(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 671 719 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
24.06.2020 Bulletin 2020/26

(51) Int Cl.:
G09G 5/00 *(2006.01)*

(21) Application number: **18214803.1**

(22) Date of filing: **20.12.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Vestel Elektronik Sanayi ve Ticaret A.S.**
45030 Manisa (TR)

(72) Inventors:
- **ÇAKMAK, Levent**
  45030 Manisa (TR)
- **ER, Alper Sait**
  45030 Manisa (TR)

(74) Representative: **Flint, Adam**
Page White & Farrer
Bedford House
John Street
London WC1N 2BF (GB)

(54) PROCESSOR AND METHOD FOR OPERATING A DISPLAY DEVICE

(57) A processor (102) is in communication with a display device (100) having a display screen (101). The processor (102) receives, from the display screen (101), information relating to one or more capabilities of the display screen (101); generates metadata indicating the one or more capabilities of the display screen (101) based on the received information; and stores the generated metadata at a storage device (103). The video source device (200) can drive the display screen (101) in accordance with the capabilities of the display screen (101) as indicated by the metadata.

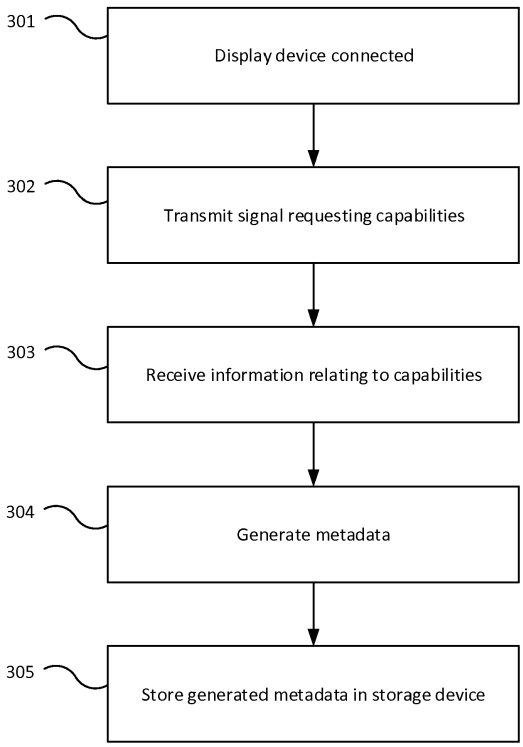

Figure 3

EP 3 671 719 A1

Description

Technical Field

[0001] The present disclosure relates to a processor and a method for operating a display device.

Background

[0002] A typical video system comprises a video source and a display device. In operation, the video source transmits video data to the display device. The display device receives the video data and displays corresponding video content accordingly.

[0003] In order to drive the display device correctly, the video source supplies the video data in an appropriate format for the display device. For example, display parameters such as resolution and horizontal and vertical size of the video content should match the resolution and horizontal and vertical size of the display screen of the display device.

Summary

[0004] According to a first aspect disclosed herein, there is provided a method performed by a processor which is in communication with a display device having a display screen, the method comprising: receiving from the display device information relating to one or more capabilities of the display screen; generating based on the received information metadata indicating the one or more capabilities of the display screen to enable a video source device to drive the display screen in accordance with the capabilities of the display screen; and storing the generated metadata at a storage device.

[0005] Because the information relating to one or more capabilities of the display screen is obtained from the display screen, and the metadata is generated based on that information, this avoids a person having to enter or create the metadata manually. This reduces the labour and time involved and also reduces or eliminates the possibility of human error.

[0006] In an example, the method may comprise transmitting to the display screen a signal requesting the display screen provide information relating to the one or more capabilities of the display screen.

[0007] In an example, said transmitting the signal is performed in response to the display screen being connected to the processor.

[0008] In an example, the one or more capabilities of the display screen comprise one or more of the following: the resolution of the display screen; manufacturer information; the size of the display screen; one or more active display areas of the display screen; the vertical line rate of the display screen; and the horizontal line rate of the display screen.

[0009] In an example, the metadata is generated to conform to the Extended Display Identification Data, EDID, Enhanced EDID, E-EDID, or DisplayID format.

[0010] In an example, the method comprises generating and storing first and second metadata based on the received information, the first metadata indicating the one or more capabilities of the display screen in accordance with a first format and the second metadata indicating the one or more capabilities of the display screen in accordance with a second format different from the first format.

[0011] According to a second aspect disclosed herein, there is provided a processor for a display device having a display screen, the processor being constructed and arranged to communicate with a display screen to: receive from a said display screen information relating to one or more capabilities of said display screen; generate based on the received information metadata indicating the one or more capabilities of said display screen to enable a video source device to drive said display screen in accordance with the capabilities of said display screen; and store the generated metadata at a storage device.

[0012] In an example, the processor is configured to transmit to a said display screen a signal requesting said display screen provide information relating to the one or more capabilities of said display screen.

[0013] In an example, the processor is configured to transmit the signal requesting the one or more capabilities of said display screen in response to said display screen being connected to the processor.

[0014] In an example, the processor is configured to generate metadata that indicates capabilities of a said display screen which comprise one or more of the following: the resolution of said display screen; manufacturer information; the size of said display screen; one or more active display areas of said display screen; the vertical line rate of said display screen; and the horizontal line rate of said display screen.

[0015] In an example, the processor is configured to generate the metadata according to the Extended Display Identification Data, EDID, Enhanced EDID, E-EDID, or DisplayID format.

[0016] In an example, the processor is configured to generate and store first and second metadata based on the received information, the first metadata indicating the one or more capabilities of the display screen in accordance with a first format and the second metadata indicating the one or more capabilities of the display screen in accordance with a second format different from the first format.

[0017] There is also provided a mainboard for a display device having a display screen, the mainboard comprising a processor as described above and a storage device in communication with the processor.

[0018] There is also provided a display device comprising a display screen and a mainboard as described above.

Brief Description of the Drawings

[0019] To assist understanding of the present disclosure and to show how embodiments may be put into effect, reference is made by way of example to the accompanying drawings in which:

Figure 1 shows schematically a front view of an example of a display device according to the present disclosure connected to a video source;

Figure 2 shows schematically a rear view of the display device of Figure 1A; and

Figure 3 is a flow chart illustrating an example of a method in accordance with the present disclosure.

Detailed Description

[0020] During manufacture of a display device having a display screen, metadata indicating capabilities of the display screen are stored on a storage device (e.g. a flash memory) which is associated with the display device. In operation, a video source, which provides video data to the display device for display by the display screen, reads the metadata from the storage device of the display device and adapts the video data according to the capabilities of the display screen. For example, the metadata may indicate properties of the screen such as resolution, colour space or characteristics, etc. of a display screen. The video source reads this data and adapts the video data such that the resolution, colour space or characteristics, etc. of the video content matches or is suitable for the resolution, etc. of the display screen.

[0021] In known manufacturing processes, the creation of the metadata to be stored on the storage device associated with the display device involves a person manually determining the capabilities of the display screen and manually creating and storing the metadata. The capabilities of a display screen vary from device to device. This is typically the case for different types or models of display device. In addition, even if two display devices are nominally of the same type or model, the specific relevant capabilities of the display screens of those devices may be different (because for example different components are used). Accordingly, the person typically needs to manually obtain the capabilities and create new metadata for each individual display device that is manufactured.

[0022] In accordance with examples described herein, a processor of the display device receives information relating to one or more display screen capabilities from the display screen itself. The processor then generates metadata indicating the one or more capabilities and stores the generated metadata at a storage device. Hence, no human input by a designer is required to manually identify the capabilities of the display screen and write the appropriate metadata. This therefore provides a quicker, cheaper, more reliable and more adaptable way to generate and store the metadata needed by the video source.

[0023] Metadata of the kind described above may conform to a Standard. Examples of such Standards include the Extended Display Identification Data (EDID), Enhanced EDID (E-EDID), and DisplayID Standards.

[0024] Figures 1 and 2 show schematically a front and rear view of an example of a display device 100 respectively. The display device 100 has a display screen 101, a processor 102 and a storage device 103. The display screen 101, processor 102 and storage device 103 are installed within and supported by a main housing 104 of the display device 100. The processor 102 is operably coupled to the display screen 101 and the storage device 103 by, for example, respective wired connections. In this example, the display device 100 is a television. Other examples of display devices include computer monitors, interactive flat panel displays (IFPDs), digital signages, displays for tablet computers, displays for laptop computers, etc.

[0025] Most televisions and other display devices have a printed circuit board, often referred to as a "mainboard", for controlling the display and other functions. There may also be a separate power board, which includes or is connected to a voltage transformer to provide supply voltages from an incoming mains power supply to one or more components of the device, though such functionality may alternatively be provided by the mainboard. As shown in Figure 2, in this example, the processor 102 and storage device 103 are located on a mainboard 105 of the display device 100. It is understood that other electronic and/or electrical components may be present on the mainboard 105, including for example one or more further processors.

[0026] In use, the display device 100 is operably coupled to a video source 200 via a wired or wireless connection. Examples of video sources 200 include graphics cards, set-top boxes, DVD or Blu Ray players, PVRs (personal video recorders, also known as DVRs or digital video recorders), games consoles, other media players, media streamers, etc.

[0027] In operation, the video source 200 sends video data to the display device 100 causing the display screen 101 to render corresponding video content. The storage device 103 is accessible by the video source 200 such that the video source 200 can read data stored thereon. The video source 200 adapts the video data so that the video data sent to the display device 100 is in accordance with metadata relating to the capabilities of the display screen 101 which is stored on the storage device 103. How the metadata is generated and stored is described below in relation to Figure 2.

[0028] Figure 3 is a flow diagram illustrating a method performed by the processor 102 in accordance with examples described herein.

[0029] At 301, the display screen 101 is connected to the processor 102. This may be a direct connection, or

may be via one or more other components. For example, if the processor 102 is installed on the mainboard 105, the display screen 101 may be connected to a port of the mainboard 105 which in turn connects to the processor 102. Once connected, communication between the display screen 101 and the processor 102 is enabled. The communication between the mainboard 105 and display screen 101 may for example be in accordance with the V-by-One HS or LVDS (low-voltage differential signalling) Standards, using V-by-One HS or LVDS pins. Alternatively, a cable connection using for example I2C or UART (universal asynchronous receiver-transmitter) may be used.

[0030] At 302, the processor 102 transmits a signal to the display screen 101 requesting information relating to the capabilities of the display screen 101. This may be performed in response to the processor 102 identifying the connection made at 301. Alternatively or additionally, the processor 102 may transmit the signal periodically. Alternatively or additionally, the processor 102 may transmit the signal in response to user input.

[0031] At 303, the processor 102 receives, from the display screen 101, information relating to one or more capabilities of the display screen 101. The capabilities may, for example, be one or more of: resolution of the display screen 101; manufacturer information; the size of the display screen 101; one or more active display areas of the display screen 101 (that is, the actual dimensions of the display area); the vertical line rate of the display screen 101; and the horizontal line rate of the display screen 101.

[0032] Further on the capabilities of the display screen 101 which may be indicated by the display screen 101, according to the EDID Standard, capabilities which may be indicated include, but are not limited to:

(i) Vendor/Product Identification Block. This identifies the manufacturer of the display screen 101 and display screen 101 itself, including serial number and date of manufacture.

(ii) EDID Structure Version & Revision. This identifies the version and revision of the EDID data within the structure.

(iii) Basic Display Parameters/Features. These define characteristics such as whether the display accepts analogue or digital inputs, sync types, maximum horizontal and vertical size of the display, gamma transfer characteristics, power management capabilities, colour space, and default video timing, etc.

(iv) Colour Characteristics. These define the RGB colour space conversion technique to be used by the display.

(v) Established Timings. These define the VESA-established video resolutions/timing that are supported by the display.

(vi) Standard Timing Identification. These define additional video resolutions supported by the display.

(vii) Detailed Timing Descriptions. These describe additional video resolutions in detail.

[0033] Similar capabilities are specified in other Standards such as E-EDID and DisplayID.

[0034] Information relating to one or more of these capabilities of the display screen 101, and optionally other capabilities not mentioned here, may be indicated by the display screen 101 to the processor 102.

[0035] At 304, the processor 102 generates metadata based on the received information. The generated metadata indicates the one or more capabilities of the display screen 101. The processor 102 generates the metadata in a specific format and is preconfigured with information about how to write metadata in that specific format. For example, the processor 102 may be configured to generate EDID metadata, and so knows how to translate the received information relating to the capabilities of the display screen 101 into the EDID format.

[0036] The processor 102 may in some examples be configured to generate metadata in accordance with a plurality of formats, i.e. to generate first metadata in a first metadata format from the received capabilities, to generate second metadata in a second metadata formation from the received capabilities, etc. For example, the processor 102 may generate both first metadata conforming to the EDID format and second metadata conforming to the DisplayID format from the same received capabilities.

[0037] At 305, the processor 102 stores the generated metadata at the storage device 103. This may involve the processor 102 storing both first and second (and third, etc.) metadata in the different formats. When a plurality of metadata formats are used, they may all be stored to the same storage device 103 or may be stored on separate storage devices.

[0038] As mentioned above, the storage device 103 is accessible by the video source 200. Hence, the video source 200 can read the metadata from storage device 103 in order to adapt video data it sends to the display device 100 according to the capabilities of the display screen 101 as specified in the metadata.

[0039] In examples described herein, because the information relating to one or more capabilities of the display screen is obtained from the display screen, and can be obtained automatically, and the metadata is generated based on that information, this avoids a person having to enter or create the metadata manually. This reduces the labour and time involved during this part of manufacture of display devices and also reduces or eliminates the possibility of human error.

[0040] It will be understood that the processor or processing system or circuitry referred to herein may in

practice be provided by a single chip or integrated circuit or plural chips or integrated circuits, optionally provided as a chipset, an application-specific integrated circuit (ASIC), field-programmable gate array (FPGA), digital signal processor (DSP), graphics processing units (GPUs), etc. The chip or chips may comprise circuitry (as well as possibly firmware) for embodying at least one or more of a data processor or processors, a digital signal processor or processors, baseband circuitry and radio frequency circuitry, which are configurable so as to operate in accordance with the exemplary embodiments. In this regard, the exemplary embodiments may be implemented at least in part by computer software stored in (non-transitory) memory and executable by the processor, or by hardware, or by a combination of tangibly stored software and hardware (and tangibly stored firmware).

[0041] Reference is made herein to data storage for storing data. This may be provided by a single device or by plural devices. Suitable devices include for example a hard disk and non-volatile semiconductor memory (including for example a solid-state drive or SSD).

[0042] Although at least some aspects of the embodiments described herein with reference to the drawings comprise computer processes performed in processing systems or processors, the invention also extends to computer programs, particularly computer programs on or in a carrier, adapted for putting the invention into practice. The program may be in the form of non-transitory source code, object code, a code intermediate source and object code such as in partially compiled form, or in any other non-transitory form suitable for use in the implementation of processes according to the invention. The carrier may be any entity or device capable of carrying the program. For example, the carrier may comprise a storage medium, such as a solid-state drive (SSD) or other semiconductor-based RAM; a ROM, for example a CD ROM or a semiconductor ROM; a magnetic recording medium, for example a floppy disk or hard disk; optical memory devices in general; etc.

[0043] The examples described herein are to be understood as illustrative examples of embodiments of the invention. Further embodiments and examples are envisaged. Any feature described in relation to any one example or embodiment may be used alone or in combination with other features. In addition, any feature described in relation to any one example or embodiment may also be used in combination with one or more features of any other of the examples or embodiments, or any combination of any other of the examples or embodiments. Furthermore, equivalents and modifications not described herein may also be employed within the scope of the invention, which is defined in the claims.

Claims

1. A method performed by a processor (102) which is in communication with a display device (100) having a display screen (101), the method comprising:

receiving from the display screen (101) information relating to one or more capabilities of the display screen (101);
generating based on the received information metadata indicating the one or more capabilities of the display screen (101) to enable a video source device (200) to drive the display screen (101) in accordance with the capabilities of the display screen (101); and
storing the generated metadata at a storage device (103).

2. A method according to claim 1, comprising transmitting to the display screen (101) a signal requesting the display screen (101) provide information relating to the one or more capabilities of the display screen (101).

3. A method according to claim 2, wherein said transmitting the signal is performed in response to the display screen (101) being connected to the processor (102).

4. A method according to any of claims 1 to 3, wherein the one or more capabilities of the display screen (101) comprise one or more of the following: the resolution of the display screen (101); manufacturer information; the size of the display screen (101); one or more display active areas of the display screen (101); the vertical line rate of the display screen (101); and the horizontal line rate of the display screen (101).

5. A method according to any of claims 1 to 4, wherein the metadata is generated to conform to the Extended Display Identification Data, EDID, Enhanced EDID, E-EDID, or DisplayID format.

6. A method according to any of claims 1 to 5, comprising generating and storing first and second metadata based on the received information, the first metadata indicating the one or more capabilities of the display screen (101) in accordance with a first format and the second metadata indicating the one or more capabilities of the display screen (101) in accordance with a second format different from the first format.

7. A processor (102) for a display device (100) having a display screen (101), the processor (102) being constructed and arranged to communicate with a display screen (101) to:

receive from a said display screen (101) information relating to one or more capabilities of said display screen (101);

generate based on the received information metadata indicating the one or more capabilities of said display screen (101) to enable a video source device (200) to drive said display screen (101) in accordance with the capabilities of said display screen (101); and
store the generated metadata at a storage device (103).

8. A processor (102) according to claim 7, wherein the processor (102) is configured to transmit to a said display screen (101) a signal requesting said display screen (101) provide information relating to the one or more capabilities of said display screen (101).

9. A processor (102) according to claim 8, wherein the processor (102) is configured to transmit the signal requesting the one or more capabilities of said display screen (101) in response to said display screen (101) being connected to the processor (102).

10. A processor (102) according to any of claims 7 to 9, wherein the processor (102) is configured to generate metadata that indicates capabilities of a said display screen (101) which comprise one or more of the following: the resolution of said display screen (101); manufacturer information; the size of said display screen (101); one or more active display areas of said display screen (101);; the vertical line rate of said display screen (101); and the horizontal line rate of said display screen (101).

11. A processor (102) according to any of claims 7 to 10, wherein the processor (102) is configured to generate the metadata according to the Extended Display Identification Data, EDID, Enhanced EDID, E-EDID, or DisplayID format.

12. A processor (102) according to any of claims 7 to 11, wherein the processor is configured to generate and store first and second metadata based on the received information, the first metadata indicating the one or more capabilities of the display screen (101) in accordance with a first format and the second metadata indicating the one or more capabilities of the display screen (101) in accordance with a second format different from the first format.

13. A mainboard for a display device (100) having a display screen (101), the mainboard comprising a processor (102) according to any of claims 7 to 12 and a storage device (103) in communication with the processor (102).

14. A display device (100) comprising a display screen (101) and a mainboard according to claim 13.

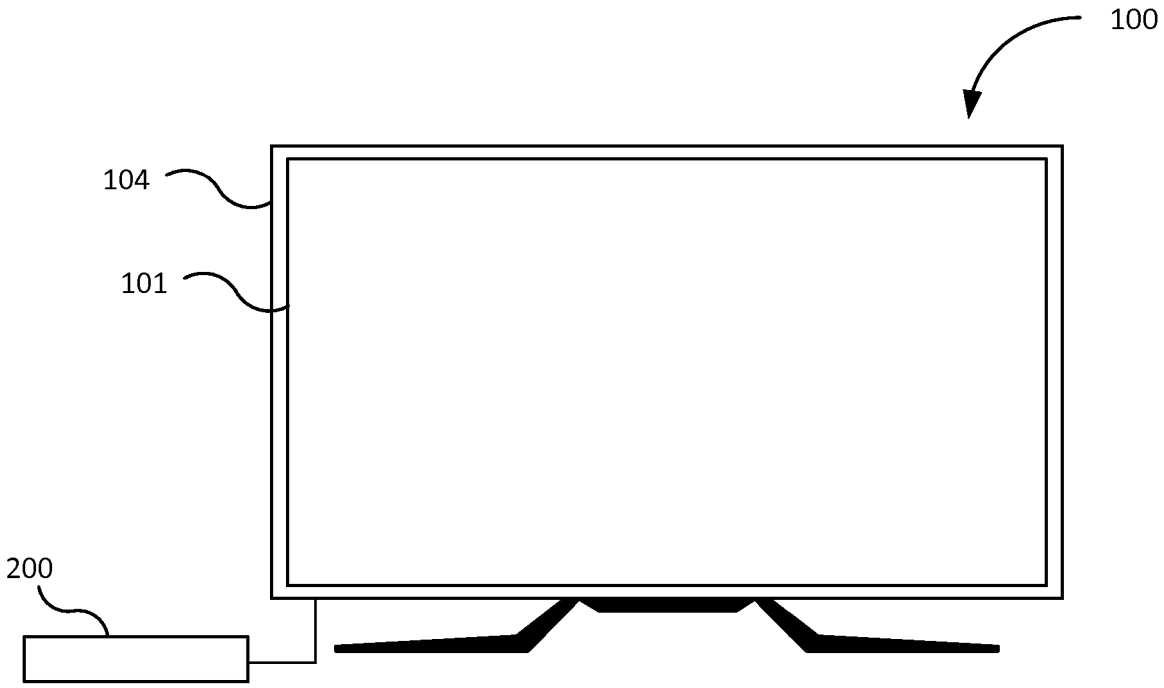

Figure 1

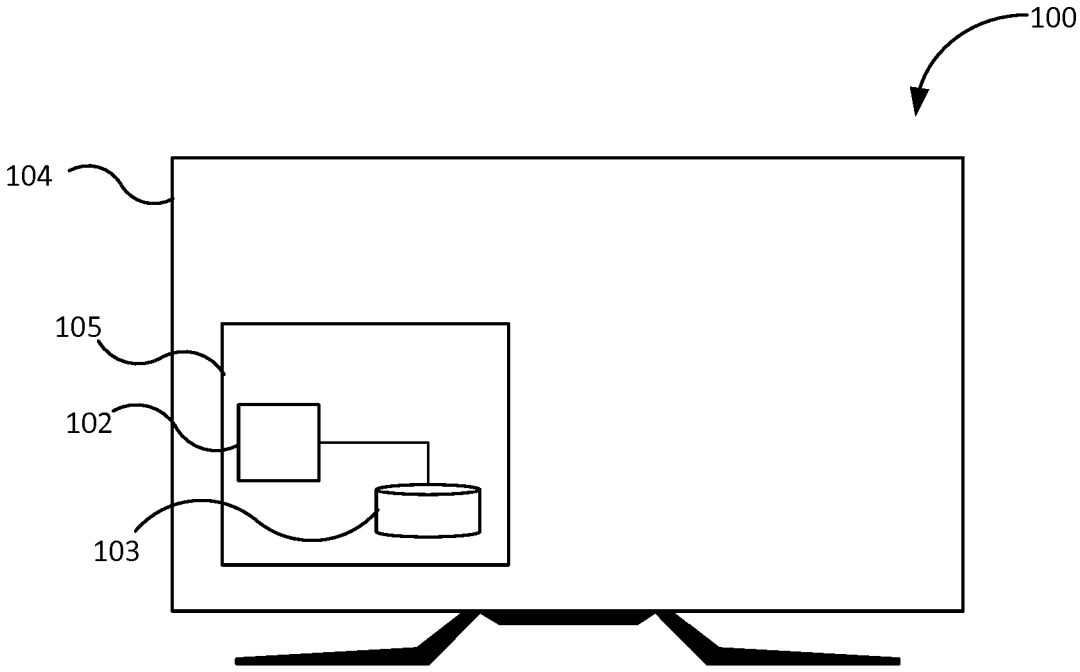

Figure 2

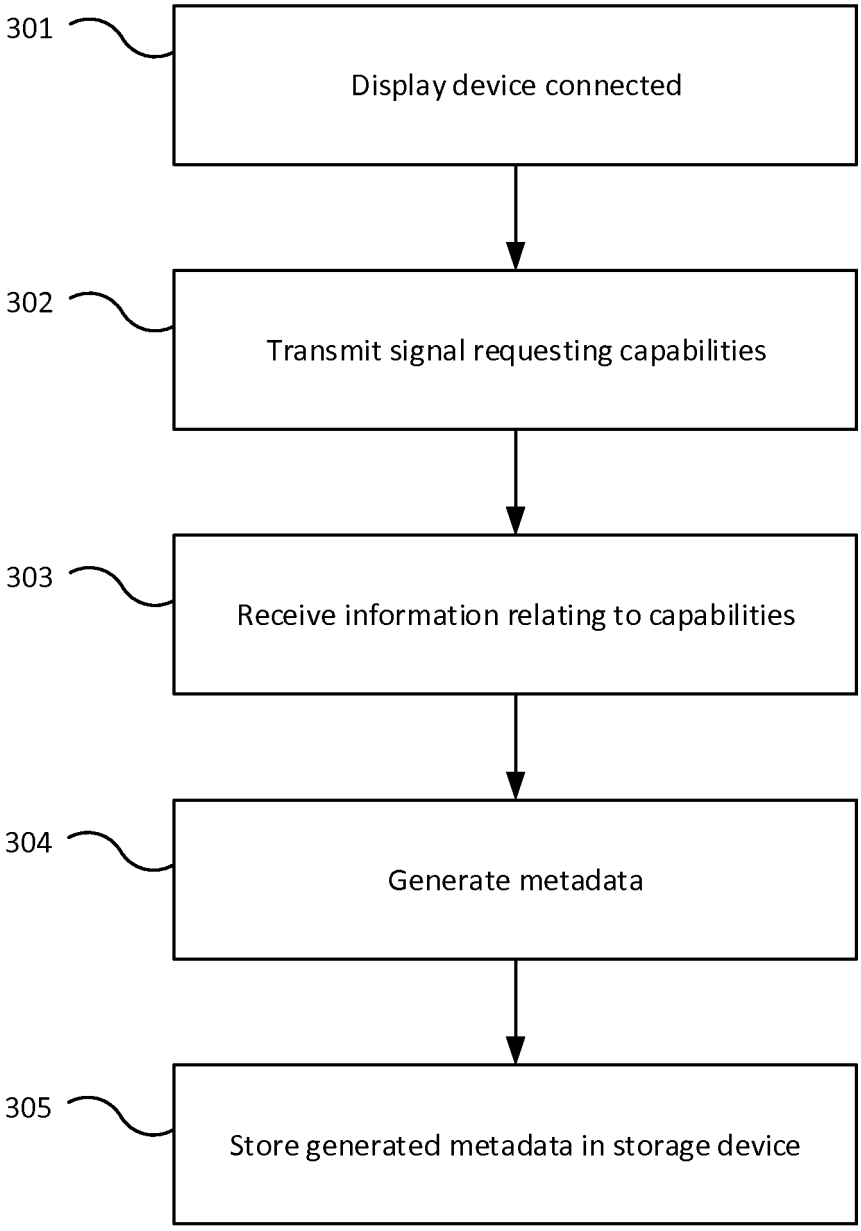
301
Display device connected
302
Transmit signal requesting capabilities
303
Receive information relating to capabilities
304
Generate metadata
305
Store generated metadata in storage device

Figure 3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 18 21 4803

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2007/274689 A1 (STONE CHRISTOPHER J [US]) 29 November 2007 (2007-11-29) * paragraphs [0016], [0019], [0020]; figures 1,2 *	1-14	INV. G09G5/00
X	US 2011/304522 A1 (ZENG HENRY [US] ET AL) 15 December 2011 (2011-12-15) * paragraphs [0048], [0049]; figures 1,2,3 *	1-14	
X	US 2009/033668 A1 (PEDERSON DOUGLAS A [US] ET AL) 5 February 2009 (2009-02-05) * paragraph [0019]; figures 2,4 *	1-14	

TECHNICAL FIELDS SEARCHED (IPC)

G09G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 May 2019	Fanning, Neil

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 21 4803

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

24-05-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007274689 A1	29-11-2007	NONE	
US 2011304522 A1	15-12-2011	US 2011304522 A1	15-12-2011
		WO 2011159815 A1	22-12-2011
US 2009033668 A1	05-02-2009	US 2009033668 A1	05-02-2009
		WO 2009032435 A1	12-03-2009

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82