

Description

This invention relates to data processing and more specifically to the application of data processing to digitized audio signals for editing.

The recording of soundtracks has, in the past, been accomplished by analog devices such as tape recorders. Editing these sound recordings or soundtracks was accomplished by mechanically splicing tapes or by recording the soundtrack from one tape recorder onto another one making the editing changes during the recording on the second tape recorder.

Digital data, however, is edited on a digital processing system. One common application of digital data processing is text processing or text editing. Text editors convert text information into a sequence of digital data that is stored in data blocks. Editing functions, such as inserting, deleting, moving or copying, are easily accomplished by manipulating these data blocks. The actual text is commonly displayed on a display screen to the text editor operator or user so that the operator may see the results of the commands given to the text editor and the actions taken by the text editor in response to these commands.

It is desirable to provide a data processing application similar to the text editor for the editing of audio soundtracks.

The paper "Computer Aided Film Sound Editing" by A. Maar (76th Convention of the Audio Engineering Society (AES), 8 October 1984, New York, USA, pages 1-13) describes a prototype film sound editor in two parts: a sound file editor for seeing, hearing and trimming sound; and a cue sheet editor that uses a graphical representation of a cue sheet. The sound file editor provides for the user to manipulate regions within a sound file using a mouse.

It is an object of the present invention to provide an audio processing system with a display to the user that enables the user to easily view the current state of the audio data and the performance of the audio editing commands on the audio data.

According to the invention, there is provided an audio processing system comprising: means for converting received audio sound information into a sequence of digital data blocks, each data block representing a corresponding portion of said sound information during a predetermined time interval; means for storing said data blocks; means for displaying a time-based graphical representation of said sound information using said data blocks and including means (12) for generating and displaying on the time axis of said graph user-positionable marks representing selected time points of said sound information; means for receiving input commands for editing said sequence of digital data blocks; and means for editing said sequence in response to said commands; characterised in that said means for generating and displaying user positionable marks is adapted to enable marks to be designated as fixedly associated with a specific point in the graphically represented sequence of digital data blocks and hence movable on the time axis together with said specific point during editing.

cific point in the graphically represented sequence of digital data blocks and hence movable on the time axis together with said specific point during editing.

There is further provided method of displaying and processing received sound information, comprising the steps of: converting the received sound information into a sequence of digital data blocks, each data block representing a corresponding portion of said sound information during a predetermined time interval of a total time period of the sound information; displaying an axis representing time; displaying adjacent the time axis a time-based graphical representation of a portion of said digital sound data using said data blocks; generating and displaying user-positionable marks on the time axis representing selected time points of said sound information during said time period; and editing said sequence of digital data blocks in response to input editing commands; characterised in that said step of generating and displaying user-positionable marks includes designating said marks either as fixed at a specific time on the time axis or as fixedly associated with a specific point in the graphically represented sequence of digital data blocks and hence movable on the time axis together with said specific point during editing.

A preferred embodiment of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a block diagram of a data processing system configured as an audio editor;

Figure 2 is a flow chart of the audio editor executive routine;

Figure 3 is a flow chart of the audio editor retrieval subroutine;

Figure 4 is a flow chart of the audio editor interface to the signal processor;

Figure 5 is a flow chart of the editing subroutine for the audio editor;

Figure 6 is an audio editor initial display;

Figure 7 is an audio editor display illustrating one soundtrack;

Figure 8 is an audio editor display illustrating two soundtracks;

Figure 9 is an audio editor display illustrating a copying function;

Figure 10 is an audio editor display illustrating the use of time marks; and

Figure 11 is an audio editor display illustrating a recording function.

Figure 1 shows a personal computer, such as a PCAT produced by International Business Machines Corporation, and indicated in the Figure as block 10. The processor includes the audio editor 12 which itself includes an audio editor program. Also included are storage 34, which can consist of both disk and RAM (random access memory) storage, buffer storage 28 that interfaces between storage 34 and an audio processor 18. The

buffer storage 28 can be a cache or a series of caches of a size suitable for the task to be performed by the audio editor in block 12. The audio processor 18 receives an audio input on line 20 and provides an audio output on line 22. In the preferred embodiment, the audio processor 18 is an Ariel DSP-16 (Real Time Data Acquisition Processor) available from Pacific Microcircuits Limited in Blaine, Washington, which includes a Texas Instruments TMS 32020 signal processor. The purpose of the audio processor is to digitize audio signals input on line 20 to provide digital data representative of the audio information input and to convert digital data from storage 34 in the data processor 10 to an audio signal which is output on audio line 22.

A terminal 42 is connected to the data processor 10 via line 40. The terminal 42 consists of a console display 44 and a keyboard 46.

The operation of this audio editor is to be similar to the operation of a text editor, such as one of the IBM Displaywrite series products. In other words, a user friendly interface is to be provided to the operator to enable the operator to easily accomplish the editing task.

In Figure 1, the audio editor 12 communicates with the audio processor over lines 14 and 16. The audio editor 12 also communicates with storage 34 over lines 38 and 36. Data that is being passed between the audio processor 18 and the storage 34 passes through the buffer 28 via lines 24, 26, 30 and 32. The control of the audio editor function is accomplished by the audio editor software represented as block 12.

In Figure 2, the executive routine of the audio editor is illustrated. In step 100, the audio editor is initialized. This includes initializing any start-up variables and allocating storage for the program execution. In step 102, the program determines what mode the user wishes to program to operate. In the select object mode, the program proceeds to step 104 to display the object prompt and receive the user input. The object prompt is a request for the soundtrack, sound recording or audio object file name that is to be edited. Once an object file has been received, the program proceeds to step 106 to determine if it is a valid object. If not, the program returns to step 104. If a valid object is selected, the program returns to step 102. It should be apparent to those skilled in the art that several objects may be selected at a single time by the operator. However, in the preferred embodiment that is disclosed herein, only two such objects are displayed at any one time.

Returning to step 102, if the user decides to quit the program, the program proceeds to step 108 to terminate the audio editor program by deallocating storage and saving any modified audio files.

The term audio file will be used herein to describe any soundtrack, sound recording or audio information that is received by the audio processor 18 (Figure 1) and that has been digitized into data blocks. In the preferred embodiment, a pulse coded modulation technique is used to sample the audio data input to provide the audio

information as a digitized data block that represents the audio information for a 1/50th of a second interval (termed a "segment"). The preferred sampling rate is 44,000 samples per second. It should be apparent to those skilled in the art that the sample size and the interval size can be varied.

In step 102, if the user desires to edit an object, the program proceeds to step 110 to determine if the object is available. If the object is not currently available, the program proceeds to Connector I. Connector I is illustrated in Figure 3 and consists of step 112 which provides the audio database retrieval services. This retrieval function fetches the object from storage and places the object in the main memory for editing. Afterwards, the program returns to step 114. Likewise, if the object is available in step 110, the program proceeds to step 114.

In step 114, the audio data and the point list are formatted for display. The audio data and point list contain the audio editor information for the user or operator.

In step 116, the formatted audio data and point list are displayed. A sample of an initialized audio display and point list appears in Figure 6. Section 216 is the audio display. Section 228 is the point list display. These two areas will be discussed in more detail later.

The program then proceeds to step 118 to determine if a valid request from the user has been entered. This request can be entered from either a keyboard command or from the use of a mouse input device. If the request is not valid, the program returns to step 116. However, if the request is valid, the program proceeds to step 120. In step 120, the program determines if the request was to save the audio object. If so, the program proceeds to the audio database retrieval services in block 112 (Figure 3) to save the audio object. If the audio object is not to be saved or upon completion of saving the audio object, the program proceeds to step 122 to determine if the request is to move the cursor. The cursor can be moved by either the mouse or by the keyboard cursor keys. If cursor movement has been requested, the program proceeds to step 124 to move the cursor on the screen.

In step 126, the program determines if the audio data or point list is to be edited. If so, the program proceeds to the editing subroutine illustrated in Figure 5.

In step 128, the program determines if an audio operation is requested. If so, the program proceeds to the audio operation subroutine illustrated in Figure 4. In step 130, the program determines if the user is requesting to exit the editing of the present object. If so, the program proceeds to connector M which starts program execution again in step 102. If not, the program proceeds to execute step 116 again.

Figure 4 illustrates the audio operation routine. In step 132, initialization takes place for the requested audio operation. In step 134, the signal processor program is loaded onto the audio processor 18. In step 136, it is determined whether the audio data that is needed to start the operation is available. If so, the program proceeds to the audio database retrieval services in Figure 3. If not,

the program proceeds to step 138 to send a command to the audio processor to start the operation.

In step 140, the program determines if the user is requested to stop. If so, the program proceeds to step 142 to terminate the audio operation. If not, the program proceeds to step 144 to determine if at this current time point, some type of action is required. If so, the program proceeds to step 146 to send the appropriate command to the audio processor to perform the action. Then, in step 148, the program determines if data is to be transferred to or from the audio processor. If so, the program proceeds to the audio database retrieval services (Figure 3). The program then proceeds back to step 140.

In Figure 5, the editing of the audio data or point list is performed. In step 150, the type of editing required is determined. If the audio data is to be edited, the program proceeds to step 154. If the point list is to be edited, the program proceeds to step 152. In step 152, the program verifies that the field input is correct. If the input is correct as determined in step 156, the program then proceeds to update the point list in step 160. Returning to step 154, the program determines if the data editing request is valid. If the request is valid as determined in step 158, the program proceeds to step 162 to reformat the physical audio data that is being displayed. From step 162, the program proceeds to the audio database retrieval services in Figure 3 and then to step 164 to update the point list as required. If either of the requests are not valid from steps 156 and 158, or upon completion of the updated point list in step 160 and 164, the program proceeds to step 168 to update any fields for changes.

Figure 6 is an illustration of the initial audio editor display. The object name is listed in area 202 as SAMPLER.AUD. The current audio editor status is listed in area 204 as edit/stopped. The audio length (in time) is listed in area 208. The time is also listed in terms of segments in area 210. The current position of the editor in the object is listed in area 212. The corresponding segment is also listed in area 214. Note that the current position is always in front of the block to be edited. The current version of the audio editor is listed in area 206. The above comprise the header area 200. The audio data appears in area 216. Two time lines, 224 and 226, are illustrated containing tick marks for minutes and seconds as shown. The first time line 224 represents the time line for the first object. The second time line 226 is used for the second object. Indicator 218 indicates the time line for the present object.

Also included are pointers 220 and 222. These pointers represent the start and end of the object. In the present example, there is no object and therefore, the start and end both reside at 0 time.

The point list is illustrated in area 228 and consists of an "ID" section 230, a corresponding position (either sliding or fixed) section 232, a time section 234, a type section 236, and a parameter/comment section 238. A command prompt area 240 is also provided to display the possible commands that a user can provide.

In Figure 7, a new audio object file named "SAMPLER.AUD" is being created by recording. Waveform 250 is a portion of the total sound recording. The length of this object file is 5 minutes, 36.58 seconds as listed in the audio length section 258. The end marker 252 denotes this end point on the time axis. In the point list, the start pointer 254 indicates that the starting time is 0. The end marker 256 indicates that the length of this recording is 5 minutes, 36.58 seconds.

The amplitude history waveform 252 has been scrolled to display the end point. The 5 minutes and 36.58 seconds of recording for SAMPLER.AUD equals 16,829 1/50th second blocks of data. The volume history is the average of blocks for a display interval. The display interval of blocks represented in each amplitude history would depend upon the resolution of the console used to provide the audio editor display.

Amplitude history for the waveform 252 may not be appropriate in all applications. Therefore, another feature, such as frequency, may be used as the basis for the waveform 252.

In the point list, the start point is listed as having a fixed position. The fixed position means that the position of this mark is permanently fixed as to time. The end mark 256, on the other hand, is a sliding mark. This means that the location of this mark is varied across the time axis but is fixed relative to some portion of the sound recording. Therefore, as additional segments would be added to the SAMPLER.AUD object file, the end point would be appropriately adjusted outwardly. Both the start mark 254 and the end mark 256 are listed as P mark type. A P mark indicates that the mark is permanent and that it cannot be removed by the user.

In Figure 8, a second audio object has been selected. The audio object indicator 260 has been moved from the top audio object line to the bottom audio object line. The bottom audio object is listed as FINALE.AUD and consists of a sound recording of 35.00 seconds (or 1750 1/50th second data segments). This is also illustrated by the updated point list consisting of the start pointer 267 and the end pointer 268.

In Figure 9, the entire audio object file FINALE .AUD has been inserted at the end of the object file SAMPLER.AUD. This results in the reselection of the first audio object as indicated by the change in pointer 277. Note that the waveform 274 (the FINALE .AUD waveform) has been inserted after point 270 as waveform 276. Note that the end pointer 278 has been repositioned. Time point 1 270 has been added to indicate where the old SAMPLER.AUD ended. Likewise, the point list 272 has been updated. Point 1 now is listed as 5 minutes 36.58 seconds (the old end of SAMPLER.AUD) and is shown as an Smark. A Smark is a system mark that is generated by the audio editor automatically to indicate the occurrence of some event for possible later use by the operator. The end mark has also been updated as illustrated in the time column.

Figure 10 illustrates the results of considerable ed-

iting wherein the user has added appropriate points within the SAMPLER.AUD object and defining their properties in the point list. Note that the SAMPLER.AUD object waveform 282 has been scrolled back to the start position. The display presented to the user displays 2 minutes and 40 seconds of waveform. However, since the objects will often be of greater length, the user has the capability to scroll the display to view the portion of interest. The waveform 282 includes several time points such as time point 2 281, time point 3 280, time point 4 and time point 5 285. The definition of these time points is contained in the point list 286. Point 2 281 has been added to define the starting of another audio object entitled "VOICE_1.AUD" that is to be mixed with SAMPLER.AUD which, according to the point list 286, is to be reduced in volume. Therefore, time point 2 (in the point list 286) includes a volume command for the SAMPLER.AUD track, a mix command, and a volume command for the track to be mixed. Point 3 has been added as a user mark (Umark) at the beginning of a live talkover to be done in real time during the playing of the audio. Point 4 marks a special sound effect. Note that the sound effect to be mixed in point 4 is redefined in the Parameter/Comment section. Both points 3 and 4 are sliding points which allows them to remain with their associated audio portions regardless of the editing operations. In other words, these points will remain fixed with the appropriate audio data but may "slide" with respect to the time axis as the audio object is edited. Point 5 is another voice-over operation similar to that associated with point 2. Point 7 marks the spot for another voice-over that may be added later. The end point is not displayed but may be scrolled into view if necessary.

Figure 11 illustrates the user display after a record function has been invoked to record 50 seconds of silence into the current position of display between marks 8 to 3. This is evidenced by the lack of the waveform (or zero amplitude) in location 286. The audio editor has inserted the recorded silence in front of point 3 and added point 8 to define the start position of this new recording. Note that points with the sliding property (i.e., points 3 and 4) have been moved along as the audio is pushed in front of the newly recorded material. The points with the fixed property (i.e., point 5) have remained at the same time displacement (i.e., their position is constant relative to the time axis). It should also be noted that the point list 287 does not display the end pointer. Like the waveform for the object files, the point list may be scrolled upwardly or downwardly to display the different portion of the total list.

Claims

1. An audio processing system comprising:

means (18) for converting received audio sound information into a sequence of digital data

blocks, each data block representing a corresponding portion of said sound information during a predetermined time interval;
means for storing said data blocks (28,34);
means (12,44) for displaying a time-based graphical representation of said sound information using said data blocks, said means for displaying including means (12) for generating and displaying on the time axis of said graph user-positionable marks (280,281,284,285) representing selected time points of said sound information;
means (46,12) for receiving input commands for editing said sequence of digital data blocks; and
means (12) for editing said sequence in response to said commands; characterised in that said means for generating and displaying user positionable marks is adapted to enable marks to be designated as fixedly associated with a specific point in the graphically represented sequence of digital data blocks and hence movable on the time axis together with said specific point during editing.

2. An audio processing system according to claim 1, including means (12,44) for displaying a textual list (286) of said positionable marks and associated operator input editing commands that are to be executed on the sound information at the times represented by the marks.
3. An audio processing system according to claim 2, wherein said textual list includes the current time location of said positionable marks on the time axis.
4. An audio processing system according to any one of the preceding claims, including user-operable means (42) for scrolling the displayed graphical representation to view a portion of interest.
5. An audio processing system according to any one of the preceding claims, including means for displaying a time-based graphical representation of a second piece of sound information;
and means for editing the two pieces of sound information so as to form a composite piece of sound information.
6. A method of displaying and processing received sound information, comprising the steps of:

converting the received sound information into a sequence of digital data blocks, each data block representing a corresponding portion of said sound information during a predetermined time interval of a total time period of the sound information;
displaying an axis representing time;

iting wherein the user has added appropriate points within the SAMPLER.AUD object and defining their properties in the point list. Note that the SAMPLER.AUD object waveform 282 has been scrolled back to the start position. The display presented to the user displays 2 minutes and 40 seconds of waveform. However, since the objects will often be of greater length, the user has the capability to scroll the display to view the portion of interest. The waveform 282 includes several time points such as time point 2 281, time point 3 280, time point 4 and time point 5 285. The definition of these time points is contained in the point list 286. Point 2 281 has been added to define the starting of another audio object entitled "VOICE_1.AUD" that is to be mixed with SAMPLER.AUD which, according to the point list 286, is to be reduced in volume. Therefore, time point 2 (in the point list 286) includes a volume command for the SAMPLER.AUD track, a mix command, and a volume command for the track to be mixed. Point 3 has been added as a user mark (Umark) at the beginning of a live talkover to be done in real time during the playing of the audio. Point 4 marks a special sound effect. Note that the sound effect to be mixed in point 4 is redefined in the Parameter/Comment section. Both points 3 and 4 are sliding points which allows them to remain with their associated audio portions regardless of the editing operations. In other words, these points will remain fixed with the appropriate audio data but may "slide" with respect to the time axis as the audio object is edited. Point 5 is another voice-over operation similar to that associated with point 2. Point 7 marks the spot for another voice-over that may be added later. The end point is not displayed but may be scrolled into view if necessary.

Figure 11 illustrates the user display after a record function has been invoked to record 50 seconds of silence into the current position of display between marks 8 to 3. This is evidenced by the lack of the waveform (or zero amplitude) in location 286. The audio editor has inserted the recorded silence in front of point 3 and added point 8 to define the start position of this new recording. Note that points with the sliding property (i.e., points 3 and 4) have been moved along as the audio is pushed in front of the newly recorded material. The points with the fixed property (i.e., point 5) have remained at the same time displacement (i.e., their position is constant relative to the time axis). It should also be noted that the point list 287 does not display the end pointer. Like the waveform for the object files, the point list may be scrolled upwardly or downwardly to display the different portion of the total list.

Claims

1. An audio processing system comprising:

means (18) for converting received audio sound information into a sequence of digital data

blocks, each data block representing a corresponding portion of said sound information during a predetermined time interval;
means for storing said data blocks (28,34);
means (12,44) for displaying a time-based graphical representation of said sound information using said data blocks, said means for displaying including means (12) for generating and displaying on the time axis of said graph user-positionable marks (280,281,284,285) representing selected time points of said sound information;
means (46,12) for receiving input commands for editing said sequence of digital data blocks; and
means (12) for editing said sequence in response to said commands; characterised in that said means for generating and displaying user positionable marks is adapted to enable marks to be designated as fixedly associated with a specific point in the graphically represented sequence of digital data blocks and hence movable on the time axis together with said specific point during editing.

2. An audio processing system according to claim 1, including means (12,44) for displaying a textual list (286) of said positionable marks and associated operator input editing commands that are to be executed on the sound information at the times represented by the marks.
3. An audio processing system according to claim 2, wherein said textual list includes the current time location of said positionable marks on the time axis.
4. An audio processing system according to any one of the preceding claims, including user-operable means (42) for scrolling the displayed graphical representation to view a portion of interest.
5. An audio processing system according to any one of the preceding claims, including means for displaying a time-based graphical representation of a second piece of sound information; and means for editing the two pieces of sound information so as to form a composite piece of sound information.
6. A method of displaying and processing received sound information, comprising the steps of:

converting the received sound information into a sequence of digital data blocks, each data block representing a corresponding portion of said sound information during a predetermined time interval of a total time period of the sound information;
displaying an axis representing time;



displaying (116) adjacent the time axis a time-based graphical representation of a portion of said digital sound data using said data blocks;

generating (150-168) and displaying (116) 5
user-positionable marks on the time axis representing selected time points of said sound information during said time period; and
editing (132-148, 150-168) said sequence of 10
digital data blocks in response to input editing commands;
characterised in that said step of generating and displaying user-positionable marks includes designating said marks as fixedly associated 15
with a specific point in the graphically represented sequence of digital data blocks and hence movable on the time axis together with said specific point during editing.

7. A method according to claim 6, wherein said graphical representation is a representation of the sound recording volume 20
8. A method according to claim 6, wherein said graphical representation is a representation of the sound recording frequency. 25
9. A method according to any one of claims 6 to 8, wherein the portion of said sound information to be operated on by each said editing command is indicated by positionable marks on the respective time axes. 30
10. A method according to any one of claims 6 to 9, including the step of displaying a textual list of said positionable marks and associated operator input editing commands that are to be executed on the sound information at the times represented by the marks. 35
11. A method according to claim 10, wherein said step of displaying a textual list includes displaying the current time location of said positionable marks on the time axis. 40

Patentansprüche

1. Ein Tonverarbeitungssystem, das folgendes umfaßt: 50

Mittel (18) zum Umwandeln empfangener hörfrequenter Toninformationen in eine Sequenz von digitalen Datenblöcken, wobei jeder Datenblock einen entsprechenden Teil der genannten Toninformation während eines vorbestimmten Zeitintervalls darstellt; 55

Mittel zum Speichern der genannten Datenblöcke (28, 34);

Mittel (12, 44) zum Anzeigen einer zeitbezogenen graphischen Darstellung der genannten Toninformation unter Verwendung der genannten Datenblöcke, wobei die genannten Mittel zum Anzeigen Mittel (12) zum Erzeugen und Anzeigen der genannten graphischen Darstellung mit Benutzer-Markierungen (280, 281, 284, 285) auf der Zeitachse enthalten, die ausgewählte Zeitpunkte der genannten Toninformation darstellen;

Mittel (46, 12) zum Empfangen von Eingabebefehlen zum Editieren der genannten Sequenz von digitalen Datenblöcken; und

Mittel (12) zum Editieren der genannten Sequenz in Antwort auf die genannten Befehle; dadurch gekennzeichnet, daß das genannte Mittel zum Erzeugen und Anzeigen von Markierungen, die vom Benutzer angebracht werden können, so ausgeführt ist, daß die Markierungen als einem Punkt in der graphisch dargestellten Sequenz von digitalen Blöcken fest zugeordnet gekennzeichnet werden können und damit auf der Zeitachse zusammen mit dem genannten bestimmten Punkt beim Editieren bewegt werden können.

2. Ein Tonverarbeitungssystem nach Anspruch 1, Mittel (12, 44) enthaltend zum Anzeigen einer Textliste (286) der genannten Markierungen und der zugeordneten vom Bediener eingegebenen Editierbefehle, die mit der Toninformation zu den von den Markierungen bezeichneten Zeitpunkten ausgeführt werden sollen.
3. Ein Tonverarbeitungssystem nach Anspruch 2, bei dem die genannte Textliste die aktuelle Zeitlege der genannten anbringbaren Markierungen auf der Zeitachse enthält. 40
4. Ein Tonverarbeitungssystem gemäß jedem der vorangehenden Ansprüche, vom Benutzer bedienbare Mittel (42) zum Rollen der angezeigten graphischen Darstellung enthaltend, um bestimmte gewünschte Teile sichtbar zu machen. 45
5. Ein Tonverarbeitungssystem nach jedem der vorangehenden Ansprüche, Mittel enthaltend zum Anzeigen einer graphischen Darstellung eines zweiten Teils einer zeitbezogenen Toninformation; und Mittel zum Editieren der beiden Toninformationsteile, so daß sich ein zusammenhängender Teil von Toninformationen ergibt.



6. Ein Verfahren zum Anzeigen und Verarbeiten empfangener Toninformationen, folgende Schritte umfassend:

Umwandeln der empfangenen Toninformation in eine Sequenz von digitalen Datenblöcken, wobei jeder Datenblock einen entsprechenden Teil der genannten Toninformation während eines vorbestimmten Zeitintervalls einer Gesamtzeitdauer der Toninformation darstellt;

Anzeigen einer die Zeit darstellenden Achse;

Anzeigen (116) einer zeitbezogenen graphischen Darstellung eines Teils der genannten digitalen Tondaten neben der Zeitachse, unter Anwendung der genannten Datenblöcke;

Erzeugen (150-168) und Anzeigen (116) von Markierungen auf der Zeitachse, die vom Benutzer angebracht werden können, und die ausgewählte Zeitpunkte der genannten Toninformation während der genannten Zeitdauer darstellen; und

Editieren (132-148, 150-168) der genannten Sequenz von digitalen Datenblöcken in Antwort auf die Eingabe von Editierbefehlen;

dadurch gekennzeichnet, daß der genannte Schritt des Erzeugens und Anzeigens von Markierungen durch den Benutzer die Kennzeichnung der genannten Markierungen als einem bestimmten Punkt in der graphisch dargestellten Sequenz von digitalen Datenblöcken fest zugeordnet beinhaltet, so daß sie auf der Zeitachse zusammen mit dem genannten bestimmten Punkt beim Editieren bewegt werden können.

7. Eine Methode nach Anspruch 6, bei der die genannte graphische Darstellung eine Darstellung der Tonaufzeichnungslautstärke ist.
8. Ein Verfahren nach Anspruch 6, bei dem die genannte graphische Darstellung eine Darstellung der Tonaufnahmefrequenz ist.
9. Eine Methode nach jedem der Ansprüche 6 bis 8, bei der der Teil der genannten Toninformation, der mit jedem der genannten Editierbefehle bearbeitet werden soll, durch auf der betreffenden Zeitachse anbringbare Markierungen angezeigt wird.
10. Eine Methode nach jedem der Ansprüche 6 bis 9, den Schritt des Anzeigens einer Textliste der genannten anbringbaren Markierungen und der zugeordneten vom Bediener einzugebenden Edi-

tierbefehle, die mit der Toninformation zu den von den Markierungen angegebenen Zeitpunkten ausgeführt werden sollen, enthaltend.

11. Ein Verfahren nach Anspruch 10, bei dem der genannte Schritt des Anzeigens einer Textliste das Anzeigen der aktuellen Zeitlage der genannten, auf der Zeitachse anbringbaren Markierungen enthält.

Revendications

1. Système de traitement audio consistant en :

un dispositif (18) servant à convertir les informations audio reçues en une séquence de blocs de données numériques, chaque bloc de données représentant une portion correspondante des dites données sonores durant un intervalle de temps prédéterminé ;

un dispositif destiné à mettre en mémoire les dits blocs de données (28, 34) ;

un dispositif (12, 44) destiné à visualiser une représentation graphique dans le temps des dites informations sonores en utilisant les dits blocs de données, le dit dispositif de visualisation comprenant un dispositif (12) pour produire et afficher sur l'axe des temps du dit graphe des marques pouvant être mises en place par l'utilisateur (280, 281, 284, 285) et représentant des points dans le temps sélectionnés se rapportant aux dites informations sonores ;

un dispositif (46, 12) destiné à recevoir des commandes entrées pour éditer la dite séquence de blocs de données numériques ; et un dispositif (12) destiné à éditer la dite séquence en réponse aux dites commandes ; caractérisé en ce que le dit dispositif destiné à produire et à afficher les marques pouvant être mises en place par l'utilisateur a été adapté de manière à permettre que les marques soient désignées comme associées fixement à un point spécifique de la séquence de blocs de données numériques représentée graphiquement, et donc déplaçables sur l'axe des temps avec le dit point spécifique pendant l'édition.

2. Système de traitement audio tel que revendiqué dans la revendication 1, comprenant un dispositif (12, 44) destiné à afficher une liste textuelle (286) des dites marques pouvant être positionnées et des instructions d'édition associées entrées par l'opérateur et devant être exécutées sur l'information sonore aux temps représentés par les marques.

3. Système de traitement audio tel que revendiqué dans la revendication 2, dans lequel la dite liste textuelle inclut la position en cours, sur l'axe des temps,



des dites marques pouvant être positionnées par l'utilisateur.

4. Système de traitement audio tel que revendiqué dans l'une quelconque des revendications précédentes, comprenant un dispositif pouvant être mis en service par l'utilisateur (42) et servant à faire défiler sur écran la représentation graphique affichée, afin de visionner la partie choisie. 5
5. Système de traitement audio tel que revendiqué dans l'une quelconque des revendications précédentes, comprenant un dispositif destiné à afficher une représentation graphique dans le temps d'un second lot de données sonores ; et un dispositif pour éditer les deux lots d'informations sonores de manière à former un lot composite de d'informations sonores. 10
6. Méthode de visualisation et de traitement de données sonores reçues, comprenant les étapes suivantes : 20

conversion des informations sonores reçues en une séquence de blocs de données numériques, chaque bloc de données représentant une portion correspondante des dites données sonores pendant un intervalle de temps prédéterminé pris sur l'intégralité d'une période de données sonores ; 25

visualisation d'un axe représentant le temps ; visualisation (116), adjacente à l'axe des temps, d'une représentation graphique dans le temps d'une portion des dites données sonores numériques à l'aide des dits blocs de données ; 30

création (150-168) et visualisation (116) de marques pouvant être placées par l'utilisateur sur l'axe de temps, marques qui représentent des points dans le temps sélectionnés des dites informations sonores pendant la dite période ; 35

et édition (132-148, 150-168) de la dite séquence de blocs de données numériques en réponse aux instructions d'édition qui ont été entrées ; 40

caractérisé en ce que la dite étape de création et de visualisation des marques pouvant être positionnées par l'utilisateur inclut la désignation des dites marques comme associées fixement à un point spécifique de la séquence de blocs de données numériques, représentée graphiquement, et donc déplaçables sur l'axe des temps avec le dit point spécifique durant l'édition. 45
7. Méthode telle que revendiquée dans la revendication 6, dans laquelle la dite représentation graphique est une représentation du volume d'enregistrement du son. 50

8. Méthode telle que revendiquée dans la revendication 6, dans laquelle la dite représentation graphique est une représentation de la fréquence d'enregistrement du son. 5
9. Méthode telle que revendiquée dans l'une quelconque des revendications 6 à 8, dans laquelle la portion des dites informations sonores sur laquelle chaque dite instruction d'édition doit être exécutée est indiquée par des marques placées sur les axes du temps respectifs. 10
10. Méthode telle que revendiquée dans l'une quelconque des revendications 6 à 9, comprenant l'étape d'affichage d'une liste textuelle des dites marques positionnables et des instructions d'édition associées, entrées par l'opérateur, qui doivent être exécutées sur les informations sonores aux temps représentés par les marques. 15
11. Méthode telle que revendiquée dans la revendication 10, dans laquelle l'étape d'affichage d'une liste textuelle comprend l'affichage de la position en cours, sur l'axe des temps, des dites marques positionnables. 20

