresponding to the received light, to enable calculation of a size of the paper.

[0010] The at least one paper guide may include a pair of paper guides to guide the left and right ends of the paper in the paper feeding direction, and the paper feeding device may further include first and second racks connected respectively to the pair of paper guides to allow the pair of paper guides to be moved in linkage with each other, and a pinion gear engaged with the first and second racks.

[0011] The light reflector may be coupled to one of the first rack and the second rack and may be moved in linkage with the paper guides.

[0012] The light reflector may be injection-molded or assembled to one of the first rack and the second rack.

[0013] The sensor may include a light emitting element to emit light and a light receiving element to receive the light, and the light emitting element and the light receiving element may be integrally formed with each other or may be separated from each other.

[0014] In accordance with another feature of the present general inventive concept, an image forming apparatus includes a body in which an image is printed on paper, at least one paper tray in which the paper is loaded, and a paper feeding device including at least one paper guide that guides a left or right end of the paper loaded in the paper tray in a paper feeding direction, a position of the paper guide being adjusted according to a width of the paper, a light reflector installed to be moved in linkage with the paper guide and having a stepped reflection surface, a sensor that emits light to the light reflector and receives the light reflected by the light reflector, and a controller that calculates a size of the paper according to a sensing voltage output from the sensor.

[0015] The at least one paper guide may include a pair of paper guides to guide the left and right ends of the paper in the paper feeding direction, and the paper feeding device may further include first and second racks connected respectively to the pair of paper guides to allow the pair of paper guides to be moved in linkage with each other, and a pinion gear engaged with the first and second racks.

[0016] The light reflector may be coupled to one of the first rack and the second rack and may be moved in linkage with the paper guides.

[0017] The light reflector may be injection-molded or assembled to one of the first rack and the second rack.

[0018] The sensor may include a light emitting element to emit light and a light receiving element to receive the light, and the light emitting element and the light receiving element may be integrally formed with each other or are separated from each other.

[0019] The at least one paper tray may include one or more of a first paper tray pivotally rotatably coupled to the body and a second paper tray inserted into the body in a drawer manner.

[0020] In a further feature of the present general inventive concept, a control method of an image forming apparatus includes confirming whether or not paper is loaded in at least one paper tray, emitting light to a light reflector if the paper is loaded in the paper tray, the light reflector being moved in linkage with a paper guide installed to the paper tray and having a stepped reflection surface, detecting a size of the
paper according to a magnitude of a sensing voltage if a sensor installed at a side of the paper tray outputs the sensing voltage corresponding to the quantity of light reflected by the reflection surface, and performing a printing operation according to the detected paper size.

[0021] The at least one paper tray may include one or more of a first paper tray pivotally rotatably coupled to the body and a second tray inserted into the body in a drawer manner, and the control method may further include confirming that paper is newly loaded into the paper tray if paper inside the first paper tray is not initially detected, but is detected later, or if the second paper tray is separated and thereafter, is reinstalled.

[0022] A paper tray to receive paper, comprising at least one paper guide that is adjustable according to a width of the paper, a light reflector having a reflective portion to reflect light and coupled to the at least one paper guide to be moved in linkage with the paper guide, and a sensor that emits light to the light reflector and receives the light reflected by the light reflector and outputs a sensing voltage corresponding to the received light.

[0023] A paper tray to receive paper, comprising first and second paper guides that are adjustable according to a width of the paper to center the paper along a center axis of the paper tray extending in a paper feeding direction, a light emitting element that emits light along a light path following the center axis of the paper tray, a light reflector moveable into the light path in response to adjusting the first and second paper guides to reflect emitted light, and a light receiving element that receives the reflected emitted light from the light reflector and outputs a sensing voltage corresponding to the received light.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] These and/or other features of the present general inventive concept will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

[0025] FIG. 1 is a perspective view illustrating an image forming apparatus having a paper feeding device according to an embodiment of the present general inventive concept;

[0026] FIG. 2 is a perspective view schematically illustrating paper guides and a sensor provided at a first paper tray of the paper feeding device according to an embodiment;

[0027] FIG. 3 is a perspective view schematically illustrating paper guides and a sensor provided at a second paper tray of the paper feeding device according to an embodiment;

[0028] FIG. 4 is a partially enlarged view illustrating a rear surface of the paper tray of the paper feeding device according to an embodiment;

[0029] FIG. 5 is a graph illustrating an output voltage of a light receiving element corresponding to a distance between a sensor and a light reflector provided in the paper feeding device according to an embodiment;

[0030] FIG. 6 is a control block diagram of the image forming apparatus according to an embodiment;

[0031] FIG. 7 is a control flow chart of the image forming apparatus according to an embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0032] Reference will now be made in detail to the embodiments of the present general inventive concept, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiments are described below in order to explain the present general inventive concept by referring to the figures.

[0033] FIG. 1 is a perspective view illustrating an image forming apparatus having a paper feeding device according to an embodiment of the present general inventive concept, FIG. 2 is a perspective view schematically illustrating paper guides and a sensor provided at a first paper tray of the paper feeding device according to an embodiment, and FIG. 3 is a perspective view schematically illustrating paper guides and a sensor provided at a second paper tray of the paper feeding device according to an embodiment.

[0034] FIG. 4 is a partially enlarged view illustrating a rear surface of the paper tray of the paper feeding device according to an embodiment, and FIG. 5 is a graph illustrating an output voltage of a light receiving element corresponding to a distance between a sensor and a light reflector provided in the paper feeding device according to an embodiment.

[0035] Referring to FIG. 1, the image forming apparatus includes a body 100 in which an image is printed on paper P, and a paper feeding device to feed the paper P into the body 100. The body 100 may be realized in an electro-photographic manner or ink-jet manner according to various embodiments. In the embodiment of FIG. 1, the paper P is fed from the bottom of the image forming apparatus and after an image is printed on the paper P inside the body 100, the printed paper P is discharged via a discharge device provided at the top of the image forming apparatus.

[0036] The paper feeding device includes paper trays 120 and 220 in which the paper P to be fed is loaded, a pair of paper guides 110a and 110b and a pair of paper guides 210a and 210b provided respectively at the paper trays 120 and 220 to center the paper about a center axis (A) of the paper tray 120 and 220 extending in a paper feed direction and to guide left and right ends of the paper P loaded in the paper trays 120 and 220 in the paper feeding direction. Sensors 150 and 250 are included with the paper tray 120 and 220 to sense the size of the paper P loaded in the paper tray 120 and 220 by sensing positions of the paper guides 110a, 110b, 210a and 210b, as discussed in greater detail below.

[0037] The paper trays 120 and 220 include a first paper tray 120 pivotally rotatably coupled to the body 100 of the image forming apparatus, and a second paper tray 220 slidably inserted into the body 100 of the image forming apparatus in a drawer manner. Various sizes of paper P may be placed on the first paper tray 120 so that both lateral ends of the paper P come into contact with and are supported by the paper guides 110a and 110b. The first paper tray 120 is a multi-purpose tray. The second paper tray 220 takes the form of a paper cassette to be inserted into or separated from the image forming apparatus, and a plurality of sheets of paper P having a specific size is loaded in the second paper tray 220. If necessary, a plurality of first paper trays 120 and a plurality of second paper trays 220 may be installed. Also, any one or both of the first paper tray 120 and the second paper tray 220 may be provided.

[0038] As illustrated in FIG. 2, the first paper tray 120 includes the pair of paper guides 110a and 110b, first and second racks 111a and 111b and a pinion 115 to link the left and right paper guides 110a and 110b to each other. The paper tray 120 further includes a light reflector 112 coupled to and moved in linkage with at least one of the first and second racks 111a and 111b. The light reflector 112 further includes a
reflective portion 114 to reflect light directed thereon. The sensor 150 may emit light emit light, including but not limited to laser light, to generate a light path extending along the center axis (A) of the paper tray 120 to the light reflector 112. Accordingly, as the light reflector 112 moves laterally and across the direction of the light path, the reflection portion 114 reflects the emitted light back to the sensor 150 such that the sensor 150 may measure a quantity of reflected light.

The sensor 150 or 250 includes a light emitting element 152 or 252 and a light receiving element 154 or 254. When the light emitting element 152 or 252 emits a predetermined quantity of light upon receiving power from a power source, the light is reflected by the light reflector 112 or 212. The light receiving element 154 or 254 senses the reflected light and outputs a voltage signal corresponding to the quantity of reflected light. Referring to FIG. 5, it will be appreciated that the greater the distance between the sensor 150 and the light reflector 112, the smaller the magnitude of a sensing voltage output from the light receiving element 154 or 254 to a controller 420.

The following Table 1 represents a relationship between a paper width (half the actual width), a sensing width, a distance between the sensor 150 and the light reflector 112, and a sensing voltage.

<table>
<thead>
<tr>
<th>Paper Size</th>
<th>Half Actual Width (mm)</th>
<th>Sensing Width (mm)</th>
<th>Distance (x) between Sensor and Light Reflector (mm)</th>
<th>Sensing Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A3</td>
<td>148.5</td>
<td>20(a)</td>
<td>6.2</td>
<td>0.75</td>
</tr>
<tr>
<td>B4</td>
<td>128.5</td>
<td>20.5(b)</td>
<td>5.9</td>
<td>0.90</td>
</tr>
<tr>
<td>Letter/Legal</td>
<td>108</td>
<td>3(c)</td>
<td>5.6</td>
<td>1.13</td>
</tr>
<tr>
<td>A4</td>
<td>105</td>
<td>14(d)</td>
<td>5.3</td>
<td>1.33</td>
</tr>
<tr>
<td>B5</td>
<td>91</td>
<td>17(e)</td>
<td>5.0</td>
<td>1.59</td>
</tr>
</tbody>
</table>

Referring to FIG. 4 and Table 1, the light reflector 112 has a stepped configuration having five steps 116 to sense paper of A3, B4, A4, Letter/Legal, and B5 sizes. When the light emitted from the light emitting element 152 or 252 of the sensor 150 or 250 is reflected by the light reflector 112 or 212 and is introduced into the light receiving element 154 or 254, the light receiving element 154 or 254 outputs different sensing voltages since the quantity of reflected light is changed according to the distance (x) between the sensor 150 and the light reflector 112.

For example, when A3 size paper is placed on the first paper tray 120 and the distance between the paper guides 110a and 110b is adjusted to correspond to the A3 size paper, the light emitted from the light emitting element 152 of the sensor 150 is reflected by the light reflector 112 that is spaced apart from the sensor 150 by the distance x of 6.2 mm and is introduced into the light receiving element 154 of the sensor 150. In this case, the sensing voltage of the light receiving element 154 is about 0.75V.

Referring now to FIG. 4 and Table 1, a sensing width may be determined based on a difference in a half width of paper. The half-width of a particular paper size may be determined based on a predetermined measurement of a half-width of a particular sheet of paper. For example, considering two sheets of paper having successive paper sizes, i.e. A3 and B4 sizes, since half a width of A3 size paper is 148.5 mm and half the width of B4 size paper is 128.5 mm, half the width difference between the A3 size paper and the B4 size paper is 20 mm. Accordingly, the sensing width (a) of the A3 size paper is 20 mm. Alternatively, a half-width of a loaded paper may be calculated based on a difference between a position of at least one of the first and second paper guides 110a/110b and the center axis (A) of the paper tray 120.

Although FIG. 4 illustrates the sensor 150 or 250 in which the light emitting element 152 or 252 and the light receiving element 154 or 254 are integrated, a separate light...
emitting element (e.g., a light emitting diode) and a separate light receiving element (e.g., a photo-diode sensor) may be provided.

[0049] Referring now to alternative exemplary embodiment illustrated in FIG. 3, the second paper tray 220 includes the pair of paper guides 210a and 210b, first and second racks 211a and 211b and a pinion 215 to link the paper guides 210a and 210b to each other, a stepped light reflector 212, and the sensor 250 to emit light to the light reflector 212 so as to measure the quantity of light reflected by the light reflector 212. Although the second paper tray 220 takes the form of a drawer type paper cassette, the same concept embodiment as the light reflector 112 and the sensor 150 illustrated in FIG. 2, and discussed in detail above may be applied to the second paper tray 220. The pair of paper guides 211a and 211b are arranged to guide both lateral ends of paper.

[0050] FIG. 6 is a control block diagram of the image forming apparatus according to an embodiment.

[0051] As illustrated in FIG. 6, the image forming apparatus includes an input unit 400, a memory 410, the controller 420, a drive unit 430 and the sensors 150 and 250. The input unit 400 includes a display window to show operational and error status of the image forming apparatus and a keypad to allow the user to select a variety of printing modes. The memory 410 consists of a Read Only Memory (ROM) in which a variety of control programs required to realize functions of the image forming apparatus are stored, and a Random Access Memory (RAM) in which a variety of programs generated according to implementation of the control programs are stored. The controller 420 controls general operations of the image forming apparatus. The drive unit 430 realizes an image forming apparatus mechanism to perform a printing operation under control of the controller 420. The sensors 150 and 250 to sense the size of paper loaded in the image forming apparatus respectively include the light emitting elements 152 and 252 to emit light, and the light receiving elements 154 and 254 to receive the light reflected by the light reflectors 112 and 212 so as to output voltage signals corresponding to the quantity of reflected light.

[0052] The memory 410 stores the sensing voltages of the light receiving elements 154 and 254 according to distances between the light reflector 112 and the sensor 150 and between the light reflector 212 and the sensor 250. The memory 410 also stores paper size data corresponding to the sensing voltages. For example, according to the data stored in the memory 410, a paper size corresponding to the sensing voltage of 0.75V is an A3 size (see Table 1). Also, the memory 410 stores an error range of the sensing voltage. Accordingly, if the sensing voltage slightly differs from the stored value, but falls within the error range, it may be determined that the sensing voltage designates a corresponding paper size.

[0053] The controller 420 confirms whether or not paper is newly loaded in the paper trays 120 and 220. If loading of new paper is confirmed, the controller 420 controls the light emitting elements 152 and 252 to emit light to the light reflectors 112 and 212.

[0054] The image forming apparatus may also include a paper detecting sensor and a paper cassette entrance/exit detecting sensor, to confirm whether or not paper is newly loaded on the first paper tray 120 or the second paper tray 220. The paper detecting sensor (not shown) is installed to the body 100 of the image forming apparatus so as to be located at an upper lateral side of the first paper tray 120. If the sensor emits light to paper and senses the light reflected by the paper, the presence of paper is determined. On the other hand, if the sensor fails to receive light emitted therefrom (because the emitted light passes a hole (not shown) formed in the first paper tray 120 in which no paper is loaded, the absence of paper is determined. The controller 420 determines loading of new paper if paper is not initially detected from the first paper tray 120, but is detected later. The paper cassette detecting sensor (not shown) is provided in the body 100 of the image forming apparatus to interfere with the second paper tray 220. The paper cassette detecting sensor may be a contact type or non-contact type sensor to interfere with the second paper tray 220 and is adapted to sense separation/reinstallation of the second paper tray 220. If separation/reinstallation of the second paper tray 220 is confirmed based on a signal transmitted from the paper cassette detecting sensor, the controller 420 determines that paper is newly loaded into the second paper tray 220. The paper detecting sensor and the paper cassette detecting sensor are known technologies and thus, detailed descriptions thereof will be omitted herein.

[0055] The light emitted from the light emitting element 152 or 252 is reflected from the light reflector 112 or 212 that has been moved in linkage with the paper guides 110a and 110b or 210a and 210b as the user adjusts the distance between the paper guides according to a paper width. The light reflected by the light reflector 112 or 212 is introduced into the light receiving element 154 or 254 of the sensor 150 or 250 and in turn, the light receiving element 154 or 254 outputs the sensing voltage, corresponding to the quantity of received light, to the controller 420. The controller 420 reads paper size information corresponding to the sensing voltage from the memory 410, thereby confirming a paper size. For example, if the sensing voltage of 0.9V is input from the light receiving element 154 or 254 to the controller 420, the controller 420 confirms that the paper loaded into the paper tray 120 or 220 is A4 size paper (see Table 1). Also, if the sensing voltage of 0.28V is input from the light receiving element 154 or 254 to the controller 420, the controller 420 confirms that the paper loaded into the paper tray 120 or 220 is A5 size paper. Here, it is noted that the controller 420 may confirm a paper size corresponding to the sensing voltage even if the sensing voltage slightly differs from a value stored in the memory 410, but falls within a preset error range.

[0056] FIG. 7 is a control flow chart of the image forming apparatus according to an exemplary embodiment of the general inventive concept.

[0057] As illustrated in FIG. 7, the controller 420 confirms whether or not paper is loaded into the paper tray 120 or 220. If the paper detecting sensor (not shown) initially fails to sense the presence of paper inside the first paper tray 120, but senses paper later, the controller 420 determines that paper is newly loaded into the first paper tray 120. Also, if it is confirmed according to a signal transmitted from the paper cassette detecting sensor (not shown) that the second paper tray 220 is separated from the body 100 and thereafter, is reinstalled into the body 100, the controller 420 determines that paper is newly loaded into the second paper tray 220 (500).

[0058] Next, after confirming loading of new paper into the paper trays 120 and 220, the controller 420 controls the sensors 150 and 250 so that the sensors 150 and 250 emit light and receive the light reflected by the light reflectors 112 and 212. The light reflectors 112 and 212 are moved respectively in linkage with the paper guides 110a and 110b and the paper guides 210a and 210b, and have any one of various stepped configurations, including forward and reverse stepped con-
figurations, to change the quantity of light to be reflected according to the adjusted distances between the paper guides 110a and 110b and between the paper guides 210a and 210b (510).

[0059] Next, the sensors 150 and 250 output sensing voltages, corresponding to the quantity of light reflected by the light reflectors 112 and 212, to the controller 420. The smaller the distance between the sensor 150 and the light reflector 112 or between the sensor 250 and the light reflector 212, the greater the quantity of light introduced into the sensor 150 or 250. In turn, the greater the quantity of light introduced into the sensor 150 or 250, the greater the sensing voltage. The sensors 150 and 250 respectively include the light emitting elements 152 and 252 and the light receiving elements 154 and 254, which may be integrally formed with each other or may be separated from each other (520).

[0060] Next, the controller 420 determines the size of paper loaded into the paper trays 120 and 220 according to the sensing voltages output from the sensors 150 and 250. The sensing voltages and corresponding paper sizes are previously stored in the memory 410. The controller 420 may determine a paper size corresponding to the sensing voltage if the sensing voltage is equal to a value stored in the memory 410 or falls within an error range of the value (530).

[0061] Next, the controller 420 stores the determined paper size in the memory 410 and controls driving of the image forming apparatus according to the stored paper size information during a printing operation (540).

[0062] As apparent from the above description, according to an embodiment of the present general inventive concept, a paper feeding device includes a light reflector having a stepped reflection surface corresponding to various paper widths. Accordingly, the size of paper may be recognized using a single sensor and the light reflector without requiring a plurality of sensors, resulting in reduction in cost and volume.

[0063] Although a few embodiments of the present general inventive concept have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the general inventive concept, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. A paper feeding device comprising:
a paper tray in which paper is loaded;
at least one paper guide adjustable in a plurality of positions according to a width of the paper to guide a left or right end of the paper loaded in the paper tray in a paper feeding direction;
a light reflector installed to be moved in linkage with the paper guide and having a stepped reflection surface; and
a sensor that emits light to the light reflector and receives the light reflected by the light reflector and outputs a sensing voltage corresponding to the received light, to enable calculation of a size of the paper.

2. The paper feeding device according to claim 1, wherein:
the at least one paper guide includes a pair of paper guides to guide the left and right ends of the paper in the paper feeding direction; and
the paper feeding device further comprises first and second racks connected respectively to the pair of paper guides to allow the pair of paper guides to be moved in linkage with each other, and a pinion gear-engaged with the first and second racks.

3. The paper feeding device according to claim 2, wherein the light reflector is coupled to at least one of the first rack and the second rack and is moved in linkage with the paper guides.

4. The paper feeding device according to claim 3, wherein the light reflector is one of injection-molded or assembled to one of the first rack and the second rack.

5. The paper feeding device according to claim 1, wherein:
the sensor includes a light emitting element to emit light and a light receiving element to receive the light; and
the light emitting element and the light receiving element are one of integrally formed with each other or are separated from each other.

6. An image forming apparatus comprising:
a body in which an image is printed on paper;
at least one paper tray to support paper; and
a paper feeding device comprising:
at least one paper guide that guides a left or right end of the paper loaded in the paper tray in a paper feeding direction, wherein a position of the paper guide being adjusted according to a width of the paper; and
a light reflector installed to be moved in linkage with the paper guide and having a stepped reflection surface; a sensor that emits light to the light reflector and receives the light reflected by the light reflector; and
a controller that calculates a size of the paper according to a sensing voltage output from the sensor.

7. The image forming apparatus according to claim 6, wherein:
the at least one paper guide includes a pair of paper guides to guide the left and right ends of the paper in the paper feeding direction; and
the paper feeding device further includes first and second racks connected respectively to the pair of paper guides to allow the pair of paper guides to be moved in linkage with each other, and a pinion gear-engaged with the first and second racks.

8. The image forming apparatus according to claim 7, wherein the light reflector is coupled to one of the first rack and the second rack and is moved in linkage with the paper guides.

9. The image forming apparatus according to claim 8, wherein the light reflector is one of injection-molded or assembled to one of the first rack and the second rack.

10. The image forming apparatus according to claim 6, wherein:
the sensor includes a light emitting element to emit light and a light receiving element to receive the light; and
the light emitting element and the light receiving element are one of integrally formed with each other or are separated from each other.

11. The image forming apparatus according to claim 6, wherein at least one paper tray includes at least one first paper tray pivotably rotatably coupled to the body and at least one second paper tray inserted into the body in a drawer manner.

12. A method of determining a paper size of paper in an image forming apparatus comprising:
confirming whether or not paper is loaded in at least one paper tray;
emitting light to a light reflector if the paper is loaded in the paper tray, the light reflector being moved in linkage with a paper guide installed to the paper tray and having a stepped reflection surface;
detecting a size of the paper according to a magnitude of a sensing voltage if a sensor installed at a side of the paper tray outputs the sensing voltage corresponding to the quantity of light reflected by the reflection surface; and
performing a printing operation according to the detected paper size.

13. The control method according to claim 12, wherein:
the at least one paper tray includes at least one first paper tray pivotally rotatably coupled to the body and at least one second tray inserted into the body in a drawer manner;
and
the confirming whether or not paper is loaded further comprises confirming that paper is newly loaded into the at least one first paper tray when paper inside the at least one first paper tray is detected subsequent to confirming paper was not loaded and confirming that paper is newly loaded into the at least one second paper tray when the second paper tray is separated and thereafter is reinstalled.

14. A paper tray to receive paper, comprising:
at least one paper guide that is adjustable according to a width of the paper;
a light reflector having a reflective portion to reflect light and coupled to the at least one paper guide to be moved in linkage with the paper guide; and
a sensor that emits light to the light reflector and receives the light reflected by the light reflector and outputs a sensing voltage corresponding to the received light.

15. The paper tray of claim 14, wherein the reflective portion is formed to reflect light at a plurality of distances different from one another based on an area of the reflective portion that reflects the light.

16. The paper tray of claim 15 wherein the reflective surface includes a plurality of reflective surface disposed in a step-like manner from one end of the light reflector to an opposite end of the light reflector such that distance between each reflective surface and the sensor defines a reflective distance between the light reflector and the sensor.

17. The paper tray of claim 14 further comprising a rack unit connected to the paper guide to move in a width direction of the paper wherein the light reflector moves together with the rack unit in the width direction.

18. The paper tray of claim 14 wherein the reflector is disposed in a width direction of the paper and the sensor emits light in a direction horizontal to the width direction.

19. The paper tray of claim 14, wherein the reflector has a pattern representing paper sizes and the sensor and the reflector are arranged in a length direction of the paper direction.

20. A paper tray to receive paper, comprising:
first and second paper guides that are adjustable according to a width of the paper to center the paper along a center axis of the paper tray extending in a paper feed direction;
a light emitting element that emits light along a light path following the center axis of the paper tray;
a light reflector moveable into the light path in response to adjusting the first and second paper guides to reflect emitted light; and
a light receiving element that receives the reflected emitted light from the light reflector and outputs a sensing voltage corresponding to the received light.

* * * * *