(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
25 June 2020 (25.06.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/128625 A1

(51) International Patent Classification:
H04N 21/442 (2011.01) *H04N 21/6379* (2011.01)
H04N 21/462 (2011.01)

(21) International Application Number:
PCT/IB2019/001369

(22) International Filing Date:
09 December 2019 (09.12.2019)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PCT/CN2018/122585
21 December 2018 (21.12.2018) CN

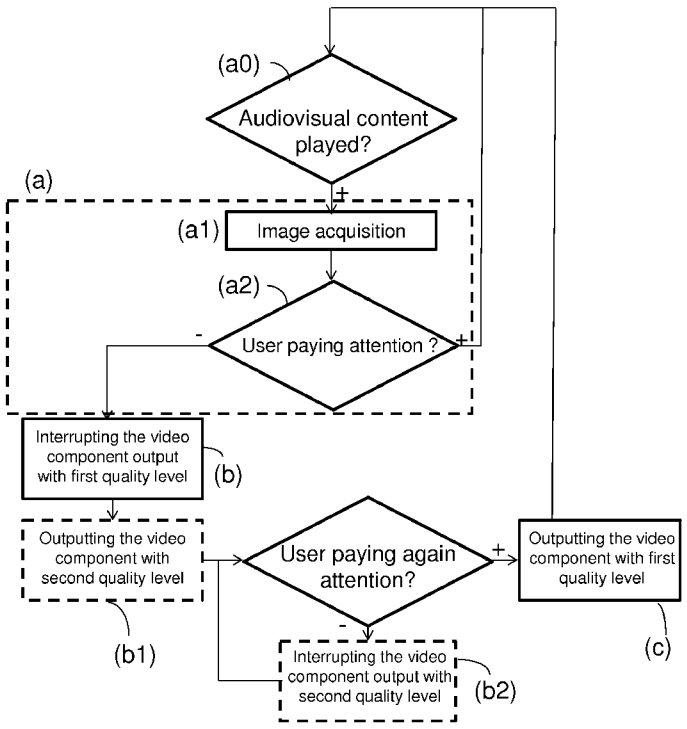
(71) Applicant: **ORANGE** [FR/FR]; 78 rue Olivier de Serres, 75015 Paris (FR).

(72) Inventors: **JIAO, Shi**; Orange Labs International Centers Beijing, 23F, Tower A, Beijing Global Trade Center, 36 North Third Ring Road East, Dongcheng District, Beijing 100013 (CN). **GUO, Zhihong**; Orange Labs International Centers Beijing, 23F, Tower A, Beijing Global Trade Center, 36 North Third Ring Road East, Dongcheng District, Beijing 100013 (CN).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(54) Title: METHOD FOR OPERATING AN ELECTRONIC DEVICE WHEN PLAYING AN AUDIOVISUAL CONTENT

FIG. 2



(57) Abstract: The present invention relates to a method for operating an electronic device (1) comprising a processing unit (11), a video output module (13) and an audio output module (14), the method being characterized in that it comprises: playing (a0) an audiovisual content on the electronic device (1), by outputting a video component of the audiovisual content with a first quality level at the video output module (13) and outputting an audio component of the audiovisual content at the audio output module (14); determining (a), by the processing unit (11), whether a user of the electronic device (1) is paying attention to the video output module (13); and in response to determining that the user is not paying attention to the video output module (13), interrupting (b) the output of the video component of the audiovisual content with the first quality level.

WO 2020/128625 A1

[Continued on next page]

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

Method for operating an electronic device when playing an audiovisual content

FIELD OF THE INVENTION

The field of this invention is that of mobile phones playing audiovisual components. More particularly, the invention relates to a method for operating a device when playing an audiovisual content.

BACKGROUND OF THE INVENTION

Recent mobile phones (smartphones) offer numerous features, including GPS, internet, music, video playing, games and countless apps. Lots of users regularly play various videos on their smartphone.

Nevertheless, it is quite common to not "watch" the video and to only listen to it, for instance in the case of music videos, presentations, talkshows, podcasts, discussions, news, etc., wherein the audio component is the most interesting one.

And even for "normal" videos that are expected to be watched, sometimes the user is doing other things (for example cooking or doing homework), and does not pay attention to the image all the time (he may look occasionally at the screen, for example when hearing interesting things).

The problem is that video playback costs sensibly more power and more data traffic than audio. Indeed, the video stream is heavier than the audio stream. When the user does not look at the screen, the data/power used for playing the video stream is wasted.

There exists ways (for example browser extensions) for downloading and playing only the audio stream of video (the video stream is blocked), for instance if the user already knows that he will only listen to the audio.

Such solution is efficient but is not very convenient as it is "all-or-nothing": should the user changes his mind and wishes to watch a part of the video, he would have to manually reload the video this time with both streams, and restart its playing from the beginning.

There is consequently a need for a simple and user-friendly solution which could further help reducing the power and bandwidth consumption when playing videos.

SUMMARY OF THE INVENTION

For these purposes, the present invention provides a method for operating an electronic device comprising a processing unit, a video output module and an audio output module, the method being characterized in that it comprises:

playing (a0) an audiovisual content on the electronic device, by outputting a video component of the audiovisual content with a first quality level at the video output module and outputting an audio component of the audiovisual content at the audio output module;

determining (a), by the processing unit, whether a user of the electronic device is paying attention to the video output module; and

in response to determining that the user is not paying attention to the video output module, interrupting (b) the output of the video component of the audiovisual content with the first quality level.

Preferred but non limiting features of the present invention are as follow:

- the electronic device comprises a camera, further comprising acquiring (a1) images using the camera, the determining step (a) being performed based on the acquired images;
- the determining step (a) further comprises analyzing (a2) the acquired images so as to detect a face of the user, the determining step (a) being performed based on the result of the detection of a face of the user;
- the determining step (a) further comprises analyzing (a2) the acquired images so as to detect an eye of the user, the determining step (a) being performed based on the result of the detection of an eye of the user;
- the determining step (a) is performed based on the result of the detection of an open eye of the user in said at least one acquired image, the user being determined as paying attention to the video output module (13) if an open eye is detected in said at least one acquired image;
- the video component of the audiovisual content with the first quality level and the audio component of the audiovisual content are transmitted from a remote server to the electronic device, and wherein interrupting (b) the output of the video component of the audiovisual content with the first quality level comprising interrupting the transmission of the video component of the audiovisual content with the first quality level;

- the method further comprises outputting (b1) the video component of the audiovisual content with a second quality level at the video output module, said second quality level being lower than the first quality level;
- outputting (b1) the video component of the audiovisual content with a second quality level at the video output module comprises triggering the transmission, from the remote server, of the video component of the audiovisual content with the second quality level;
- the video component of the audiovisual content with the second quality level has a lower resolution and/or a reduced number of frames by seconds than the video component of the audiovisual content with the first quality level;
- the method further comprises, in response to determining that the user has not been paying attention to the video output module for a duration exceeding an inattention threshold, interrupting (b2) the output of the video component of the audiovisual content with the second quality level;
- the audiovisual content is further played without outputting any video component after interrupting (b) the output of the video component of the audiovisual content with the first quality level;
- the method further comprises determining, by the processing unit, if the user is paying again attention to the video output module of the audiovisual content; and, in response to determining that the user is paying again attention to the video output module, outputting (c) the video component of the audiovisual content with the first quality level.

In a second aspect, the invention provides an electronic device comprising:

a processing unit,

a video output module for outputting a video component of an audiovisual content with a first quality level; and

an audio output module for outputting an audio component of the audiovisual content at the audio output module,

wherein said processing unit is configured to determine (a) whether a user of the electronic device is paying attention to the video output module and in response to determining that the user is not paying attention to the video output module, interrupt (b) the output of the video component of the audiovisual content with the first quality level.

According to preferred but non limiting features:

- the video output module is a screen, and the electronic device comprises further, next to the screen, a front camera for acquiring images to be used by the processing unit to determine whether the user is paying attention to the video output module;
- the electronic device comprises further at least one of a proximity sensor, an accelerometer, an infrared detector and a motion sensor, the output of which is used by the processing unit to determine whether the user is paying attention to the video output module.

According to a third and a fourth aspects, the invention provides a computer program product, comprising code instructions for executing a method according to the first aspect for operating a device comprising at least one processing unit, a video output module and an audio output module; and a computer-readable medium, on which is stored a computer program product comprising code instructions for executing a method according to the first aspect for operating a device comprising at least one processing unit, a video output module and an audio output module.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of this invention will be apparent in the following detailed description of an illustrative embodiment thereof, which is to be read in connection with the accompanying drawings wherein:

- figure 1 illustrates an example of architecture in which is performed the method according to the invention; and
- figure 2 is a diagram representing steps of an embodiment of a method according to the invention.

DETAILED DESCRIPTION PREFERRED EMBODIMENTS

Architecture

The present invention relates to a method for operating an electronic device 1 as represented by **figure 1**, in particular for playing an audiovisual content.

For the sake of clarity, in the following description, a distinction is made between the “video” and the “audio”. By video, it will be meant only the visual content, in other

words the "moving picture" without the sound. By audio, it will be meant only the sound content, without the video. Thus, by "audiovisual content", it will be meant a content possessing both an audio component and a video component, i.e. an AV media. An audiovisual content is often inappropriately referred to as a "video", despite having an audio component.

As explained, the electronic device 1 comprises one or more processing unit(s) 11, a video output module 13 (for instance a built-in screen, acting as the default video output unit of the device 1), and an audio output module 14 (for instance a built-in speaker, acting as the default audio output unit of the device 1). It is to be noted that the electronic device 1 could alternately comprise as audio and/or video output module 13, 14 at least one video and/or audio connector toward an external device such as a TV, a projector, etc. Indeed, such connector could be video and audio (such a HDMI port), video-only, or audio-only (such as a jack for earphones). Furthermore, such audio and/or video connector could be virtual, for instance a Bluetooth connection to a VR headset.

It will be understood that the present invention can be implemented on any electronic device 1 able to play in any way an audiovisual content with audio and video components.

In a preferred embodiment, the electronic device 1 further comprises a camera 15 (in particular a front camera). The electronic device 1 typically further comprises a communication unit for connecting (in particular wirelessly) the electronic device 1 to a network 20 (for example WiFi, Bluetooth, and preferably a mobile network, in particular a GSM/UMTS/LTE network), a memory 12 (for example flash memory), in particular for storing applications, which can be of various types. In a known fashion, the processing unit 11 is able to run these applications, and one or more of them could be players, i.e. applications able to retrieve an audiovisual content from a remote server 2 of the network, and play it.

The electronic device 1 may further comprise others units such as a battery, a user interface (for instance, if it comprises a screen as video output module 13, this screen could be touch sensitive), a location unit for providing location data representative of the position of the electronic device 1 (using for example GPS, network triangulation), etc.

The electronic device 1 is typically a smartphone, a tablet computer, a laptop, etc. In the following description, the example of a smartphone will be used.

Playing an audiovisual content

The present method is performed mostly by the processing unit 11 of the electronic device 1, and is advantageously implemented by the operating system of this electronic device 1, or a dedicated application such as an audio/video player.

The present method starts with a step (a0) of playing an audiovisual content, which is typically obtained from a remote server 2, i.e. downloaded via the network 20. In other words, the audiovisual content is preferably streamed from such a remote server 2. However, the present invention may also apply to downloaded audiovisual content which is not streamed, i.e. audiovisual content which is played after having been completely downloaded by the electronic device 1.

As explained, such audiovisual content has a video component and an audio component, so that playing the audiovisual content includes outputting the video component of the audiovisual content at the video output module 13 and outputting an audio component of the audiovisual content at the audio output module 14.

It is to be understood that several versions of the video component might be available, corresponding to different qualities. For example, there might be a plurality of resolutions (generally six resolutions: 144p, 240p, 360p, 480p, 720p or 1080p), and/or several numbers of frames by seconds (generally 30 fps or 60 fps). Similarly, several versions of the audio component might be available, even if it is rarer than for the video component (indeed the video component is far heavier than the audio component).

Typically, either the user selects the quality he wishes, or it is automatically selected thanks to the Adaptive bitrate (ABR) streaming technique. Such an adaptive bitrate streaming works by detecting a user's bandwidth and CPU capacity in real time and adjusting the quality of the component accordingly: the quality selected shall be the highest possible without degrading the user experience (i.e. with very little buffering, fast start time, etc.). To this end, the Real Time Streaming Protocol (RTSP) is preferably used: when the user wishes to play the audiovisual content, a RSTP request is sent from the electronic device 1 to the remote server 2, and the content with the "optimal" video and audio components is received in return.

In the following description, we will refer to a first quality level of video and audio components as the quality level of the components as normally outputted at the electronic device 1 during step (a0), even if such quality could vary over time thanks to

the ABR because of some events: for example, should a network congestion happens, the current quality will be temporary reduced (with respect to the quality when starting playing) to avoid uncomfortable rebuffering, but the provided components will always be the "optimal" ones given the available resources.

As represented by the **figure 2**, the present method comprises a determining step (a) of determining whether a user is paying attention to the video output module 13.

This determining step (a) can be continuously performed after having initiated (step a0) the playing of the audiovisual content by the electronic device 1. More precisely, playing an audiovisual content (step (a0)) triggers the determining step (a). To rephrase again, the step (a) is advantageously performed only during the playing of audiovisual contents by the electronic device 1, so as to save battery of this electronic device.

The principle behind the present invention is that, if the user is not paying attention to the video output module 13, the video component could be "lightened", or even cancelled, without altering the user experience: (s)he will not even realize it, while the network bandwidth usage and/or electronic device power consumption are reduced.

Image analysis

The present method proposes to assess the attention of the user to the video output module 13, i.e. to detect whether or not the user is looking at the video, and only listening to the audio component.

Advantageously, to avoid false negatives, a check is performed at a given frequency (for instance every minutes), and the user is determined as not paying attention if the user has not looked at the video output module 13 for a duration exceeding a first inattention threshold (for example 5 minutes). Indeed, the user might be distracted during a short moment without this meaning that (s)he is only listening to the audio component.

Determining step (a) is typically a step of "observing" the user. To this end, when the electronic device 1 comprises a camera 15, the present method comprises (a1) acquiring images using the camera 15 (in particular at a given frequency such as 1 image each minute), the recorded images being used by the processing unit 11 to determine whether the user is paying attention to the video output module 13.

In a particular embodiment, the acquired images are analyzed by the processing unit 11 (step a2) so as to detect a face of the user, the determining step (a) being performed based on the result of the detection of a face of the user. Indeed, from the position of the face, it can be determined what the user is watching, and thus whether (s)he is staring at the video output module 13 or not.

Such a so-called "face detection" embodiment based on analyzing an acquired image in order to detect the face of the user, for determining whether the user pays attention to the video output module or not, is advantageous when compared to another embodiment where the electrical device 1 would simply detect if a user is present in a specific area in front of the video output module (for instance using an infrared sensor): in the last case, the electronic device 1 is not able to infer for sure that the user is indeed paying attention to the video output module, as the user could be looking away from the electronic device 1 while still being detected in front of the electronic device 1. With such a detection of the face of the user from acquired image(s), the determination is quite easy to implement while still more accurate than detecting the presence of a user in front of the electronic device 1.

In another more refined embodiment, the acquired images are analyzed by the processing unit 11 (step a2) so as to detect an eye of the user, the determining step (a) being performed based on the result of the detection of an eye of the user. Indeed, from the detection of an eye facing the video output module 13, it can be determined that the user is watching, in particular when this eye is detected as being open, and thus whether (s)he is staring at the video output module 13 or not.

Such an embodiment based on analyzing an acquired image in order to detect an (open) eye of the user, for determining whether the user pays attention to the video output module or not, is advantageous when compared to the previous embodiments based on presence detection or face detection: in these last cases, the electronic device 1 is not able to discriminate for sure between an awaken user watching the video and a sleeping user merely facing electronic device 1. With the detection of an eye of the user facing the video output module 13, and in particular the detection of an open eye facing this video output module 13, such a determination can be made even more accurate.

The above-mentioned face and/or eye detection in an image can be implemented using well-known techniques for the skilled person in the field of image processing, such as the face and eye detection stages discussed for instance in the

article "Real-time Eye Gaze Direction Classification Using Convolutional Neural Network", Anjith George et al., 2016 International Conference on Signal Processing and Communications (SPCOM), IEEE, 12-15 June 2016, Bangalore, India.

In a preferred embodiment, the video output module 13 is a screen, and the camera 15 is a front camera next to the screen (generally just above the screen). In such an embodiment, what the camera 15 sees is what sees the screen: if an eye of the user is visible, it means that the user can pay attention to the screen. To the contrary, if the face is not visible it means that either the screen is concealed (and not visible) or that the user is staring at something else, so that the user cannot be paying attention to the video output module 13.

In other words, in such an embodiment, it can be considered that the user is paying intention to the video output module simply when its face or its eye is detectable on the acquired images, which is easy to implement.

More generally speaking, lots of techniques for image analysis able to detect a face or an eye and possibly track their direction are known to the skilled person and could be used here, in order to determine if the user is watching the video output module 13. A pre-trained AI model can be used effectively.

It will be understood that the determination of whether the user of the electronic device 1 is paying attention to the video output module 13 is not limited to the analysis of acquired images, and other techniques could be used, as for instance :

- a proximity sensor of the electronic device 1 (if the proximity sensor detects a nearby surface it means that the screen is not visible – for instance the device 1 is put down on a table -and thus that the user is not paying attention),

- an accelerometer (if small movements are detected it means that the user is holding the electronic device 1 in his hands and is probably paying attention to the video output module 13),

- an infrared detector, which can detect if there are people in front of the electronic device 1 or not,

- a motion sensor, which can detect if there are people in front of the electronic device 1 by motion detection.

Interrupting the output of the video component with the first quality

When it has been determined that the user is not paying attention to the video output module 13, in a further step (b), the output of the video component of the

audiovisual content with the first quality level is interrupted. It is to be understood that the output of the audio component with the first quality level is not interrupted, so that the playing of the audiovisual content continues.

By interrupting the output of the video component of the audiovisual content with the first quality level, it is simply meant that there is no more output at this first quality level, but there might still be an output of the video component of the audiovisual content at another quality level. In other words, the video component is "degraded".

As an example of such an interruption of the video output, if the audiovisual content is played through a media player application, the processing unit 11 may instruct this media player application to stop outputting the video, or to replace the video component with a still image (for instance a black screen). Alternatively, when the present method is implemented by a video player application running on the processing unit 11, this application directly stops the video output.

In another embodiment wherein the electronic device 1 is a mobile terminal having lock screen functionality, a software application, such as the operating system of the electronic device 1, may replace the video output of the video component with the locked screen, i.e. may trigger the locking of the screen, while the audio output continues.

According to a first embodiment, the method further comprises outputting (b1) the video component of the audiovisual content with a second quality level at the video output module 13, said second quality level being lower than the first quality level. Here, there is a partial degradation of the video component, as its quality is simply reduced, which reduces the power consumption of the electronic device 1.

As an example of such a video output using a second quality level, if the audiovisual content is played through a media player application, the processing unit 11 (or the operating system of the electronic device 1) may instruct this media player application to replace the initial audiovisual component comprising a video component with a first quality level with a corresponding audiovisual content comprising a video component with a second quality level, for instance by instructing this media player to read a file storing such a video component with a second quality level instead of reading a file storing the video component with the first quality level. Such files with different video quality levels may be stored locally, in the electronic device 1, after having been downloaded from a remote server 2, or may be stored remotely, in the remote server 2, in which case they may be streamed from this remote server 2.

Alternatively, when the present method is implemented by a software application running on the processing unit 11 (e.g. the operating system of the electronic device 1), this software application may directly replace the video output with the first quality level by the video output with a second quality level, for instead by reading a file storing the video component with the second quality level.

According to a second embodiment, the method does not further comprise outputting any video component of the audiovisual content (i.e. whatever the quality) at the video output module 13. In other words, the audiovisual content is further played without outputting any video component after interrupting (b) the output of the video component of the audiovisual content with the first quality level. This time, this is a "total degradation" of the video component (i.e. no more video component is outputted), which allows to save even more in terms of power consumption of the electronic device 1.

By contrast, the audio component is not degraded. The audio component keeps being outputted with the same quality level as it was before that the video component was degraded. In the case of a "total degradation" of the video component, it is to be understood that the playing of the audiovisual content becomes "audio-only".

As an example of such an audio output kept outputted, if the audiovisual content is played through a media player application, the processing unit 11 may instruct this media player application to replace the initial audiovisual content with a video component with a corresponding audiovisual content having only an audio component, for instance by instructing this media player to read a file storing such an audiovisual content with only audio component instead of reading a file storing the full audiovisual content, i.e. with a video component. Here also, such corresponding files, with or without video component, may be stored locally, in the electronic device 1, after having been downloaded from a remote server 2, or may be stored remotely, in the remote server 2, in which case they may be streamed from this remote server 2.

Lowering the quality level of the video component, or even completely stopping its output, reduces the power consumption of the electronic device 1, as a screen is for example one of the more consuming units of the electronic device 1.

In the case of a content obtained from a remote server 2, typically by a streaming technique, step (b) preferably comprises (in response to determining that the user is not paying attention to the video output module 13) interrupting the transmission of the video component of the audiovisual content with the first quality level, so as to also reduce bandwidth consumption in the network.

This interruption can be achieved typically by sending, from the electronic device 1 to the remote server 2, a RTSP request to stop streaming the audiovisual content. Other protocols can naturally be used for such requests to stop streaming, for instance the HTTP Live Streaming (HLS) protocol.

It is to be noted that it is possible that only the output of the video component with the first quality level may be interrupted on the electronic device 1, but not its transmission from the remote server 2 (i.e. the invention is not limited to interrupting both), leading to reduction of the power consumption of the electronic device 1 but not reduction of the bandwidth consumption on the network side, with a very simple implementation on the electronic device.

Similarly, the interruption of the video component transmission could be either partial of total (i.e. the video component is no more transmitted at all). In the case where there is a step of outputting (b1) the video component of the audiovisual content with a second quality level at the video output module 13, the method preferably comprises triggering the transmission, from the remote server 2, of the video component of the audiovisual content with the second quality level.

For instance, if the first quality level corresponds to a video resolution of 720p, the second quality level could correspond to a video resolution of 480p.

To this end, besides the aforementioned RTSP request to stop the transmission of the video component with the first quality level, a new RSTP request could be sent to the remote server 2, in order to trigger the transmission of the video component with the second quality level. Other protocols can naturally be used for such requests to stop streaming, for instance the HTTP Live Streaming (HLS) protocol.

The application preferably records the progress of the user watching the video with the first quality level, so as to switch to the second quality level from current progress when receiving the video component with the second quality level in response to the request: the playing is not interrupted and the users does not even notice that the video component has been switched or even interrupted.

In the opposite case, if it has not been detected (for a duration exceeding said first inattention threshold) that the user is not paying attention to the video output module 13 (i.e. it has been determined that the user is actually paying attention to the video output module 13, in particular at least once during the duration of said first inattention threshold), the output of the video component is not interrupted (it is kept outputted with the first quality level), i.e. the playing of the audiovisual content continues as such, with the same quality level as initially provided.

As explained, the determining step (a) could be performed during the whole audiovisual content playing, even after that the output of the video component has been interrupted. Indeed, in a further step (c), in response to determining that the user is paying again attention to the video output module 13, the video component of the audiovisual content may be outputted again with the first quality level. In other words, the video component is restored to its initial quality, i.e. the video component is no more degraded.

It is to be understood that the determination that the user is paying again attention to the video output module 13 is preferably instantaneous: as soon as it is detected that the user is looking at the screen, (s)he is determined as paying again attention (there is no need to wait for the duration of an inattention threshold, contrary to the determination of a user not paying attention to the video output module) and the output of the video component with the first quality level may be resumed immediately.

In that case, if the transmission from the remote server 2 of the video component with the first quality level was also interrupted, the electronic device 1 also triggers the resuming of the transmission, from the remote server 2, of the video component with the first quality level. Here also, the application preferably records the progress of the user watching the video with the second quality level, so as to switch to the first quality level from current progress when receiving again the video component with the first quality level in response to a request to resume to the first quality level: the playing is not interrupted and the users does not even notice that the video component has been switched or even interrupted.

The method of the present invention can go on as long as the audiovisual content is played (i.e. as long as the user does not voluntarily stop its playing) : after having determined that the user is paying again attention to the video output module, if the user is again determined as not paying attention to the video output module 13, step (b) may be performed again (by interrupting the output of the video component with the first quality level), and so on, for the whole duration of the audiovisual content playing.

In another embodiment, when the video component of the audiovisual content is outputted with the second quality level, and when the user is still determined as not paying attention to the video output module 13 for a duration exceeding a second inattention threshold (longer that the first inattention threshold), the method further comprises a step (b2) of interrupting the output of the video component of the

audiovisual content with the second quality level. In other words, there might be a further degradation of the video component. Again, if the video component of the audiovisual content with the second quality level is transmitted from a remote server 2 to the electronic device 1, step (b2) preferably comprises the interruption of this transmission.

In a particularly preferred embodiment, there could be more than two quality levels, and for instance the method could further comprises outputting the video component of the audiovisual content with a third quality level at the video output module 13, then possibly when the user is still determined as not paying attention to the video output module 13 for a duration exceeding a third inattention threshold (longer that the second inattention threshold) interrupting the output of the video component of the audiovisual content with the third quality level, then outputting the video component of the audiovisual content with a fourth quality level at the video output module 13, etc.

For the sake of convenience, a "last" quality level could be defined as the absence of further output of any video component (the so-called "total degradation" mentioned before).

For instance, in the case of 4 quality levels:

- first level ➔ no degradation, video component as initially outputted (for example 1080p);
- second level ➔ video component with slightly reduced quality (for example 480p);
- third level ➔ video component with strongly reduced quality (for example 240p);
- fourth level ➔ total degradation, no video component outputted.

At each time an inattention threshold is reached, the quality is reduced, i.e. changed from the *n-th* level to the *n+1-th* level.

Then, if the user keeps not paying attention to the video output module 13, the quality keeps droping, in particular at a given rate, for example 1 level per more minute (i.e. the *n+1-th* inattention threshold is one minute longer than the *n-th* inattention threshold). Indeed, if despite the degradation of the video component the user is still not looking at the screen, it means that the degradation does not bother him and this confirms that (s)he is not paying attention. The degradation can therefore go further so as to even more reduce the power and/or bandwidth consumption.

In the present example, after 7 minutes of not paying attention, the fourth level is reached so that there is no more outputted video component, while the audio component is continuously outputted.

Whatever the quality level reached, when step (c) is performed (i.e. in response to determining that the user is paying again attention to the video output module 13), the quality level is directly set back to the first level (no degradation at all).

In the aforementioned embodiment wherein the electronic device 1 is a mobile terminal having a screen lock functionality, where the screen has been locked following the determination that the user was not paying attention to the video output module, this can be achieved by the software application (typically the operating system of the mobile terminal) which triggers the unlocking of the screen, thereby leading to outputting again the video component with the first quality level on the video output module 13.

Device, computer product program, and computer-readable medium

The present invention concerns an electronic device 1 comprising at least one processing unit 11, a video output module 13 (in particular a screen) and an audio output module 14 (in particular a speaker or an audio jack for connecting an external speaker or headset), wherein the processing unit 11 is adapted for carrying out the method for operating as previously described.

The video and audio output modules 13, 14 are initially respectively for outputting a video and an audio component of an audiovisual content with a first quality level.

This electronic device 1 may also comprise a memory 12, a camera 15. The electronic device 1 is typically a smartphone. In various embodiments, instead or in addition to the camera 15, the electronic device can also comprise a proximity sensor, an accelerometer, an infrared detector and/or a motion sensor (not illustrated), the output of which can be used by the processing unit 11 to determine if a user pays attention to the smartphone.

The aforementioned processing unit 11 is in particular configured to:

- determine (a) whether a user of the electronic device 1 is paying attention to the video output module 13 (in particular by analyzing images acquired by the camera 15 so as to detect a face or an eye of the user and/or the output of any combination of a proximity sensor, an accelerometer, infrared detector and/or motion sensor);

- in response to determining that the user is not paying attention to the video output module 13, interrupt (b) the output of the video component of the audiovisual content with the first quality level (preferably by outputting the video component with a second quality level or by not outputting the video component);
- and possibly, in response to determining that the user is paying again attention to the video output module 13, re-outputting the video component of the audiovisual content with the first quality level (i.e. reverting to the video component as initially outputted at the video output module 13).

As already explained, the present method is preferably implemented by an application such as an audio/video player.

Advantageously, the video output module 13 is a screen, and the electronic device 1 comprises further, next to the screen, a front camera 15 for acquiring images to be used by the processing unit 13 to determine whether the user is paying attention to the video output module 13.

The invention further proposes a computer program product, comprising code instructions for executing (in particular with a processing unit 11 of the device 1) the previously described method, as well as a computer-readable medium (in particular a memory 12 of the device 1), on which is stored a computer program product comprising code instructions for executing said method. In particular, this computer program product may correspond to the operating system, and especially the media controller.

CLAIMS

1. A method for operating an electronic device (1) comprising a processing unit (11), a video output module (13) and an audio output module (14), the method being characterized in that it comprises:

playing (a0) an audiovisual content on the electronic device (1), by outputting a video component of the audiovisual content with a first quality level at the video output module (13) and outputting an audio component of the audiovisual content at the audio output module (14);

determining (a), by the processing unit (11), whether a user of the electronic device (1) is paying attention to the video output module (13); and

in response to determining that the user is not paying attention to the video output module (13), interrupting (b) the output of the video component of the audiovisual content with the first quality level.

2. A method according to claim 1, wherein the electronic device (1) comprises a camera (15), further comprising acquiring (a1) at least one image using the camera (15), the determining step (a) being performed based on said at least one acquired image.

3. A method according to claim 2, wherein step (a) further comprises analyzing (a2) said at least one acquired image so as to detect a face of the user in said at least one acquired image, the determining step (a) being performed based on the result of the detection of a face of the user.

4. A method according to claim 2 or 3, wherein step (a) further comprises analyzing (a2) said at least one acquired image so as to detect an eye of the user in said at least one acquired image, the determining step (a) being performed based on the result of the detection of an eye of the user.

5. A method according to claim 4, wherein the determining step (a) is performed based on the result of the detection of an open eye of the user in said at least one acquired image, the user being determined as paying attention to the video output module (13) if an open eye is detected in said at least one acquired image.

6. A method according to any one of claims 1 to 5, wherein the video component of the audiovisual content with the first quality level and the audio component of the audiovisual content are transmitted from a remote server (2) to the electronic device (1), and wherein interrupting (b) the output of the video component of the audiovisual content with the first quality level comprising interrupting the transmission of the video component of the audiovisual content with the first quality level.

7. A method according to any one of claims 1 to 6, further comprising outputting (b1) the video component of the audiovisual content with a second quality level at the video output module (13), said second quality level being lower than the first quality level.

8. A method according to claims 6 and 7 in combination, wherein outputting (b1) the video component of the audiovisual content with a second quality level at the video output module (13) comprises triggering the transmission, from the remote server (2), of the video component of the audiovisual content with the second quality level.

9. A method according to any one of claims 7 and 8, wherein the video component of the audiovisual content with the second quality level has a lower resolution and/or a reduced number of frames by seconds than the video component of the audiovisual content with the first quality level.

10. A method according to any one of claims 7 to 9, wherein the method further comprises, in response to determining that the user has not been paying attention to the video output module (13) for a duration exceeding an inattention threshold, interrupting (b2) the output of the video component of the audiovisual content with the second quality level.

11. A method according to any one of claims 1 to 6, wherein the audiovisual content is further played without outputting any video component after interrupting (b) the output of the video component of the audiovisual content with the first quality level.

12. An electronic device (1) comprising:

a processing unit (11),

a video output module (13) for outputting a video component of an audiovisual content with a first quality level; and

an audio output module (14) for outputting an audio component of the audiovisual content;

wherein said processing unit (11) is configured to determine (a) whether a user of the electronic device (1) is paying attention to the video output module (13), and, in response to determining that the user is not paying attention to the video output module (13), interrupt (b) the output of the video component of the audiovisual content with the first quality level.

13. The electronic device according to claim 12, wherein the video output module (13) is a screen, and the electronic device (1) comprises further, next to the screen, a front camera (15) for acquiring images to be used by the processing unit (11) to determine whether the user is paying attention to the video output module (13).

14. The electronic device according to any one of claims 12 or 13, comprising further at least one of a proximity sensor, an accelerometer, an infrared detector and a motion sensor, the output of which is used by the processing unit (11) to determine whether the user is paying attention to the video output module (13).

15. A computer program product, comprising code instructions for executing a method according to any one of claims 1 to 11 for operating a device (1) comprising at least one processing unit (11), a video output module (13) and an audio output module (14).

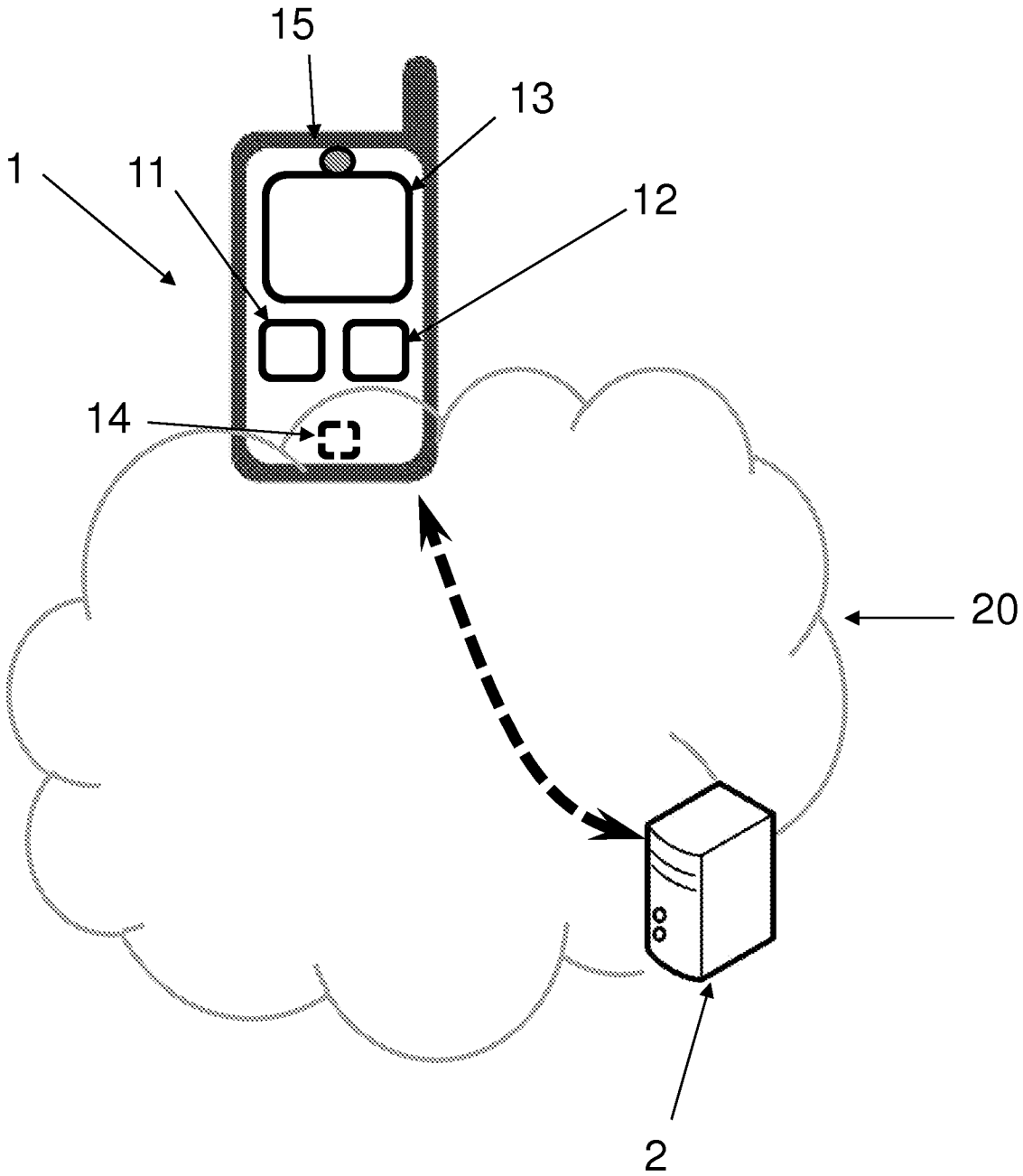


FIG. 1

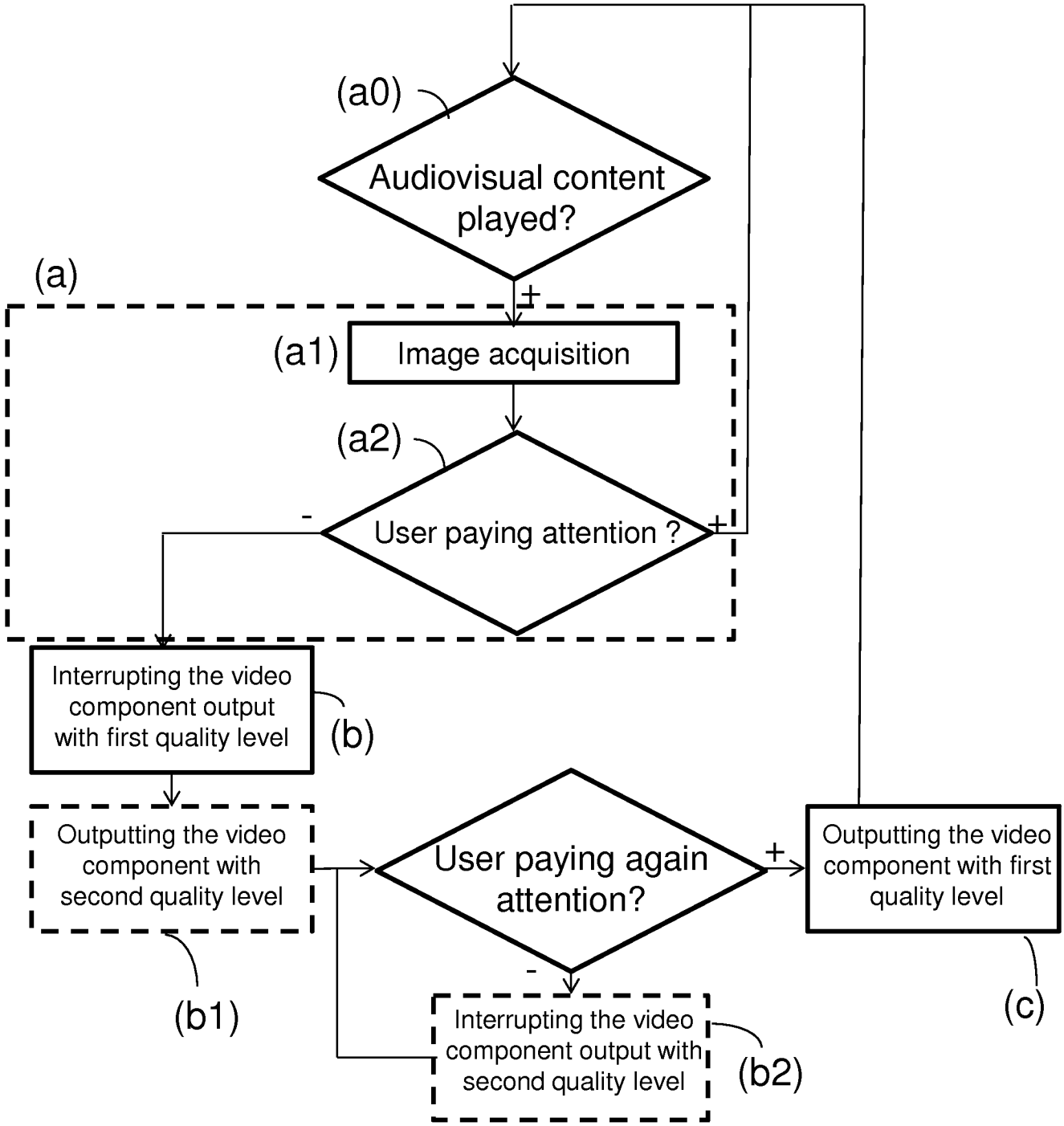

(a0)
Audiovisual content played?
(a)
+
(a1)
Image acquisition
(a2)
User paying attention ?
-
+
Interrupting the video component output with first quality level
(b)
Outputting the video component with second quality level
(b1)
User paying again attention?
+
Outputting the video component with first quality level
(c)
-
Interrupting the video component output with second quality level
(b2)

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2019/001369

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N21/442 H04N21/462 H04N21/6379
ADD.

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)
H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2015/341411 A1 (HUBER MICHAEL [SE] ET AL) 26 November 2015 (2015-11-26) paragraphs [0012] - [0031], [0040] - [0071]	1-15
X	US 2003/052911 A1 (COHEN-SOLAL ERIC [US]) 20 March 2003 (2003-03-20) paragraphs [0008] - [0010], [0016] - [0033]	1-15
X	EP 1 843 592 A1 (BRITISH TELECOMM [GB]) 10 October 2007 (2007-10-10) paragraphs [0004] - [0007], [0010] - [0037]	1-3, 6-13,15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 March 2020	24/03/2020

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Sanahuja, Francesc

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2019/001369

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2015341411 A1	26-11-2015	CN 105359479 A	24-02-2016
		EP 2944063 A1	18-11-2015
		US 2015341411 A1	26-11-2015
		WO 2014108194 A1	17-07-2014
US 2003052911 A1	20-03-2003	CN 1557083 A	22-12-2004
		EP 1430692 A1	23-06-2004
		JP 4768888 B2	07-09-2011
		JP 2005503726 A	03-02-2005
		JP 2011172250 A	01-09-2011
		KR 20040041168 A	14-05-2004
		US 2003052911 A1	20-03-2003
		WO 03026250 A1	27-03-2003
EP 1843592 A1	10-10-2007	NONE	