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(54) **VIDEO-PREVIEWING METHODS AND SYSTEMS FOR PROVIDING PREVIEW OF A VIDEO AND MACHINE-READABLE STORAGE MEDIUMS THEREOF**

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(51) **Int. Cl.**

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H04N 5/91	(2006.01)
G06F 17/30	(2006.01)
G11B 27/00	(2006.01)
H04N 5/00	(2011.01)

(52) **U.S. Cl.**

CPC ***H04N 5/91*** (2013.01); ***G06F 17/30*** (2013.01); ***G06F 17/30852*** (2013.01); ***G11B 27/00*** (2013.01); ***H04N 5/00*** (2013.01)

(58) **Field of Classification Search**

CPC H04N 5/91; H04N 5/00; G06F 17/30; G06F 17/30852; G06F 17/00; G06F 17/3085

USPC 386/241

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2001/0015762	A1*	8/2001	Suzuki et al.	348/333.05
2005/0200762	A1*	9/2005	Barletta et al.	348/700
2007/0223068	A1*	9/2007	Ishii et al.	358/527
2009/0034806	A1*	2/2009	Hayase	G06F 3/0482 382/118
2010/0174993	A1*	7/2010	Pennington et al.	715/738
2013/0039535	A1*	2/2013	Ho et al.	382/103
2013/0159822	A1*	6/2013	Grossman et al.	715/201
2013/0239063	A1*	9/2013	Ubillos et al.	715/838

FOREIGN PATENT DOCUMENTS

CN	102316370 A	1/2012
TW	M399566 U1	3/2011

OTHER PUBLICATIONS

Taiwan Patent Office, Office Action, Patent Application Serial No. 101127130, Sep. 15, 2014, Taiwan.

Mobile-web-viewpoint , Apr. 5, 2011, 5 pages, Taiwan.

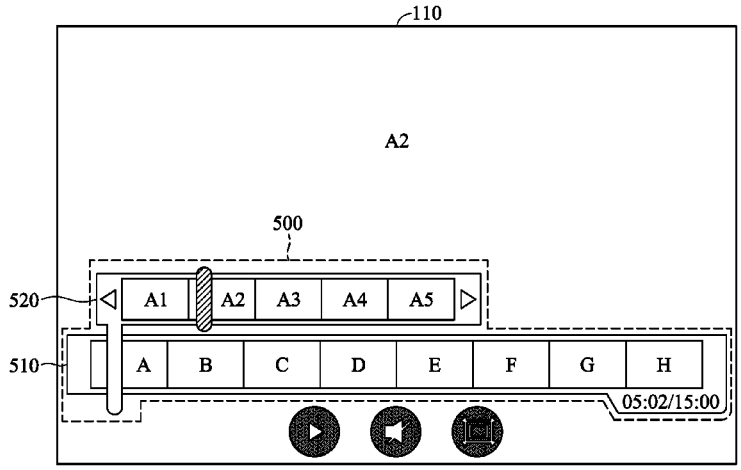
* cited by examiner

Primary Examiner — William Tran

(57) **ABSTRACT**

Video previewing methods for electronic devices with a touch-sensitive display unit for providing preview of a video to be played are provided. First, a resolution of the touch-sensitive display unit of the electronic device is detected. Thereafter, a preview screen is generated on the touch-sensitive display unit according to the resolution of the touch-sensitive display unit, wherein the preview screen includes M level frame bars and each of the M level frame bars displays N video frames, and N for each of the M level frame bars is determined based on the resolution of the touch-sensitive display unit, where M≥1 and N≥1.

10 Claims, 9 Drawing Sheets



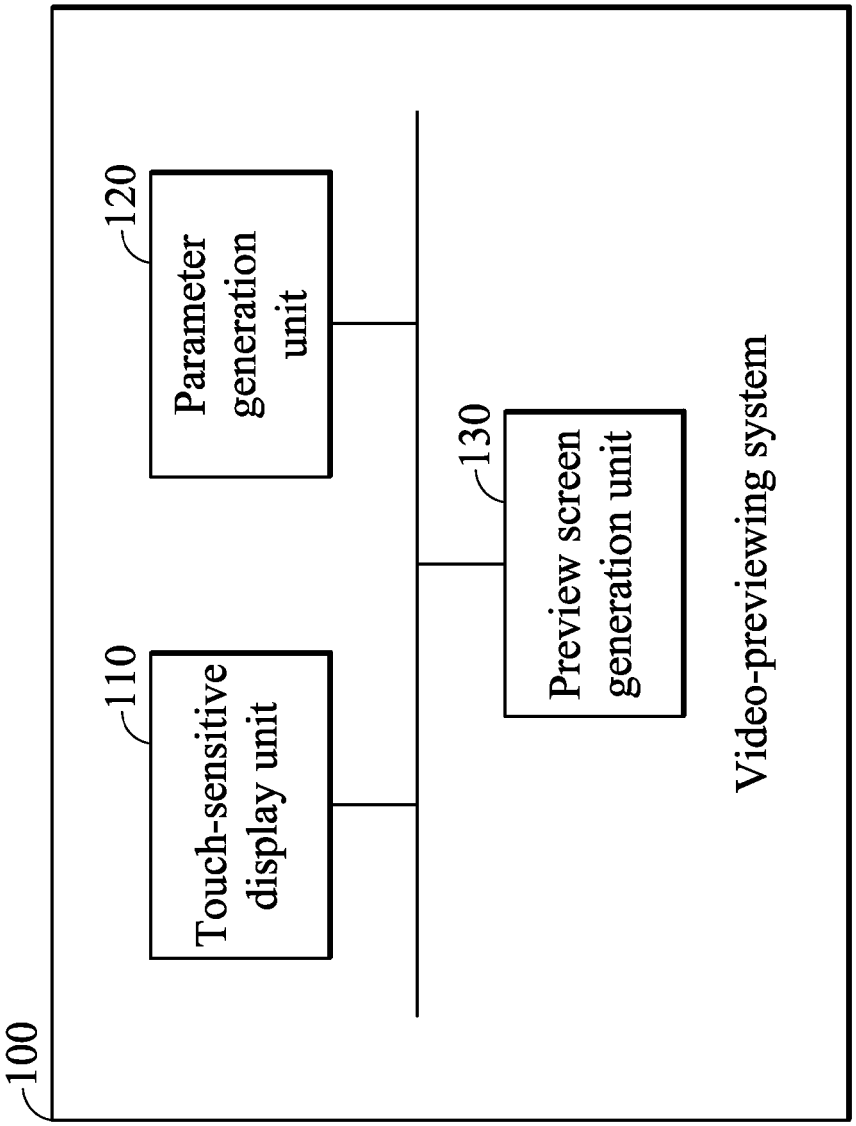

100
110
Touch-sensitive display unit
120
Parameter generation unit
130
Preview screen generation unit
Video-previewing system

FIG. 1

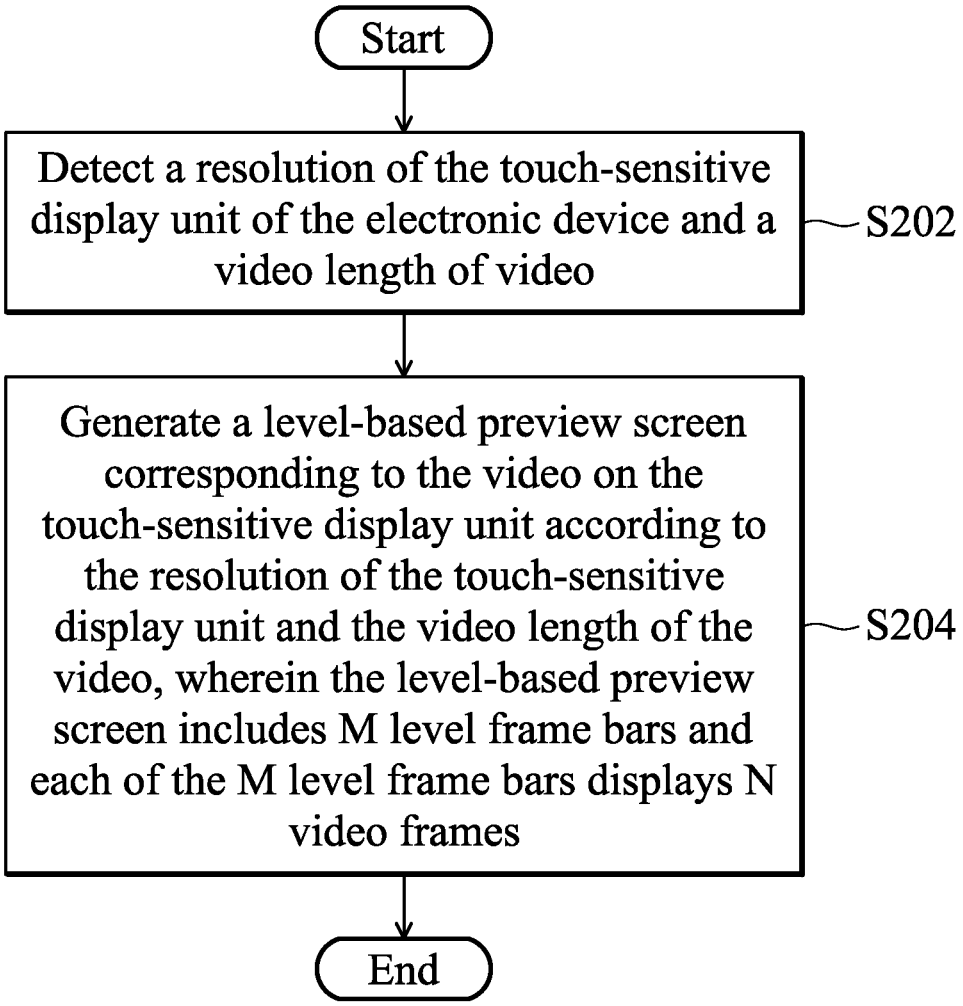

Start
Detect a resolution of the touch-sensitive display unit of the electronic device and a video length of video
S202
Generate a level-based preview screen corresponding to the video on the touch-sensitive display unit according to the resolution of the touch-sensitive display unit and the video length of the video, wherein the level-based preview screen includes M level frame bars and each of the M level frame bars displays N video frames
S204
End

FIG. 2

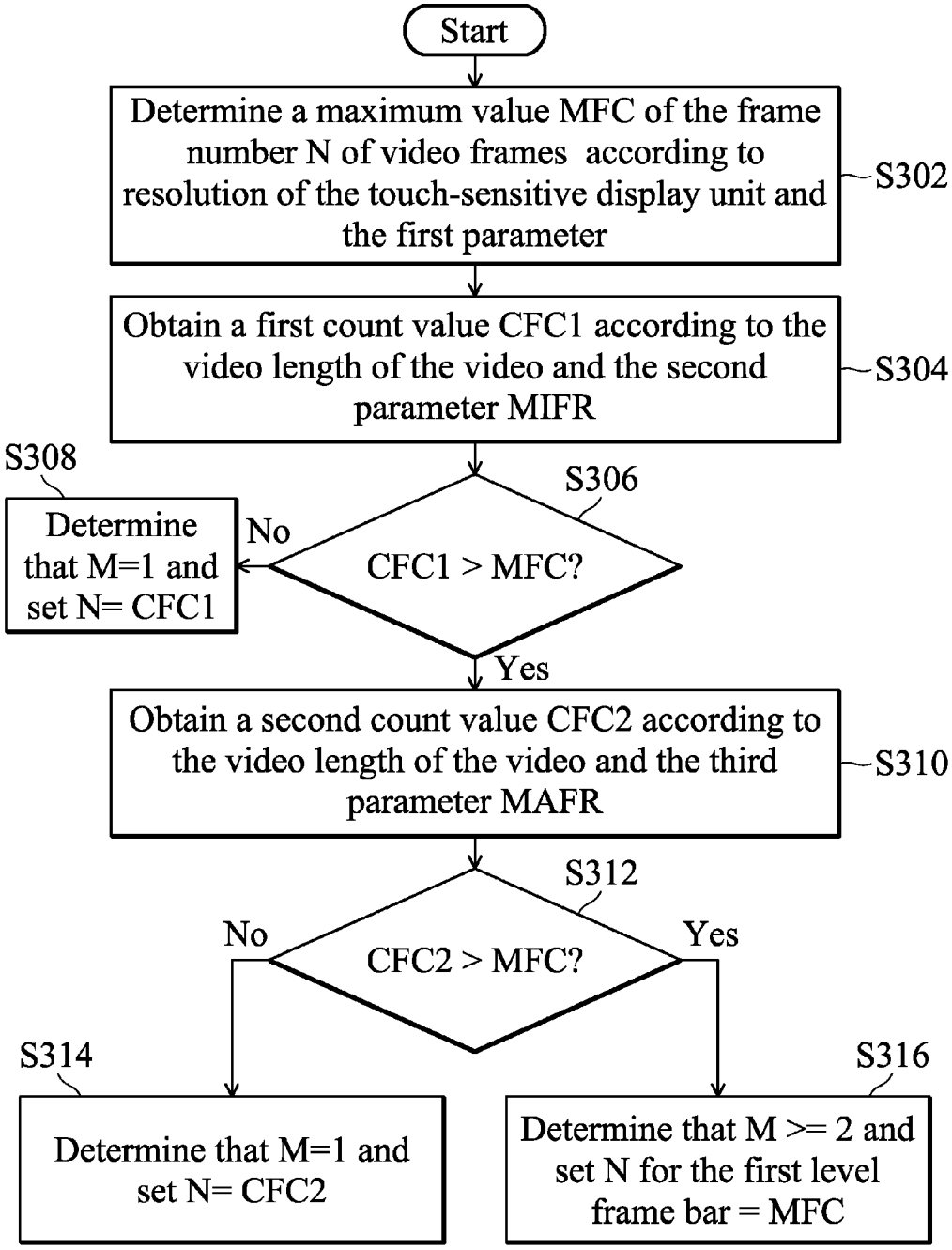

Start
Determine a maximum value MFC of the frame number N of video frames according to resolution of the touch-sensitive display unit and the first parameter
S302
Obtain a first count value CFC1 according to the video length of the video and the second parameter MIFR
S304
S306
CFC1 > MFC?
No
S308
Determine that M=1 and set N= CFC1
Yes
Obtain a second count value CFC2 according to the video length of the video and the third parameter MAFR
S310
S312
CFC2 > MFC?
No
Yes
S314
Determine that M=1 and set N= CFC2
S316
Determine that M >= 2 and set N for the first level frame bar = MFC

FIG. 3

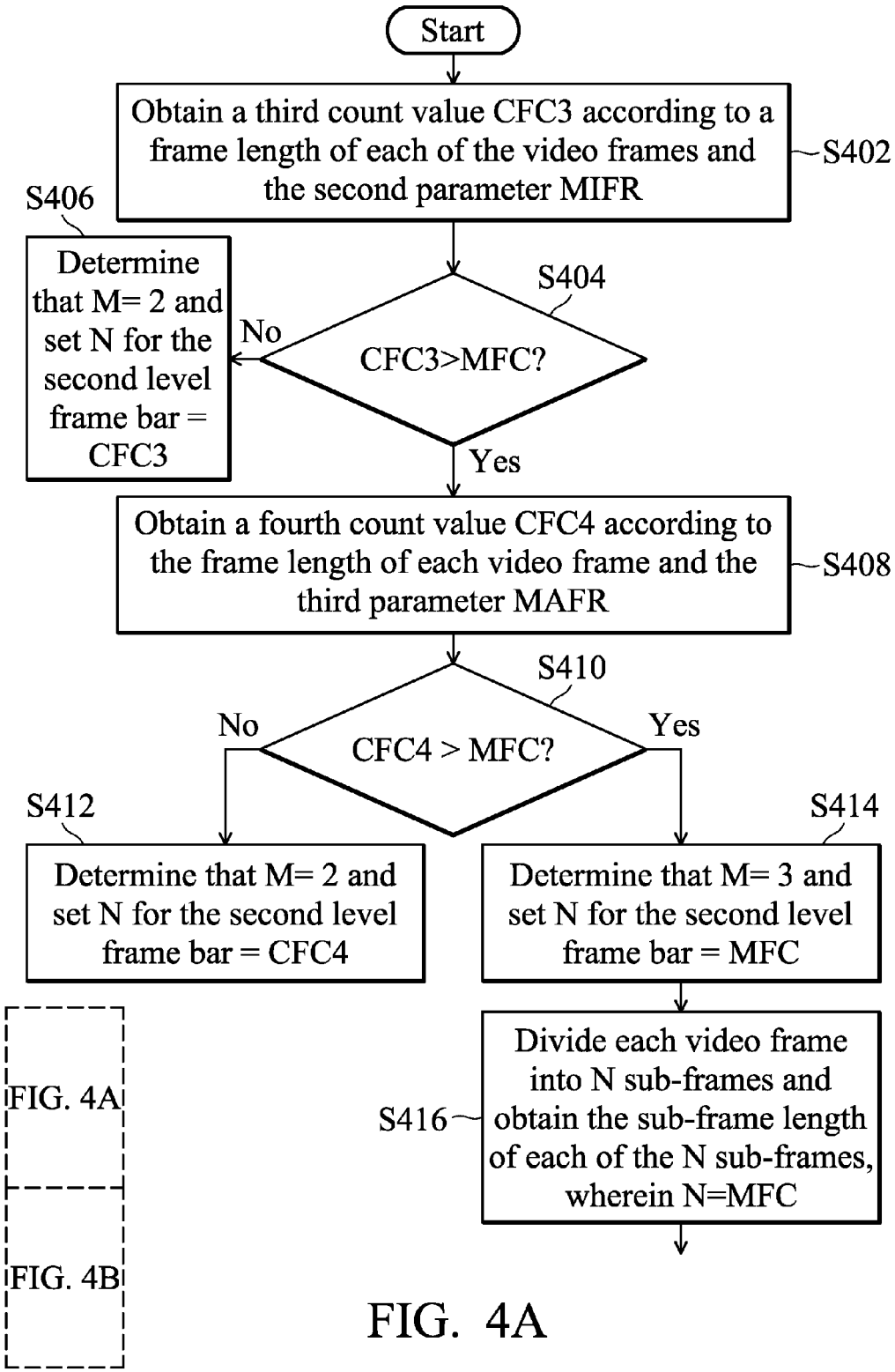

Start
Obtain a third count value CFC3 according to a frame length of each of the video frames and the second parameter MIFR
S402
S404
CFC3>MFC?
No
Yes
S406
Determine that M= 2 and set N for the second level frame bar = CFC3
Obtain a fourth count value CFC4 according to the frame length of each video frame and the third parameter MAFR
S408
S410
CFC4 > MFC?
No
Yes
S412
Determine that M= 2 and set N for the second level frame bar = CFC4
S414
Determine that M= 3 and set N for the second level frame bar = MFC
S416
Divide each video frame into N sub-frames and obtain the sub-frame length of each of the N sub-frames, wherein N=MFC
FIG. 4A
FIG. 4B

FIG. 4A

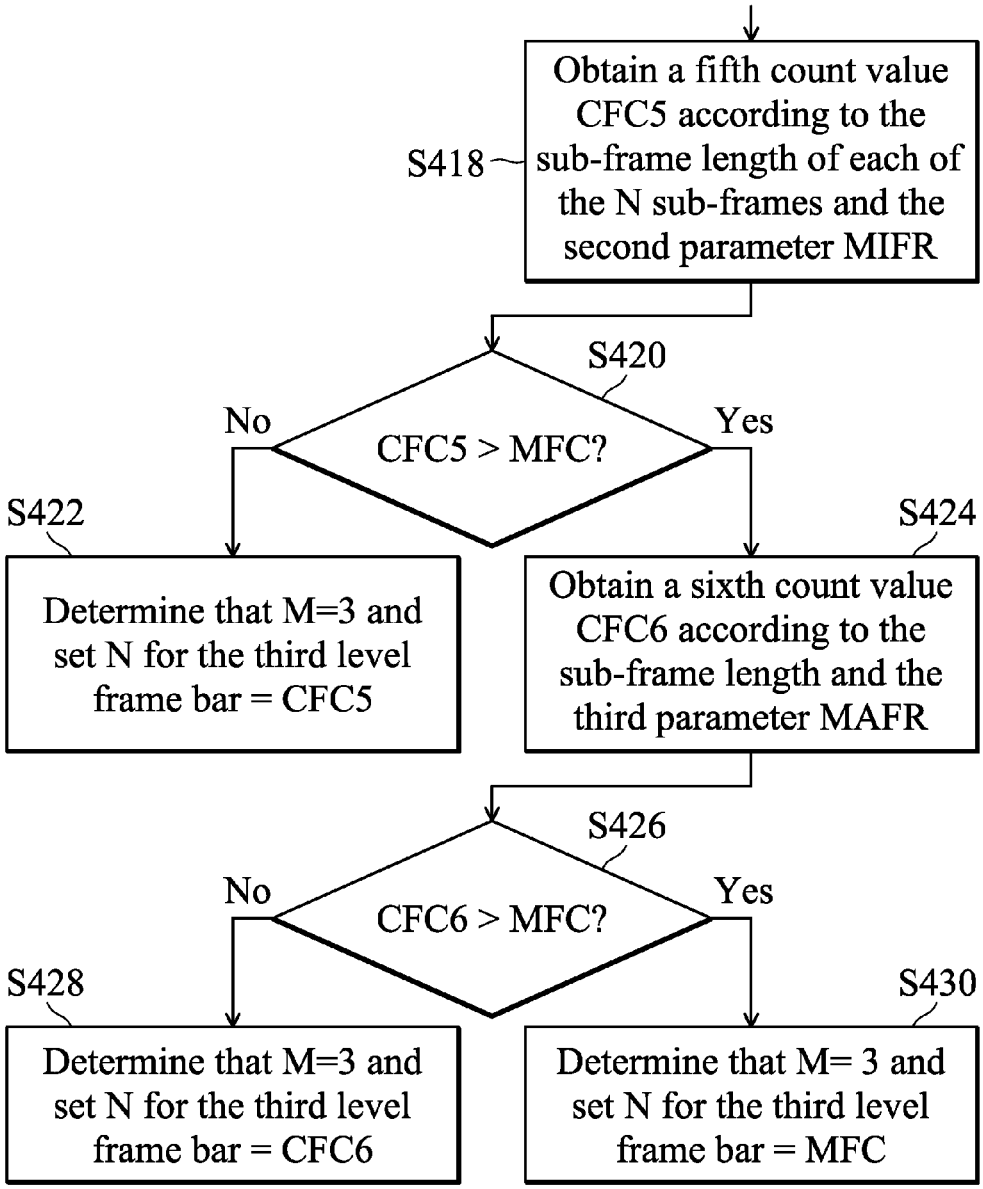

Obtain a fifth count value CFC5 according to the sub-frame length of each of the N sub-frames and the second parameter MIFR
S418
S420
CFC5 > MFC?
No
Yes
S422
Determine that M=3 and set N for the third level frame bar = CFC5
S424
Obtain a sixth count value CFC6 according to the sub-frame length and the third parameter MAFR
S426
CFC6 > MFC?
No
Yes
S428
Determine that M=3 and set N for the third level frame bar = CFC6
S430
Determine that M= 3 and set N for the third level frame bar = MFC

FIG. 4B

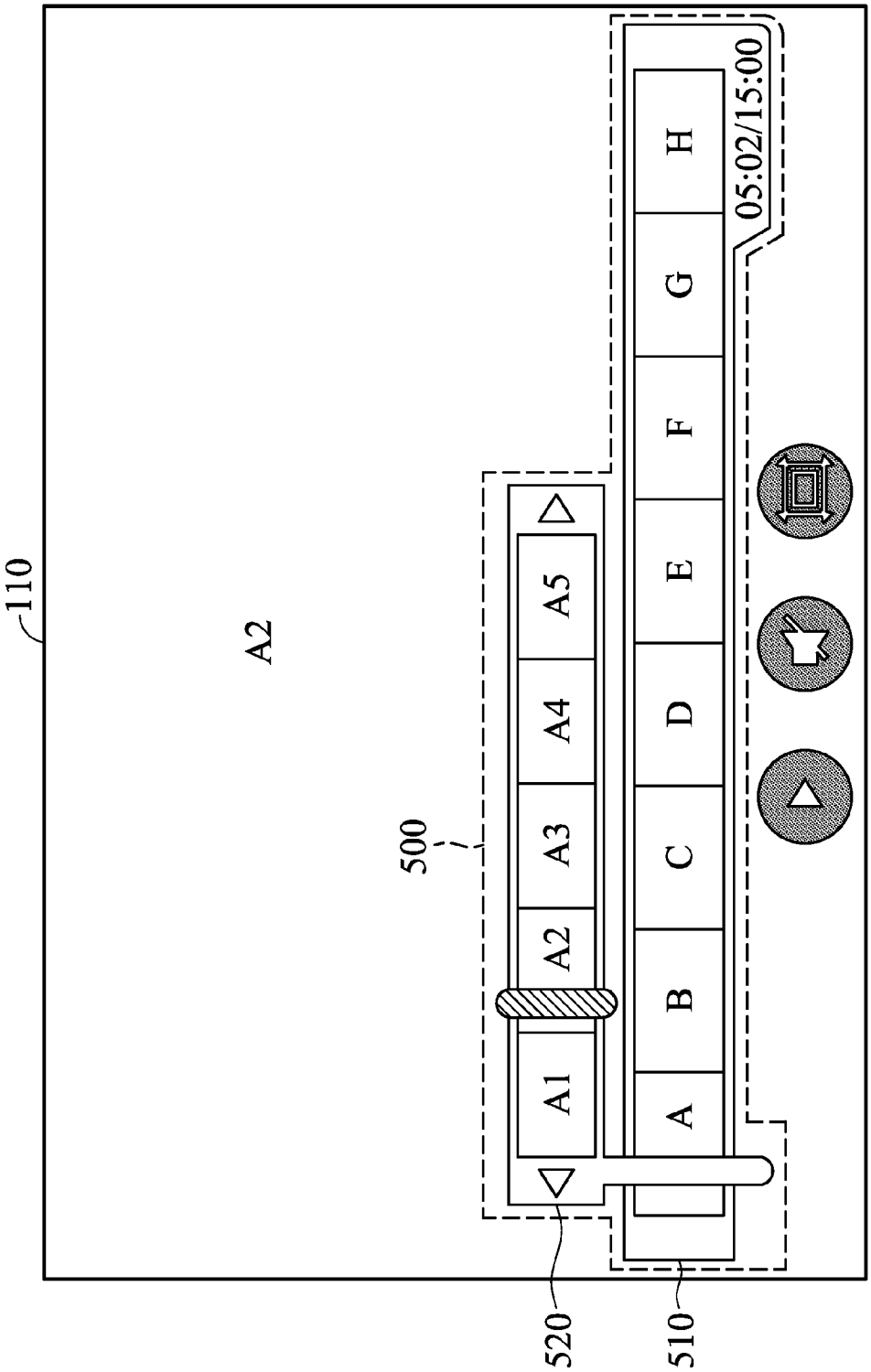


FIG. 5

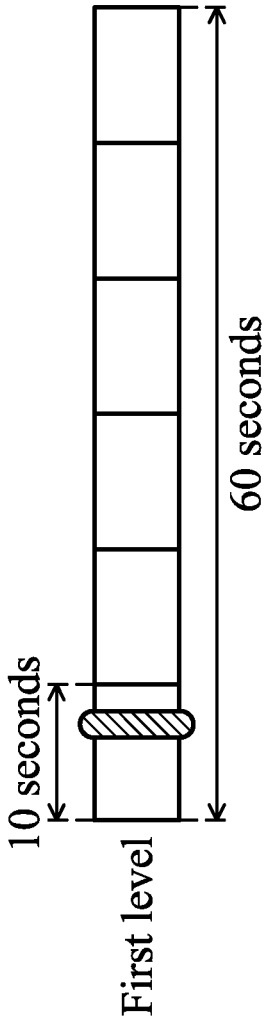


FIG. 6A

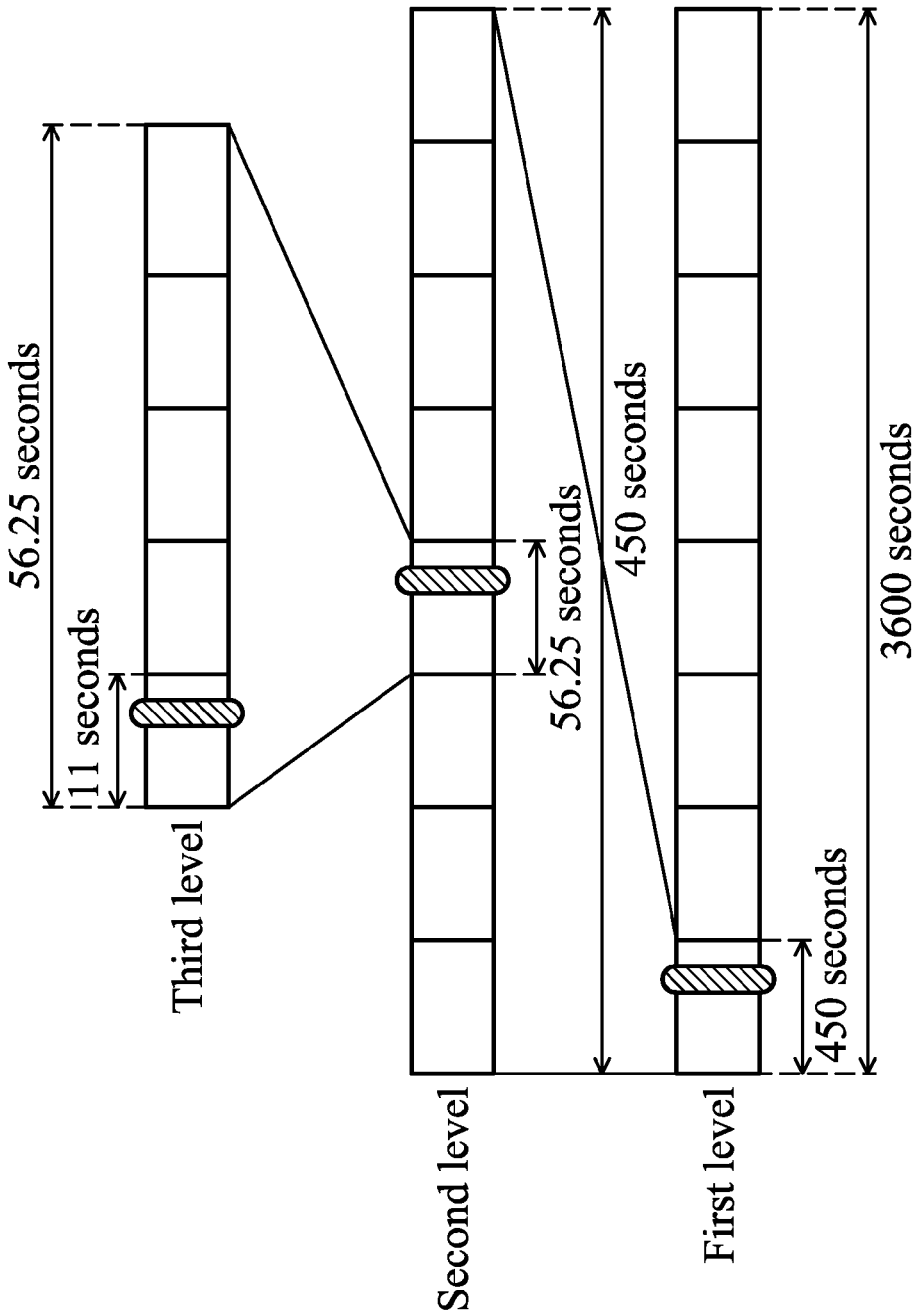

56.25 seconds
11 seconds
Third level
Second level
56.25 seconds
450 seconds
First level
450 seconds
3600 seconds

FIG. 6B

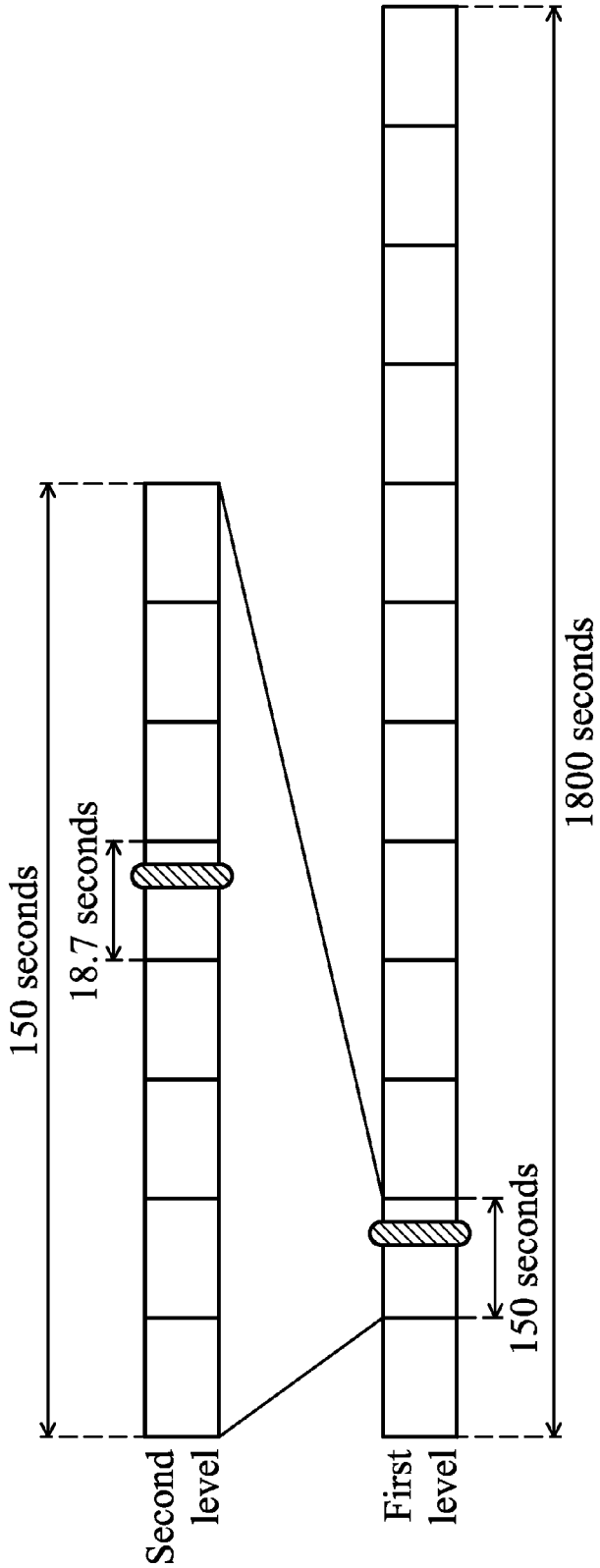

150 seconds
18.7 seconds
Second level
First level
150 seconds
1800 seconds

FIG. 6C

VIDEO-PREVIEWING METHODS AND SYSTEMS FOR PROVIDING PREVIEW OF A VIDEO AND MACHINE-READABLE STORAGE MEDIUMS THEREOF

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority of Taiwan Application No. 101127130, filed on Jul. 27, 2012, and the entirety of which is incorporated by reference herein.

BACKGROUND

1. Field of the Disclosure

The disclosure generally relates to video-previewing systems and video-previewing methods thereof, and more particularly, to frame-based video-previewing systems and video-previewing methods using the same.

2. Description of the Related Art

Recently, because of the rapidly grow of touchable equipments, electronic devices, such as smart phones, PDAs, tablet PCs or Ultra Mobile PCs (UMPCs), are equipped with a touch screen which is directly touchable may be provided as a main input device for users to play or preview the video. Users of the handheld devices can slide their fingers to drag a progress bar to find a starting position in the video where they want to start the video browsing. For seeking or jumping to a special video frame of the video, however, no quick method can be provided yet such that users may spend a lot of time to seek for the video frame that they want to review, thus lacking of capability of quickly viewing for the digital video data.

In addition, for current video player, the video at the specific time point has to be clicked by fingers so as to browse the video. Movements of the fingers, however, are often inconsistent with the proportion of the progress bar that it moves, making the desired time point of the video can not be clicked exactly.

BRIEF SUMMARY

Accordingly, embodiments of the disclosure provide video previewing methods and systems for providing quickly previewing of a video during it is playing.

In one aspect of the disclosure, a video-previewing method for providing preview of a video to be played for an electronic device with a touch-sensitive display is provided. The method includes the following steps. First, a resolution of the touch-sensitive display unit of the electronic device is detected. A preview screen corresponding to the video is then generated on the touch-sensitive display unit according to the resolution of the touch-sensitive display unit, wherein the preview screen includes M level frame bars and each of the M level frame bars displays N video frames, wherein the value of the frame number N representing the number of video frames for each of the M level frame bars is determined based on the resolution of the touch-sensitive display unit, where $M \geq 1$ and $N \geq 1$.

In another aspect of the invention, a video-previewing system for providing preview of a video to be played is provided which includes a touch-sensitive display unit, a parameter generation unit and a preview screen generation unit. The touch-sensitive display unit has a resolution. The parameter generation unit is arranged for detecting the resolution of the touch-sensitive display unit. The preview screen generation unit which is coupled to the parameter generation unit and the touch-sensitive display unit is arranged for generating a preview screen corresponding to the video on the touch-sensitive display unit according to the resolution of the touch-sensitive display unit detected by the parameter generation unit, wherein the preview screen includes M level frame bars and each of the M level frame bars displays N video frames, wherein the value of the frame number N representing the number of video frames for each of the M level frame bars is determined based on the resolution of the touch-sensitive display unit, where $M \geq 1$ and $N \geq 1$.

Video-previewing methods may take the form of a program code embodied in a tangible media. When the program code is loaded into and executed by a machine, the machine becomes an apparatus for practicing the disclosed method.

BRIEF DESCRIPTION OF DRAWINGS

The disclosure can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

FIG. **1** is a schematic diagram illustrating an embodiment of a video-previewing system of the disclosure;

FIG. **2** is a flowchart of an embodiment of a video-previewing method of the disclosure;

FIG. **3** is a flowchart of another embodiment of a video-previewing method of the disclosure;

FIGS. **4**A and **4**B show a flowchart of another embodiment of a video-previewing method of the disclosure;

FIG. **5** is a schematic diagram illustrating an embodiment of an example of a level-based preview screen of the disclosure; and

FIGS. **6**A to **6**C are schematic diagrams illustrating other embodiments of examples of a level-based preview screen of the disclosure.

DETAILED DESCRIPTION

The following description is of the best-contemplated mode of carrying out the disclosure. This description is made for the purpose of illustrating the general principles of the disclosure and should not be taken in a limiting sense. The scope of the disclosure is best determined by reference to the appended claims.

Current video players can be divided into two kinds of representations, one kind for frame-based players while the other kind for non-frame-based players. The non-frame-based player provides a simple time axis for users to make the video scene selection. Although the user interface for the non-frame-based player is simple and the playing speed for which is quicker than that of the frame-based player, users may be unable to observe changes in each time scene easier such that users may be unable to quickly seek for a desired video frame for playing. The frame-based player intercepts the video frames at specific time points in the video to present a scene view for each section to the users such that the users can have a rough overview of the video. Therefore, embodiments of the invention provide frame-based video previewing and playing devices which can present a level-based preview screen with multiple levels corresponding to the video during the video is playing, wherein the number of levels and the number of video frames displayed on the level-based preview screen can dynamically varied according to the resolution of the playing device and the video length of the video, thus providing effective video data indexes with multiple levels and achieving a goal for previewing and searching for the video data quickly.

FIG. **1** is a schematic diagram illustrating an embodiment of a video-previewing system for providing preview of a

video to be played of the disclosure. The video-previewing system **100** can be used in an electronic device, such as a PDA (Personal Digital Assistant), a smart phone, a mobile phone, an MID (Mobile Internet Device, MID), a laptop computer, a car computer, a digital camera, a multi-media player, a game device, or any other type of mobile computational device, however, it is to be understood that the invention is not limited thereto. The video-previewing system **100** includes a touch-sensitive display unit **110**, a parameter generation unit **120**, and a preview screen generation unit **130**. It is understood that, in some embodiments, the touch-sensitive display unit **110** may be integrated with a touch-sensitive device (not shown). The touch-sensitive device has a touch-sensitive surface comprising sensors in at least one dimension to detect contact and movement of at least one object (input tool), such as a pen/stylus or finger near or on the touch-sensitive surface. The touch-sensitive display unit **110** can also display data, such as texts, figures, interfaces, and/or information. The touch-sensitive display unit **110** can have a resolution for indicating a display range for the touch-sensitive display unit **110**. For example, the touch-sensitive display unit **110** may have a resolution of 800*600, which indicates that the pixel amount of the screen width of its screen is 800 and the pixels amount of the screen height of its screen is 600.

The parameter generation unit **120** can detect and collect parameters related to the video-previewing system **100** and videos, such as the resolution of the touch-sensitive display unit **110** and the video length of the video, and then generate required parameters according to those related parameters. For example, the parameters may comprise a parameter representing an expected frame size, a parameter minimum frame range (MIFR), a parameter maximum frame range (MAFR), a parameter maximum frame count (MFC) and a count value CFC and so on, wherein the parameter MIFR represents an expected value for a minimum expected gap between each two of the video frames, the parameter MAFR represents an expected value for a maximum expected gap between each two of the video frames, the parameter MFC represents the maximum frame amount which is calculated for each frame bar in each level on the screen of the touch-sensitive display unit **110**, and the count value CFC represents/determines the number of frame levels and the size of frame segments. For example, if MIFR is 10 and MAFR is 20, the minimum expected gap between each two of the divided video frames is set to be at least 10 seconds while the maximum expected gap between each two of the divided video frames is set to be less than 20 seconds. In other words, the frame gap between each two of the video frames is to be set between 10 and 20 seconds. Note that, the width of the resolution of the touch-sensitive display unit **110** is divided by a first parameter representing the expected frame size to obtain the parameter MFC. In one embodiment, it is assumed that a target frame size of each touchable frame is at least 100 pixels and it is with a format of 16:9. For example, if the width of the resolution of the touch-sensitive display unit **110** is 800 and the first parameter is set to 100 (pixels), the parameter MFC=800/100=8, which means that the frame bar displayed by each level on the screen of the touch-sensitive display unit **110** at most have 8 frames. Additionally, the count value CFC (Current Frame Count) can be defined as shown in formula (1) below:

$$CFC=Length/MIFR \| CFC=Length/MAFR \quad (1)$$

wherein Length represents the video length in unit of second.

The preview screen generation unit **130** which is coupled to the parameter generation unit **120** and the touch-sensitive display unit **110** can dynamically adjust the number of video frames displayed in the frame bar of each level according to the video length of the video to be played. If the video length is too long, the preview screen may have/generate a second level frame bar and a third level frame bar to show the video frames in each level frame bar. The preview screen generation unit **130** may further divide the video into the N video frames based on the parameter MIFR. If the number of divided video frames has exceeded the maximum frame amount of the video MFC, the preview screen generation unit **130** may then divide the video into the video frames based on the parameter MAFR. Similarly, if the number of divided video frames which are divided by the parameter MAFR has exceeded the maximum frame amount of the video MFC, the preview screen generation unit **130** may further determine whether the level three has reached and if not, increase the level by one and distribute the video frames in the lower level with the maximum frame count MFC. Thereafter, one of the distributed video frames of the lower level will be utilized to extend a next level and the aforementioned determinations of whether the number of divided video frames has exceeded the maximum frame amount of the video MFC based on the parameters MIFR and MAFR will also be performed on this level to see if a next level should be further generated. The level-based video-previewing method of the present invention will be discussed further in the following paragraphs.

FIG. **2** is a flowchart of an embodiment of a video-previewing method of the disclosure. The video-previewing method can be used in an electronic device, such as a Television, a laptop computer, or portable devices, such as a PDA, a smart phone, a mobile phone, an MID, a mini-laptop computer, a tablet computer or any other type of handheld device, however, it is to be understood that the invention is not limited thereto. It is understood that, in this embodiment, the electronic device may include a touch-sensitive display unit **110**, wherein the touch-sensitive display unit **110** can display a level-based preview screen for a video to be played during which it is playing.

In step S**202**, the parameter generation unit **120** first detects the resolution of the touch-sensitive display unit **110** of the electronic device and the video length of the video. In step S**204**, the preview screen generation unit **130** generates a preview screen corresponding to the video on the touch-sensitive display unit **110** according to the resolution of the touch-sensitive display unit **110** and the video length of the video detected by the parameter generation unit **120**, wherein the preview screen is a level-based preview screen which includes M level frame bars and each of the M level frame bars displays N video frames, where M≥1 and N≥1, wherein the value of the frame number N is determined based on the resolution of the touch-sensitive display unit while the value of the level number M is determined based on the video length of the video. In other words, the level number M represents the number of levels of the preview screen, which at least be one, wherein the value of the level number M is varied according to the video length of the video, e.g. the value of the level number M of the preview screen for a video with a video length of 160 seconds is different than that for a video with a video length of 1800 seconds. The frame number N represents the number of video frames displayed on each level, wherein the frame number N of video frames may be set different in each level according to the resolution of the touch-sensitive display unit **110**, e.g. the frame number N of the video frames set in each level of the preview screen for a touch-sensitive display unit with a resolution of 800*600 is different than that for a touch-sensitive display unit with a resolution of 1280*768. For example, M=2 means that the

preview screen has two level frame bars and the frame number N displayed on each level can be set separately. For example, please referring to FIG. **5**, FIG. **5** is a schematic diagram illustrating an embodiment of an example of a level-based preview screen of the disclosure. As shown in FIG. **5**, the level-based preview screen **500** includes two level frame bars **510** and **520** in which the first level frame bar **510** displays eight video frames A to H while the second level frame bar **520** displays five video frames A**1** to A**5**, which are sub-frames divided from the video frame A. Similarly, when users select the video frame with the content B, the second level frame bar **520** may display five video frames B**1** to B**5**, which are sub-frames divided from the video frame B. Thus, users can perform a search operation and set the location of the initial video frame to be previewed quickly through the level-based preview screen generated by the preview screen generation unit **130**.

FIG. **3** is a flowchart of another embodiment of a video-previewing method of the disclosure for illustrating how to determine the level number M representing the number of levels and the frame number N representing the number of frames for each of the level number M levels based on the resolution of the touch-sensitive display unit **110** and the video length of the video. The video-previewing method can be used in an electronic device, such as a Television, a laptop computer, or portable devices, such as a PDA, a smart phone, a mobile phone, an MID, a mini-laptop computer, a tablet computer or any other type of handheld device, however, it is to be understood that the invention is not limited thereto. In this embodiment, first, second and third parameters are first provided, wherein the first parameter represents an expected frame resolution, the second parameter MIFR represents a minimum expected gap between each two of the N video frames and the third parameter MAFR represents a maximum expected gap between each two of the N video frames. In the following embodiments, it is assumed that the expected frame resolution is set to 100 pixels and each frame is with a format of 16:9, the minimum expected gap between each two of the video frames is set to 10 seconds and the maximum expected gap between each two of the video frames is set to 20 seconds, but the invention is not limited thereto. In one embodiment, the video-previewing system **100** may further include a user interface for providing users to input or modify default values of the above-mentioned first, second and third parameters.

In step S**302**, the parameter generation unit **120** determines a maximum value of the frame number N, MFC, i.e. the maximum number of video frames, according to the resolution of the touch-sensitive display unit **110** and the first parameter. In this step, the parameter generation unit **120** can divide the width of the touch-sensitive display unit **110** by the first parameter (i.e. 100 pixels) to obtain the maximum value MFC of the frame number N.

After obtaining the maximum value MFC of the frame number N, the preview screen generation unit **130** further determines the value of the level number M, i.e. the number of levels for the level-based preview screen, according to the video length of the video, the second parameter MIFR and the third parameter MAFR.

In step S**304**, the preview screen generation unit **130** obtains a first count value CFC**1** according to the video length of the video and the second parameter MIFR and then, in step S**306**, determines whether the first count value CFC**1** has exceeded the maximum value MFC of the frame number N. In this step, the video length of the video is first divided by the second parameter MIFR to obtain the first count value CFC**1** and it is further determined whether the first count value CFC**1** has exceeded the maximum value MFC of the frame number N. Note that the first count value CFC**1** is determined as not exceeding the maximum value MFC of the frame number N if the first count value CFC**1** is less than or equal to the maximum value MFC of the frame number N. When the first count value CFC**1** has not exceeded the maximum value MFC of the frame number N (No in step S**306**), meaning that the number of divided video frames which are divided using the parameter MIFR has not exceeded the maximum allowed number of video frames, in step S**308**, the preview screen generation unit **130** determines that the value of the level number M is set to be 1 and sets the value of the frame number N to the first count value CFC**1**. In other words, the level-based preview screen may only have the first level frame bar and the number of video frames displayed on the first level frame bar is the first count value CFC**1**, wherein the size of each video frame is obtained by dividing the video length by the second parameter MIFR.

Contrarily, when the first count value CFC**1** has exceeded the maximum value MFC of the frame number N (Yes in step S**306**), meaning that the number of divided video frames which are divided using the parameter MIFR has exceeded the maximum allowed number of video frames and re-calculation are required, then, in step S**310**, the preview screen generation unit **130** further obtains a second count value CFC**2** according to the video length of the video and the third parameter MAFR and, in step S**312**, determines whether the second count value CFC**2** has exceeded the maximum value of the frame number N. Similarly, in this step, the preview screen generation unit **130** may divide the video length of the video by the parameter MAFR to obtain the second count value CFC**2**.

When the second count value CFC**2** has not exceeded the maximum value MFC of the frame number N (No in step S**312**), meaning that the number of divided video frames which are divided using the parameter MAFR has not exceeded the maximum allowed number of video frames, in step S**314**, the preview screen generation unit **130** determines that the value of the level number M is set to be 1 and sets the value of the frame number N to the second count value CFC**2**. In other words, the level-based preview screen may only have the first level frame bar and the number of video frames displayed on the first level frame bar is the second count value CFC**2**, wherein the size of each video frame is obtained by dividing the video length by the third parameter MAFR.

Contrarily, when the second count value CFC**2** has exceeded the maximum value MFC of the frame number N (Yes in step S**312**), meaning that the number of the divided video frames which are divided using the parameter MAFR has exceeded the maximum allowed number of video frames and at least two levels are required, then, in step S**316**, the preview screen generation unit **130** determines that the value of the level number M is set to be at least 2 and sets the value of the frame number N for the first level frame bar among the M level frame bars to the maximum value MFC of the frame number N. In other words, the level-based preview screen generated by the preview screen generation unit **130** may have at least first and second level frame bars and the number of video frames displayed on the first level frame bar is the maximum value MFC of the frame number N, wherein the size of each video frame is obtained by dividing the video length by the maximum value MFC of the frame number N. It is to be noted that, for displaying the level-based preview screen easily, the preview screen generation unit **130** configures that the maximum value of the frame number N is set to be 3, that is, at most three levels can be displayed on the level-based preview screen regardless the video length of the video.

After it is calculated that the level-based preview screen includes at least two levels, which means that each video frame is required to be divided into sub-frames, the video length of each video frame in the first level is further be utilized to perform subsequent determination. Please refer to FIGS. **4**A and **4**B.

FIGS. **4**A and **4**B show a flowchart of another embodiment of a video-previewing method of the disclosure for illustrating how to determine next level and the value of the number of frames N in the next level for each video frame of the first level of the level-based preview screen based on the resolution of the touch-sensitive display unit **110** and the video length of the video. The video-previewing method can be used in an electronic device, such as a Television, a laptop computer, or portable devices, such as a PDA, a smart phone, a mobile phone, an MID, a mini-laptop computer, a tablet computer or any other type of handheld device, however, it is to be understood that the invention is not limited thereto. In this embodiment, it is assumed that the video is divided into N video frames based on the video length of the video, wherein N is set to be the maximum value MFC of the frame number N.

In step S**402**, the preview screen generation unit **130** obtains a third count value CFC**3** according to a frame length of each of the N frames and the second parameter MIFR and then, in step S**404**, determines whether the third count value CFC**3** has exceeded the maximum value MFC of the frame number N. In this step, the preview screen generation unit **130** divides the frame length of each video frame by the second parameter MIFR to obtain the third count value CFC**3** and determines whether the third count value CFC**3** has exceeded the maximum value MFC of the frame number N. When the third count value CFC**3** has not exceeded the maximum value MFC of the frame number N (No in step S**404**), meaning that the number of the divided sub-frames which are divided using the parameter MIFR has not exceeded the maximum allowed number of video frames, in step S**406**, the preview screen generation unit **130** determines the value of the level number M is set to be 2 and sets the value of the frame number N for the second level frame bar among the M level frame bars to the third count value CFC**3**. In other words, the level-based preview screen generated by the preview screen generation unit **130** may have both the first and second level frame bars and the number of video frames for each frame displayed on the second level frame bar is the third count value CFC**3**, wherein the size of each sub-frame is obtained by dividing the video length by the second parameter MIFR.

Contrarily, when the third count value CFC**3** has exceeded the maximum value MFC of the frame number N (Yes in step S**404**), meaning that the number of the divided sub-frames which are divided using the parameter MIFR has exceeded the maximum allowed number of video frames and re-calculation are required, then, in step S**408**, the preview screen generation unit **130** further obtains a fourth count value CFC**4** according to the video length of the video and the third parameter MAFR and, in step S**410**, determines whether the fourth count value CFC**4** has exceeded the maximum value of the frame number N. Similarly, in this step, the preview screen generation unit **130** may divide the video length of the video by the parameter MAFR to obtain the fourth count value CFC**4**.

When the fourth count value CFC**4** has not exceeded the maximum value MFC of the frame number N (No in step S**410**), meaning that the number of the divided video frames which are divided using the parameter MAFR has not exceeded the maximum allowed number of video frames, in step S**412**, the preview screen generation unit **130** determines the value of the level number M is set to be 2 and sets the value of the frame number N for the second level frame bar among the M level frame bars N to the fourth count value CFC**4**. In other words, the level-based preview screen may have both the first and second level frame bars and the number of video frames displayed on the second level frame bar is the fourth count value CFC**4**, wherein the length of each sub-frame is obtained by dividing the video length by the third parameter MAFR.

Contrarily, when the fourth count value CFC**4** has exceeded the maximum value MFC of the frame number N (Yes in step S**410**), meaning that the number of the divided video frames which are divided using the parameter MAFR has exceeded the maximum allowed number of video frames and a level three is required, then, in step S**414**, the preview screen generation unit **130** determines the value of the level number M is set to be 3 and sets the value of the frame number N for the second level frame bar among the M level frame bars to the maximum value MFC of the frame number N.

In other words, the level-based preview screen generated by the preview screen generation unit **130** may have at least first, second and three level frame bars and the number of video frames displayed on the first and second level frame bars are the maximum value MFC of the frame number N, wherein the length of each video frame is obtained by dividing the video length by the maximum value MFC of the frame number N.

After it is calculated that the level-based preview screen includes the third level, which means that each sub-frame is required to be divided into sub-frames, the sub-frame length of each video sub-frame in the second level is further be utilized to perform subsequent determination.

In step S**416**, the preview screen generation unit **130** divides the video frame into N sub-frames and obtains the sub-frame length of each of the N sub-frames based on the video length of the video, wherein N is set to be the maximum value MFC of the frame number N.

In step S**418**, the preview screen generation unit **130** obtains a fifth count value CFC**5** according to the sub-frame length of each of the N sub-frames and the second parameter MIFR and then, in step S**420**, determines whether the fifth count value CFC**5** has exceeded the maximum value MFC of the frame number N. In this step, the preview screen generation unit **130** divides the sub-frame length of each of the N sub-frames by the second parameter MIFR to obtain the fifth count value CFC**5** and determines whether the fifth count value CFC**5** has exceeded the maximum value MFC of the frame number N. When the fifth count value CFC**5** has not exceeded the maximum value MFC of the frame number N (No in step S**420**), meaning that the number of the divided sub-frames which are divided using the parameter MIFR has not exceeded the maximum allowed number of video frames, in step S**422**, the preview screen generation unit **130** determines the value of the level number M is set to be 3 and sets the value of the frame number N for the third level frame bar among the M level frame bars to the fifth count value CFC**5**. In other words, the level-based preview screen generated by the preview screen generation unit **130** may have the first, second and third level frame bars and the number of video frames for each sub-frame displayed on the third level frame bar is the fifth count value CFC**5**, wherein the length of each sub-frame is obtained by dividing the sub-frame length by the second parameter MIFR.

Contrarily, when the fifth count value CFC**5** has exceeded the maximum value MFC of the frame number N (Yes in step S**420**), meaning that the number of the divided sub-frames which are divided using the parameter MIFR has exceeded

the maximum allowed number of video frames and re-calculation is required, then, in step S**424**, the preview screen generation unit **130** further obtains a sixth count value CFC**6** according to the sub-frame length and the third parameter MAFR and, in step S**426**, determines whether the fifth count value CFC**6** has exceeded the maximum value of the frame number N. Similarly, in this step, the preview screen generation unit **130** may divide the sub-frame length of the sub-frame by the parameter MAFR to obtain the sixth count value CFC**6**.

When the sixth count value CFC**6** has not exceeded the maximum value MFC of the frame number N (No in step S**426**), meaning that the number of the divided video frames which are divided using the parameter MAFR has not exceeded the maximum allowed number of video frames, in step S**428**, the preview screen generation unit **130** determines the value of the level number M is set to be 3 and sets the value of the frame number N for the third level frame bar among the M level frame bars to the sixth count value CFC**6**.

In other words, the level-based preview screen may have the first, second and third level frame bars and the number of video frames displayed on the third level frame bar is the sixth count value CFC**6**, wherein the length of each sub-frame is obtained by dividing the sub-frame length by the third parameter MAFR.

Contrarily, when the sixth count value CFC**6** has exceeded the maximum value MFC of the frame number N (Yes in step S**426**), meaning that the number of the divided video frames which are divided using the parameter MAFR has exceeded the maximum allowed number of video frames and a maximum number of levels three has reached, then, in step S**430**, the preview screen generation unit **130** determines the value of the level number M is set to be 3 and sets the value of the frame number N for the third level frame bar among the M level frame bars to the maximum value MFC of the frame number N.

It is to be noted that, during the calculation of the number of frames for the third level frame bar, if the sub-frame is divided into the sub-frames using the parameter MIFR, the number of frames for the third level frame bar can be determined by using an unconditional cutting method to round down the calculated count value after the decimals; and if the sub-frame is divided into the sub-frames using the parameter MIFR, the number of frames for the third level frame bar can be determined by using an unconditional rounding-up method to round up the calculated count value after the decimals.

For explanation, specific embodiments are illustrated in the following to explain the detailed process of a video-previewing method of the invention and how to determine the number of levels and the number of the frames for the level-based preview screen, and those skilled in the art will understand that these specific embodiments are used for explanation only and the invention is not limited thereto.

In the first embodiment, assume that the resolution of the electronic device is defined as 800*480 and the video length is defined as 600 seconds, the value of the parameter MFC can be obtained by following formula: MFC=800/100=8, which means that each level can display at most eight video frames. It is then calculated the number of levels of the level-based preview screen. As the video length is of 60 seconds, the count value CFC can be calculated by following formula using the parameter MIFR (i.e. 10): CFC=60/10=6. Because the value 6 is less than the MFC, it is determined that the level-based preview screen corresponding to the video has only the first level and the number of frames thereof is set to 6, wherein each frame is with a length of 10 seconds. Thus, when the video is being previewed, a level-based preview screen with only one level which contains six video frames will be displayed for selection by the users, as shown in FIG. **6**A.

In the second embodiment, assume that the resolution of the electronic device is defined as 800*480 and the video length is defined as 3600 seconds, the value of the parameter MFC can be obtained by following formula: MFC=800/100=8, which means that each level can display at most eight video frames. It is then calculated the number of levels of the level-based preview screen. As the video length is of 3600 seconds, the first count value CFC**1** can be calculated by following formula using the parameter MIFR: CFC**1**=3600/10=360. Because the value **3600** has exceeded the MFC, it is determined to calculate a second count value CFC**2** by following formula using the parameter MAFR (i.e. 20): CFC**2**=3600/20=180. As the value 180 has still exceeded the MFC, it means that the number of levels of the level-based preview screen at least be set to be 2. Accordingly, the video is divided into video frames by the MFC for the first level i.e., the number of frames for the first level is set to 8, and the video is divided into 8 video frames, each with a frame length of 450 seconds. Next, the frame length of one of the video frames in the first level (i.e. 450 seconds) is further utilized to determine the number of frames for the second level and to see if a third level is required.

Similarly, during the calculation of the number of frames of the second level, as the frame length is of 450 seconds, a third count value CFC**3** can be calculated by following formula using the parameter MIFR: CFC**3**=450/10=45. Because the value **450** has exceeded the MFC, it is determined to calculate a fourth count value CFC**4** by following formula using the parameter MAFR: CFC**4**=450/20=22.5. As the value 22.5 has still exceeded the value 8, it means that the number of levels of the level-based preview screen has exceeded two and the third level is required. Accordingly, each video frame in the second level is divided into video frames by the MFC, i.e., the number of frames for the second level is set to 8, and each video frame is divided into 8 sub-frames, each with a sub-frame length of 56.25 seconds. Next, the sub-frame length of one of the sub-frames in the second level (i.e. 56.25 seconds) is further utilized to determine the number of frames for the third level.

Similarly, during the calculation of the number of frames of the third level, as the sub-frame length is of 56.25 seconds, a fifth count value CFC**5** can be calculated by following formula using the parameter MIFR: CFC**5**=56.25/10=5.25. Because the value 5.25 is less than the MFC, it is determined that the level-based preview screen corresponding to the video has the first, second and third levels and the number of frames for the third level is set to 5, wherein each frame is with a length of 11 seconds. Thus, when the video is being previewed, a level-based preview screen with three levels will be displayed for selection by the users, wherein the first level displays eight video frames, the second level displays eight video frames and the third level displays five video frames, as shown in FIG. **6**B.

In some embodiments, when the level-based preview screen includes at least two levels, it can be displayed in different manners. In one embodiment, the first and second levels are simultaneously displayed for selection by the users while the third level is display only when one of the video frames of the second level has been selected if the third level exists. In another embodiment, the first, second and third levels are displayed for selection by the users at the same time.

In the third embodiment, assume that the resolution of the electronic device is defined as 1280*720 and the video length

is defined as 1800 seconds, the parameter generation unit **120** can obtain the value of the parameter MFC by following formula: MFC=1280/100=12, which means that each level can display at most twelve video frames. It is then calculated the number of levels of the level-based preview screen. As the video length is of 180 seconds, the first count value CFC**1** can be calculated by following formula using the parameter MIFR: CFC**1**=1800/10=180. Because the value 180 has exceeded the MFC, it is determined to calculate the second count value CFC**2** by following formula using the parameter MAFR: CFC**2**=1800/20=90. As the value 90 has still exceeded the MFC, it means that the number of levels of the level-based preview screen at least be set to be 2. Accordingly, the video is divided into video frames by the MFC for the first level, i.e., the number of frames for the first level is set to 12, and the video is divided into 12 video frames, each with a frame length of 150 seconds. Next, the frame length of one of the video frames in the first level (i.e. 150 seconds) is further utilized to determine the number of frames for the second level and to see if a third level is required.

Similarly, during the calculation of the number of frames of the second level, as the frame length is of 150 seconds, the third count value CFC**3** can be calculated by following formula using the parameter MIFR: CFC3=$^{150}/_{10}$=15. Because the value 15 has exceeded the MFC, it is determined to calculate the fourth count value CFC**4** by following formula using the parameter MAFR: CFC**4**=150/20=7.5. As the value 7.5 is less than the value 12, it is determined that the level-based preview screen corresponding to the video has the first and second levels and the number of frames for the second level is set to 8, each frame with a length of 18.7 seconds. Thus, when the video is being previewed, a level-based preview screen with two levels will be displayed for selection by the users, wherein the first level displays 12 video frames and the second level displays 8 video frames, as shown in FIG. **6**C.

In the fourth embodiment, the display of the level-based preview screen may not be activated if the video length is less than the parameter MIFR (i.e. 10 seconds) or the parameter MAFR (i.e. 20 seconds). For example, if the video length is less than 10 seconds, the division of the video to the video frames is not required. If the video length is less than or equal to 20 seconds, the level-based preview screen may display only one level which contain two video frames displayed thereon.

In the fifth embodiment, it is assumed that the video length is too long such that the maximum expected gap between each two of the video frames defined by the parameter MAFR can not be matched even if the third level is presented. In this case, the sub-frame length of the sub-frame for the second level will all be used to divide the sub-frame into video frames, i.e., a level-based preview screen with three levels will be displayed and each of the first, second and third levels displays MFC video frames.

Therefore, according to the video-previewing method and related video-previewing system of the invention, optimized video frames to be cached can be determined during a video is playing to generate a level-based preview screen corresponding to the video automatically according to the video length of the video and the screen resolution of the touch-sensitive display unit, so as to provide fast previewing to quickly search video frames and/or change the operations for the video, making the use of video playing quicker and easier.

Video-previewing methods for use in an electronic device, or certain aspects or portions thereof, may take the form of a program code (i.e., executable instructions) embodied in tangible media, such as floppy diskettes, CD-ROMS, hard drives, or any other non-transitory machine-readable storage medium, wherein, when the program code is loaded into and executed by a machine, such as a computer, the machine thereby becomes an apparatus for practicing the methods. The methods may also be embodied in the form of a program code transmitted over some transmission medium, such as electrical wiring or cabling, through fiber optics, or via any other form of transmission, wherein, when the program code is received and loaded into and executed by a machine, such as a computer, the machine becomes an apparatus for practicing the disclosed methods. When implemented on a general-purpose processor, the program code combines with the processor to provide a unique apparatus that operates analogously to application-specific logic circuits.

While the invention has been described by way of example and in terms of preferred embodiment, it is to be understood that the invention is not limited thereto. Those who are skilled in this technology can still make various alterations and modifications without departing from the scope and spirit of this invention. Therefore, the scope of the present invention shall be defined and protected by the following claims and their equivalents.

What is claimed is:

1. A video-previewing method for providing preview of a video to be played for an electronic device with a touch-sensitive display unit, the method comprising:

detecting a resolution of the touch-sensitive display unit of the electronic device; and

generating a preview screen corresponding to the video on the touch-sensitive display unit according to the resolution of the touch-sensitive display unit, wherein the preview screen includes M level frame bars and each of the M level frame bars displays N video frames,

wherein a frame number N is a value representing a number of video frames for each of the M level frame bars determined based on the resolution of the touch-sensitive display unit and a level number M is a value representing a number of levels determined according to a video length of the video, where M>1 and N≥1, wherein the video length is a total time length of the video to be played,

wherein the method further comprises:

providing first, second and third parameters;

determining a maximum value of the N according to the resolution of the touch-sensitive display unit and the first parameter; and

determining the value of the level number M according to the video length of the video, the second parameter and the third parameter,

wherein the first parameter represents an expected resolution, the second parameter represents a minimum expected gap between each two of the N video frames and the third parameter represents a maximum expected gap between each two of the N video frames;

wherein the step of determining the value of the level number M according to the video length of the video, the second parameter and the third parameters further comprises:

obtaining a first count value according to the video length of the video and the second parameter and determining whether the first count value has exceeded the maximum value of the frame number N;

when the first count value has exceeded the maximum value of the frame number N, obtaining a second count value according to the video length of the video and the third parameter and determining whether the second count value has exceeded the maximum value of the frame number N; and

when the second count value has exceeded the maximum value of the frame number N, determining the value of the level number M is set to be at least 2 and setting the value of the frame number N for a first level frame bar among the M level frame bars to the maximum value of the frame number N;

and wherein the method further comprises:

dividing the video into the N video frames based on the video length of the video; and

obtaining a third count value according to a frame length of each of the N frames and the second parameter and determining whether the third count value has exceeded the maximum value of the frame number N;

when the third count value has not exceeded the maximum value of the frame number N, determining the value of the level number M is set to be 2 and setting the value of the frame number N for a second level frame bar among the M level frame bars to the third count value;

when the third count value has exceeded the maximum value of the frame number N, obtaining a fourth count value according to the video length of the video and the third parameter and determining whether the fourth count value has exceeded the maximum value of the frame number N; and

when the fourth count value has not exceeded the maximum value of the frame number N, determining the value of the level number M is set to be 2 and setting the value of the frame number N for the second level frame bar among the M level frame bars N to the fourth count value.

2. The video-previewing method of claim **1**, wherein the maximum value of the level number M is set to be 3.

3. The video-previewing method of claim **1**, further comprising:

when the fourth count value has exceeded the maximum value of the frame number N, determining the value of the level number M is set to be 3 and setting the value of the frame number N for the second level frame bar among the M level frame bars to the maximum value of the frame number N.

4. The video-previewing method of claim **3**, further comprising:

dividing the video frame into N sub-frames based on the video length of the video; and

obtaining a fifth count value according to a sub-frame length of each of the N sub-frames and the second parameter and determining whether the fifth count value has exceeded the maximum value of the frame number N;

when the fifth count value has not exceeded the maximum value of the frame number N, determining the value of the level number M is set to be 3 and setting the value of the frame number N for a third level frame bar among the M level frame bars to the fifth count value;

when the fifth count value has exceeded the maximum value of the frame number N, obtaining a sixth count value according to the sub-frame length and the third parameter and determining whether the sixth count value has exceeded the maximum value of the frame number N; and

when the sixth count value has not exceeded the maximum value of the frame number N, determining the value of the level number M is set to be 3 and setting the value of the frame number N for the third level frame bar among the M level frame bars to the sixth count value.

5. The video-previewing method of claim **4**, further comprising:

when determining that the value of the level number M is set to be 3, determining the value of the frame number N for the third level frame bar among the M level frame bars according to an unconditional cutting or an unconditional rounding-up method.

6. A video-previewing system for providing preview of a video to be played, the system comprising:

a touch-sensitive display unit, having a resolution;

a parameter generation unit, detecting the resolution of the touch-sensitive display unit; and

a preview screen generation unit coupled to the parameter generation unit and the touch-sensitive display unit, generating a preview screen corresponding to the video on the touch-sensitive display unit according to the resolution of the touch-sensitive display unit detected by the parameter generation unit, wherein the preview screen includes M level frame bars and each of the M level frame bars displays N video frames;

wherein a frame number N is a value representing a number of video frames for each of the M level frame bars determined based on the resolution of the touch-sensitive display unit, and a level number M is a value representing a number of levels determined according to a video length of the video detected by the parameter generation unit, where $M>1$ and $N\geq1$, wherein the video length is a total time length of the video to be played;

wherein the parameter generation unit further provides first, second and third parameters and the preview screen generation unit further determines a maximum value of the N according to the resolution of the touch-sensitive display unit and the first parameter; and determines the value of the level number M according to the video length of the video, the second parameter and the third parameter, wherein the first parameter represents an expected resolution, the second parameter represents a minimum expected gap between each two of the N video frames and the third parameter represents a maximum expected gap between each two of the N video frames;

wherein the preview screen generation unit further obtains a first count value according to the video length of the video and the second parameter and determines whether the first count value has exceeded the maximum value of the frame number N preview screen generation unit, wherein when the first count value has exceeded the maximum value of the frame number N, the preview screen generation unit further obtains a second count value according to the video length of the video and the third parameter and determines whether the second count value has exceeded the maximum value of the frame number N and determines the value of the level number M is set to be at least 2 and sets the value of the frame number N for a first level frame bar among the M level frame bars to the maximum value of the frame number N when the second count value has exceeded the maximum value of the frame number N;

wherein the preview screen generation unit further divides the video into the N video frames based on the video length of the video, obtains a third count value according to a frame length of each of the N frames and the second parameter and determines whether the third count value has exceeded the maximum value of the frame number N;

wherein when the third count value has not exceeded the maximum value of the frame number N, the preview screen generation unit determines the value of the level

number M is set to be 2 and sets the value of the frame number N for a second level frame bar among the M level frame bars to the third count value;

when the third count value has exceeded the maximum value of the frame number N, the preview screen generation unit obtains a fourth count value according to the video length of the video and the third parameter and determines whether the fourth count value has exceeded the maximum value of the frame number N; and

when the fourth count value has not exceeded the maximum value of the frame number N, the preview screen generation unit further determines the value of the level number M is set to be 2 and sets the value of the frame number N for the second level frame bar among the M level frame bars to the fourth count value.

7. The video-previewing system of claim **6**, wherein the maximum value of the level number M is set to be 3.

8. The video-previewing system of claim **6**, wherein the preview screen generation unit further determines the value of the level number M is set to be 3 and sets the value of the frame number N for the second level frame bar among the M level frame bars to the maximum value of the frame number N when the fourth count value has exceeded the maximum value of the frame number N.

9. The video-previewing system of claim **8**, wherein the preview screen generation unit further divides the video frame into N sub-frames based on the video length of the video, obtains a fifth count value according to a sub-frame length of each of the N sub-frames and the second parameter and determines whether the fifth count value has exceeded the maximum value of the frame number N;

wherein when the fifth count value has not exceeded the maximum value of the frame number N, the preview screen generation unit determines the value of the level number M is set to be 3 and sets the value of the frame number N for a third level frame bar among the M level frame bars to the fifth count value;

when the fifth count value has exceeded the maximum value of the frame number N, the preview screen generation unit obtains a sixth count value according to the sub-frame length and the third parameter and determines whether the sixth count value has exceeded the maximum value of the frame number N; and when the sixth count value has not exceeded the maximum value of the frame number N, the preview screen generation unit further determines the value of the level number M is set to be 3 and setting the third level frame bar among the M level frame bars to the sixth count value;

wherein the preview screen generation unit further determines the value of the frame number N for the third level frame bar among the M level frame bars according to an unconditional cutting or an unconditional rounding-up method when determining that the value of the level number M is set to be 3.

10. A non-transitory machine-readable storage medium comprising a computer program, which means for driving a device to perform a video-previewing method for providing preview of a video to be played, wherein the device includes a touch-sensitive display unit and the video-previewing method comprises the steps of:

detecting a resolution of the touch-sensitive display unit; and

generating a preview screen corresponding to the video on the touch-sensitive display unit according to the resolution of the touch-sensitive display unit detected by the parameter generation unit,

wherein the preview screen includes M level frame bars and each of the M level frame bars displays N video frames, wherein a frame number N is a value representing a number of video frames for each of the M level frame bars determined based on the resolution of the touch-sensitive display unit, and a level number M is a value representing a number of levels determined according to a video length of the video, where M>1 and N≥1, wherein the video length is a total time length of the video to be played,

wherein the method further comprises:

providing first, second and third parameters;

determining a maximum value of the N according to the resolution of the touch-sensitive display unit and the first parameter; and

determining the value of the level number M according to the video length of the video, the second parameter and the third parameter,

wherein the first parameter represents an expected resolution, the second parameter represents a minimum expected gap between each two of the N video frames and the third parameter represents a maximum expected gap between each two of the N video frames,

wherein the step of determining the value of the level number M according to the video length of the video, the second parameter and the third parameters further comprises:

obtaining a first count value according to the video length of the video and the second parameter and determining whether the first count value has exceeded the maximum value of the frame number N;

when the first count value has exceeded the maximum value of the frame number N, obtaining a second count value according to the video length of the video and the third parameter and determining whether the second count value has exceeded the maximum value of the frame number N; and

when the second count value has exceeded the maximum value of the frame number N, determining the value of the level number M is set to be at least 2 and setting the value of the frame number N for a first level frame bar among the M level frame bars to the maximum value of the frame number N;

and wherein the method further comprises:

dividing the video into the N video frames based on the video length of the video; and

obtaining a third count value according to a frame length of each of the N frames and the second parameter and determining whether the third count value has exceeded the maximum value of the frame number N;

when the third count value has not exceeded the maximum value of the frame number N, determining the value of the level number M is set to be 2 and setting the value of the frame number N for a second level frame bar among the M level frame bars to the third count value;

when the third count value has exceeded the maximum value of the frame number N, obtaining a fourth count value according to the video length of the video and the third parameter and determining whether the fourth count value has exceeded the maximum value of the frame number N; and

when the fourth count value has not exceeded the maximum value of the frame number N, determining the value of the level number M is set to be 2 and setting

the value of the frame number N for the second level frame bar among the M level frame bars N to the fourth count value.

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