Title: APPARATUS AND METHODS FOR DISPLAYING ON FLEXIBLE DISPLAY

Abstract: An apparatus and method for displaying on a portable terminal is provided. The apparatus includes a display unit configured to display information at a display location on a screen, a sensor configured to provide motion information of the portable terminal when the portable terminal is bent, and a controller configured to adjust the display location on the screen based on the motion information. A method comprises displaying information at a display location on a screen, providing motion information of the portable terminal when the portable terminal is bent and adjusting the display location on the screen based on the motion information provided.
Description

Title of Invention: APPARATUS AND METHODS FOR DISPLAYING ON FLEXIBLE DISPLAY

Technical Field

The present disclosure relates to apparatus and methods for displaying on a portable terminal with a flexible display. More particularly, the present disclosure relates to apparatus and methods for displaying on a flexible display that is bent around.

Background Art

With the development of electronics communication industries, a portable terminal has become necessities of modern life as an important means for delivering information which changes rapidly.

Recently, with the development and popularity of a Graphic User Interface (GUI) system, the portable terminal uses a flexible display without satisfying with a touch screen. Since the flexible display is bendable, it contributes to lead a sector in which the conventional display faces a limitation. Examples of sectors that can utilize the flexible display include an e-book sector capable of replacing publication such as magazines, a new portable Information Technology (IT) product sector such as an ultra-compact Personal Computer (PC) that can be carried by bending or rolling a display thereof, a smart card capable of confirming information on a real-time basis and the like.

There is, therefore, a need for a method and an apparatus for displaying on a flexible display.

Disclosure of Invention

Solution to Problem

To address the above-discussed deficiencies of the prior art, it is a primary object to provide an apparatus and a method for displaying on a portable terminal with a flexible display by adjusting display location on a screen when the portable terminal is bent.

Another aspect of the present disclosure is to provide an apparatus and a method for displaying on a screen in which a user's field of vision is secured when the portable terminal is bent around.

In accordance with an aspect of the present disclosure, an apparatus for detecting that a portable terminal is bent is provided. The apparatus includes an engagement unit configured to provide an engagement signal to a controller when a first end of the portable terminal is engaged with a second end of the portable terminal, and the controller configured to detect that the portable terminal is bent upon receiving the engagement signal provided from the engagement unit.
In accordance with another aspect of the present disclosure, an information display apparatus of a portable terminal is provided. The apparatus includes a display unit configured to display at a display location on a screen, a sensor configured to provide motion information of the portable terminal when the portable terminal is bent, and a controller configured to adjust the display location based on the motion information provided from the sensor.

In accordance with another aspect of the present disclosure, an information display apparatus of a portable terminal is provided. The apparatus includes a display unit configured to display at a display location on a screen, a first sensor configured to provide a signal reporting that the portable terminal is bent, a second sensor configured to provide motion information of the portable terminal upon receiving from the first sensor the signal reporting that the portable terminal is bent, and a controller configured to adjust the display location based on the motion information provided from the second sensor.

In accordance with another aspect of the present disclosure, a method of detecting that a portable terminal is bent is provided. The method includes providing an engagement signal when a first end of the portable terminal is engaged with a second end of the portable terminal, and detecting that the portable terminal is bent upon receiving the provided engagement signal.

In accordance with another aspect of the present disclosure, a method of displaying information of a portable terminal is provided. The method includes displaying information at a display location on a screen, providing motion information of the portable terminal when the portable terminal is bent, and adjusting the display location based on the motion information provided.

In accordance with another aspect of the present disclosure, an information display method of a portable terminal is provided. The method includes displaying information at a display location on a screen, providing a signal reporting that the portable terminal is bent, providing motion information of the portable terminal upon receiving the provided signal reporting that the portable terminal is bent, and adjusting the display location on the screen based on the motion information provided.

Before undertaking the DETAILED DESCRIPTION OF THE INVENTION below, it may be advantageous to set forth definitions of certain words and phrases used throughout this patent document: the terms "include" and "comprise," as well as derivatives thereof, mean inclusion without limitation; the term "or," is inclusive, meaning and/or; the phrases "associated with" and "associated therewith," as well as derivatives thereof, may mean to include, be included within, interconnect with, contain, be contained within, connect to or with, couple to or with, be communicable with, cooperate with, interleave, juxtapose, be proximate to, be bound to or with, have,
have a property of, or the like; and the term "controller" means any device, system or part thereof that controls at least one operation, such a device may be implemented in hardware, firmware or software, or some combination of at least two of the same. It should be noted that the functionality associated with any particular controller may be centralized or distributed, whether locally or remotely. Definitions for certain words and phrases are provided throughout this patent document, those of ordinary skill in the art should understand that in many, if not most instances, such definitions apply to prior, as well as future uses of such defined words and phrases.

**Brief Description of Drawings**

For a more complete understanding of the present disclosure and its advantages, reference is now made to the following description taken in conjunction with the accompanying drawings, in which like reference numerals represent like parts:

FIG. 1 illustrates that a portable terminal employing a flexible display is worn on a wrist according to an exemplary embodiment of the present disclosure;

FIG. 2 is a perspective view of a portable terminal according to an exemplary embodiment of the present disclosure;

FIGs 3 and 4 illustrate an engagement unit for wearing a portable terminal on a wrist according to an exemplary embodiment of the present disclosure;

FIG. 5 is a very high level of block diagram of a portable terminal according to an exemplary embodiment of the present disclosure;

FIG. 6 illustrates a method for displaying information on a portable terminal according to an exemplary embodiment of the present disclosure;

FIG. 7 is a flowchart illustrating a process for displaying information on a portable terminal according to an exemplary embodiment of the present disclosure;

FIG. 8 is a flowchart illustrating a process for displaying information on a portable terminal according to an exemplary embodiment of the present disclosure;

FIG. 9 illustrates adjusting a display location on a screen of a portable terminal according to an exemplary embodiment of the present disclosure; and

FIG. 10 illustrates determining a display position on a screen of a portable terminal according to an exemplary embodiment of the present disclosure.

**Best Mode for Carrying out the Invention**

FIGURES 1 through 10, discussed below, and the various embodiments used to describe the principles of the present disclosure in this patent document are by way of illustration only and should not be construed in any way to limit the scope of the disclosure. Those skilled in the art will understand that the principles of the present disclosure may be implemented in any suitably arranged flexible electronic device. Exemplary embodiments of the present disclosure will be described herein below with
reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail since they would obscure the disclosure in unnecessary detail. Also, the terms used herein are defined according to the functions of the present disclosure. Thus, the terms may vary depending on user's or operator's intension and usage. That is, the terms used herein must be understood based on the descriptions made herein.

The present disclosure provides a method and apparatus for displaying information on a portable terminal which adjust a display location on a screen such that a user's field of vision is secured when the portable terminal is bent to be worn on the wrist.

According to an exemplary embodiment of the present disclosure, the portable terminal can be deformed in bending, folding, distorting, curving and the like. For example, the portable terminal can be rolled in a scroll fashion and can be curved (or bendable) like paper. The portable terminal includes a flexible display that is deformable. In addition, according to the exemplary embodiment of the present disclosure, the portable terminal is wearable on a body part such as a wrist or the like and has a structure described below.

FIG. 1 illustrates that a portable terminal employing the flexible display is worn on a wrist. Referring to FIG. 1, a portable terminal 1 is bent to wrap a user's wrist. In general, a user watches a flexible display 3 as if the user watches a wrist watch. Since a screen is bent, the user can turn a wrist 40 on which the portable terminal 1 is worn in order to see information 31 located beyond a field of vision.

FIG. 2 is a perspective view of a portable terminal according to an exemplary embodiment of the present disclosure. Referring to FIG. 2, a portable terminal 100 is bent around when both ends 1191 and 1192 are engaged. The portable terminal 100 can include a flexible display 105 that provides a bendable screen. The portable terminal 110 includes an engaging unit at the both ends 1191 and 1192, which will be described below with reference to FIG. 3 and FIG. 4.

FIG. 3 and FIG. 4 illustrate a portable terminal worn on a wrist according to an exemplary embodiment of the present disclosure. The portable terminal 100 includes an engagement unit 119 for engaging the both ends 1191 and 1192. The engagement unit 119 has a mechanical and electrical structure. In particular, the portable terminal 100 can detect that the both ends 1191 and 1192 are engaged by means of the engagement unit 119. Referring to FIG. 3, the first end 1191 includes a male connector 1192 connected to a first circuit 1193, and the second end 1192 includes a female connector 1194 connected to a second circuit 1195.

When the first end 1191 and the second end 1192 are engaged, the male connector 1192 and the female connector 1194 are electrically connected and thereby the first circuit 1193 and the second circuit 1195 are connected each other, which is detected by
the portable terminal 100. Referring to FIG. 4, the first end 1191 includes a switch 1196, and the second end 1192 includes a member capable of turning on the switch. When the first end 1191 and the second end 1192 are engaged, the switch 1196 turns on, which is detected by the portable terminal 100. Alternatively, the first end 1191 includes a sensor such as a proximity sensor, a magnetic sensor or a photo sensor, and the second end 1192 includes a member 1198 to trigger the sensor. When the first end 1191 and the second end 1192 are engaged, the member triggers the sensor, which is detected by the portable terminal 100.

When the first end 1191 and the second end 1192 are engaged, the portable terminal 100 is bent around. When the portable terminal 100 is bent, even if the portable terminal rotates, information on the screen is moved control so that a user's field of vision is secured.

FIG. 5 is a high level block diagram of a portable terminal according to an exemplary embodiment of the present disclosure. Referring to FIG. 5, a portable terminal 100 includes a communication unit 101, an input unit 103, a display unit 105, a storage unit 107, a camera 109, a video codec 111, an audio codec 113, a speaker 115, a microphone 117, an engagement unit 119, a sensor 123, an antenna 125 and a controller 127.

The portable terminal 100 can be deformed. For example, the portable terminal 100 can be rolled or curved (or bendable) like paper. For the flexibility, at least one of the aforementioned elements is deformable. In particular, the display unit 105 includes a flexible display.

The portable terminal 100 includes a cellular phone, a Personal Communication System (PCS), a Personal Data Assistant (PDA), an International Mobile Communication-2000 (IMT2000) terminal, a fourth-generation broadband system terminal and the like.

The communication unit 101 has a hardware and a software structures which enable video communication, audio communication and data communication. The communication unit 101 transmits and receives a radio signal through the antenna 125.

The input unit 103 receives a user input, and provides the controller 127 with an input signal corresponding to the user input.

The display unit 105 displays visual data under the control of the controller 127, which was demodulated by means of the video codec 111.

The storage unit 107 stores a program for controlling an overall operation of the portable terminal 100 and a variety of data which is input and output when a control operation of the portable terminal is executed.

The camera 109 generates image data by capturing an object, and displays the generated data to the video codec 111.
The audio codec 113 modulates image data provided from the camera 109, and provides the modulated data to the controller 127. In addition, the audio codec 113 demodulates image data provided from the controller 127, and thereafter provides the demodulated data to the display unit 105.

The audio codec 113 modulates audio data provided from the microphone 117, and provides the modulated data to the controller 127. Further, the audio codec 113 demodulates the audio data provided from the controller 127, and thereafter provides the demodulated data to the speaker 115.

The engagement unit 119 has a mechanical and electrical structure which engages the both ends of the portable terminal 100. In particular, if the both ends are engaged, the controller 127 detects the engagement.

The sensor 123 detects a physical situation of the portable terminal 100, and reports the detected situation to the controller 127. For example, the sensor 123 includes a gravity sensor 123-1, a rotation sensor 123-2, an acceleration sensor, a Global Positioning System (GPS) sensor, a temperature sensor and the like.

The controller 127 processes and controls video communication, audio communication, and data communication. The controller 127 configures an execution environment of the portable terminal 100, maintains information thereof, allows the portable terminal 100 to reliably operate and facilitates data input/output exchanges for the portable terminal 100.

In particular, the controller 127 detects that the portable terminal 100 is bent around from the engagement unit 119, detects the motion of the portable terminal 100 by means of the sensor 123, and controls an on-screen location of the information so that the information displayed on the display unit 105 is not beyond the user's field of vision.

FIG. 6 illustrates an information display method of a portable terminal according to an exemplary embodiment of the present disclosure. Referring to FIG. 6, visual information is displayed at an initial position in which a user's field of vision is secured. The display location adjusts on the motion of the portable terminal when, for example, the user turns a wrist 40 so that the user's field of vision is secured. As a result, the user can feel that the display information does not move on the screen despite the motion of the portable device, and thus the field of vision for the display information can be secured.

FIG. 7 is a flowchart illustrating an information display process of a portable terminal according to an exemplary embodiment of the present disclosure. Referring to FIG. 7, the controller 127 determines whether the portable terminal 100 is bent by means of the engagement unit 119 (step 701).

When the portable terminal 100 is bent around, the controller 127 receives motion in-
formation (e.g., a rotation angle, a rotation direction, a rotation speed, elasticity, etc.) of the portable terminal 100 from the sensor 123, and displays information that can be adjusted according to the motion information (step 703). For example, the controller 127 determines an on-screen location corresponding to the motion information provided from the sensor 123 by consulting a database or adopting an arithmetic algorithm, and displays information at the determined on-screen location.

Further, the sensor 123 provides the controller 127 with a velocity at which the portable terminal 100 rotates, and the controller 127 adjust the display location on the screen at a velocity in proportion to the velocity provided from the sensor 123. In addition, the sensor 123 provides the controller 127 a direction in which the portable terminal 100 rotates, and the controller 127 adjusts the display location on the screen in opposite direction.

FIG. 8 is a flowchart illustrating an information display process of a portable terminal according to an exemplary embodiment of the present disclosure. Referring to FIG. 8, the controller 127 determines whether the portable terminal 100 is bent around from the engagement unit 119 (step 801).

When the portable terminal 100 is bent around, the controller 127 receives from the gravity sensor 123-1 a gravity direction and an angle by which the portable terminal 100 is in motion with respect to the gravity direction (step 803).

Thereafter, the controller 127 determines a display location on a screen corresponding to the detected angle in the database, and displays information at the determined position on a screen (step 805). The database specifies display location on a screen for the angles by which the portable terminal rotates with respect to the gravity direction.

The information to display can be provided by various S/W applications, for example, a Short Message Service (SMS), a Multimedia Message Service (MMS), an e-mail, an application shortcut, a Social Network Service (SNS), an alarm, a software update and the like.

FIG. 9 illustrates adjusting a display location on a screen of a portable terminal according to an exemplary embodiment of the present disclosure. Referring to FIG. 9, the controller 127 detects that the portable terminal 100 is bent over from the engagement unit 119, and receives from the gravity sensor 123-1 a gravity direction and an angle R1 by which the portable terminal 100 rotates relatively with respect to the gravity direction. The controller 127 determines from the database the display location on a screen, 1 (XI, Y1), corresponding to the provided angle R1, and displays information at the determined location 1 (XI, Y1).

Thereafter, if a user turns a wrist, the controller 127 receives from the gravity sensor 123-1 the gravity direction and the angle R2 by which the portable terminal rotates
relatively with respect to the gravity direction. The controller 127 determines from the
database the display location on a screen, 2(X2, Y2), corresponding to the angle R2
received from the gravity sensor 123-1, and displays the information by adjusting the
display location from 1 (X1, Y2) to 2 (X2, Y2).

FIG. 10 illustrates a method of determining a display location on a screen in a
portable terminal according to an exemplary embodiment of the present disclosure.
Referring to FIG. 10, the controller 127 receives from the gravity sensor 123-1 an
angle by which the portable terminal 100 rotates in at least one or more directions with
respect to the gravity direction. As illustrated, the controller 127 can receive from the
gravity sensor 123-1 an angle by which the portable terminal rotates in an axis X', that
is, rotates in left and right directions of the screen with respect to the gravity direction,
and can determine from the database a coordinate x on the screen corresponding to the
provided angle.

Further, the controller 127 can receive from the gravity sensor 123-1 an angle by
which the portable terminal rotates in an axis Y', that is, rotates in the upward and
downward directions of the screen with respect to the gravity angle, and can determine
from the database a coordinate y on the screen corresponding to the provided angle.

In particular, the portable terminal 100 can store the database that provides a plurality
of angle ranges and coordinates that are specified for each angle range. In addition, the
controller 127 can configure an arithmetic algorithm for the database, and calculate a
coordinate corresponding to an angle by which the portable terminal 100 rotates with
respect to the gravity direction by using the arithmetic algorithm.

Methods based on the embodiments disclosed in the claims and/or specification of
the present disclosure can be implemented in hardware, software, or a combination of
both. When implemented in software, computer readable recording medium for storing
one or more programs (i.e., software modules) can be provided. The one or more
programs stored in the computer readable recording medium are configured for
execution performed by one or more processors in an electronic device such as a
portable terminal. The one or more programs include instructions for allowing the
electronic device to execute the methods based on the embodiments disclosed in the
claims and/or specification of the present disclosure.

The program (i.e., the software module or software) can be stored in a random access
memory, a non-volatile memory including a flash memory, a Read Only Memory
(ROM), an Electrically Erasable Programmable Read Only Memory (EEPROM), a
magnetic disc storage device, a Compact Disc-ROM (CD-ROM), Digital Versatile
Discs (DVDs) or other forms of optical storage devices, and a magnetic cassette.

Alternatively, the program can be stored in a memory configured in combination of
all or some of these storage media. In addition, the configured memory can be plural in
Further, the program can be stored in an attachable storage device capable of accessing the electronic device through a communication network such as the Internet, an Intranet, a Local Area Network (LAN), a Wide LAN (WLAN), a Storage Area Network (SAN), or a communication network configured by combining the networks. The storage device can access the electronic device through an external port. Furthermore, an additional storage device on the communication network can access a portable electronic device.

[62] In conclusion, an information display method and apparatus of a portable terminal according to the present disclosure displays information at a location on a screen where a user easily watches when the portable terminal is bent around.

[63] While the present disclosure has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the appended claims.
Claims

[Claim 1] A method for displaying information on a portable terminal, the method comprising:
displaying information at a display location on a flexible display screen;
determining if the portable terminal is bent;
determining rotation information for the portable terminal indicating a
rotational position of the portable terminal upon determining that the
portable terminal is bent; and
adjusting the display location on the display screen based on the
rotation information.

[Claim 2] The method of claim 1, wherein determining if the portable terminal is
bent comprises receiving a signal when a first end of the portable
terminal is engaged with a second end of the portable terminal.

[Claim 3] The method of claim 2, wherein the signal is provided when a male
connector located in the first end of the portable terminal is engaged
with a female connector located in the second end of the portable
terminal.

[Claim 4] The method of claim 2, wherein the signal is provided when a switch
located in the first end of the portable terminal is engaged with a
member located in the second end of the portable terminal.

[Claim 5] The method of claim 2, wherein the signal is provided when a sensor
located in the first end of the portable terminal responds to a member
for the sensor located in the second end of the portable terminal.

[Claim 6] The method of any one of the preceding claims, wherein the rotation in-
formation includes an angle by which the portable terminal is rotated in
at least one direction with respect to a gravity direction, and the display
location on the display screen is adjusted by consulting a database for a
new display location corresponding to the angle.

[Claim 7] The method of any one of the preceding claims, wherein the rotation in-
formation includes or further includes a first velocity at which the
portable terminal is rotating relative to a gravity direction, and the
display location on the display screen is adjusted at a second velocity in
proportion to the first velocity.

[Claim 8] The method of any one of the preceding claims, wherein the rotation in-
formation includes a rotation direction in which the portable terminal
has rotated, and the display location is adjusted in an opposite direction
of the rotation direction.

[Claim 9] The method of any one of the preceding claims, wherein the information includes at least one of a Short Message Service, SMS, a Multimedia Message Service, MMS, an e-mail, an application shortcut, a Social Network Service, SNS, an alarm, and a software update.

[Claim 10] A portable terminal comprising:

- a flexible display screen configured to display information at a display location; and
- a controller configured to determine if the portable terminal is bent;

wherein the controller is further configured to determine rotation information for the portable terminal indicating a rotational position of the portable terminal upon determining that the portable terminal is bent; and

wherein the controller is further configured to adjust the display location on the display screen based on the rotation information.

[Claim 11] The portable terminal of claim 10, wherein the portable terminal further comprises a first sensor configured to provide the controller with a signal reporting that the portable terminal is bent when a first end of the portable terminal is engaged with a second end of the portable terminal.

[Claim 12] The portable terminal of claim 11, wherein the first sensor has a male connector in the first end of the portable terminal and a female connector in the second end of the portable terminal, and is configured to provide the signal when the male connector and the female connector are electrically connected each other; or

wherein the first sensor has a switch in the first end of the portable terminal and a member for turning on the switch in the second end of the portable terminal, and is configured to provide the signal when the switch and the member are engaged; or

wherein the first sensor has a sensor in the first end of the portable terminal and a member for the sensor in the second end of the portable terminal, and is configured to provide the signal when the sensor responds to the member of the sensor.

[Claim 13] The portable terminal of any one of claims 10 to 12, wherein the portable terminal further comprises a second sensor configured to provide the controller with a gravity direction such that the controller can determine an angle by which the portable terminal is rotated in at least one direction with respect to the gravity direction, and

wherein the controller is further configured to determine a display
location on the screen corresponding to the determined angle by consulting a database, and to display the information at the determined display location on the screen.

[Claim 14] The portable terminal of claim 13, wherein the controller is further configured to determine a first velocity at which the portable terminal is rotating relative to the gravity direction; and wherein the controller is further configured to adjust the display location at a second velocity in proportion to the first velocity.

[Claim 15] The portable terminal of claim 13 or claim 14, wherein the second sensor is configured to provide the controller with a rotation direction of the portable terminal; and wherein the controller is configured to adjust the display location on the screen in a direction opposite to the direction of rotation.
[Fig. 7]

START

IS PORTABLE TERMINAL BENT?

701

NO

YES

703

ACQUIRE MOTION INFORMATION OF PORTABLE TERMINAL, AND DISPLAY MOBILE INFORMATION ACCORDING TO ACQUIRED MOTION INFORMATION
[Fig. 8]

START

IS PORTABLE TERMINAL BENT?

801

NO

YES

CALCULATE ANGLE BY WHICH PORTABLE TERMINAL RELATIVELY ROTATES WITH RESPECT TO GRAVITY DIRECTION

803

NO

YES

DETERMINE ON-SCREEN LOCATION CORRESPONDING TO CALCULATED ANGLE FROM DATABASE, AND DISPLAY CORRESPONDING INFORMATION AT DETERMINED LOCATION

805
The image shows a diagram with labeled axes and a table containing data on angles and corresponding screen locations. The table is divided into two sections:

### Angles in Axis X' with Respect to Gravity Direction

<table>
<thead>
<tr>
<th>Angle Range</th>
<th>On-Screen Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(x, y)</td>
</tr>
<tr>
<td></td>
<td>x(0<del>10), y(0</del>20)</td>
</tr>
</tbody>
</table>

-20° ~ -10°, (3,0)
-10° ~ 0°, (4,0)
0°, (5,0)
0° ~ 10°, (6,0)

### Angles in Axis Z' with Respect to Gravity Direction

<table>
<thead>
<tr>
<th>Angle Range</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P(x, y)</td>
</tr>
<tr>
<td></td>
<td>x(0<del>10), y(0</del>20)</td>
</tr>
</tbody>
</table>

-20° ~ -10°, (0,6)
-10° ~ 0°, (0,7)
0°, (0,8)
0° ~ 10°, (0,9)

The diagram illustrates the relationship between these angles and their corresponding screen locations.
A. CLASSIFICATION OF SUBJECT MATTER

H04B I/40(2006.01)i, G06F 3/01(2006.01)i, G06F 3/14(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04B 1/40; H04M 1/00; G09G 5/00; G06F 3/041; H04B 1/38; G06F 3/01; G06F 3/14

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
KONPASS(KIPO internal) & Keywords: flexible display, bending detection, rotation information, display location adjustment, gravity sensor, rotation sensor, and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>✗</td>
<td>US 2011-0187681 (KIM et al.) 04 August 2011 See paragraphs [0003] - [0006], [0033]-[0039], [0041]-[0042]; claim 1; and figures 2-3.</td>
<td>1, 6, 10, 13-14</td>
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<td>✗</td>
<td>US 2008-0291225 (ARNESON, THEODORE R.) 27 November 2008 See paragraphs [0002], [0017]-[0018], [0027]; and figures 1-2, 4.</td>
<td>2-5, 11-12</td>
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<td>US 2010-0029327 (JEE, HYUN HO) 04 February 2010 See paragraphs [0008], [0010], [0027],[0066H0072]; claims 1, 13; and figure 4.</td>
<td>1-6, 10-14</td>
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<td>✗</td>
<td>US 2011-0086680 (KIM et al.) 14 April 2011 See paragraphs [0040], [0044]; claim 1; and figures 1b, 2.</td>
<td>1-6, 10-14</td>
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<tr>
<td>✗</td>
<td>KR 10-2010-0050318 (LG ELECTRONICS INC.) 13 May 2010 See paragraphs [0086], [0088]; claim 1; and figure 13.</td>
<td>1-6, 10-14</td>
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</table>

Further documents are listed in the continuation of Box C. See patent family annex.

Date of the actual completion of the international search: 25 June 2013 (25.06.2013)

Date of mailing of the international search report: 26 June 2013 (26.06.2013)

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea
Facsimile No. 82-42-472-7140

Authorized officer
PARK, Jin Ho
Telephone No. 0424818398

Form PCT/ISA/210 (second sheet) (July 2009)
This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. □ Claims Nos.;  
   because they relate to subject matter not required to be searched by this Authority, namely:

2. □ Claims Nos.;  
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. □ Claims Nos.: 7-9,15  
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

This International Searching Authority found multiple inventions in this international application, as follows:

1. □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. □ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. □ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. □ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  

Remark on Protest  
□ The additional search fees were accompanied by the applicant’s protest and, where applicable, the payment of a protest fee.  
□ The additional search fees were accompanied by the applicant’s protest but the applicable protest fee was not paid within the time limit specified in the invitation.  
□ No protest accompanied the payment of additional search fees.
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