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(54) AUDIO/VIDEO RECORDER/TRANSCEIVER

AUDIO/VIDEO AUFNAHME-ÜBERTRAGUNGSGERÄT

ENREGISTREUR/EMETTEUR-RECEPTEUR AUDIO/VIDEO

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Description

The video cassette recorder (VCR) has added significantly to the usefulness of the home television set. Important or exceptionally good programs may be recorded to be viewed again. Programs appearing at times that are inconvenient for viewing may be recorded for playback at a later time. Recorded movies or other materials, educational or entertaining, may be rented or borrowed for viewing at home. (As used in the remainder of this specification, the term "program" encompasses movies and other types of video and/or audio materials, whether broadcast from a TV station or another source.)

The typical VCR has its own tuner-receiver and a video-recorder. It can receive and record a program from one channel while the television set is being employed to view a program on another channel. Programs are recorded on magnetic tape. The tape is then played back and viewed on the television set. Features commonly included in the VCR are capabilities for advancing the tape forward or backward at a high speed, stopping motion at any frame to hold the image, or simply playing back the recording at normal speed.

Desirable features that are not normally available in a VCR are capabilities for copying recorded programs from one tape or alternative storage medium to a similar or dissimilar storage medium, editing recorded programs and high speed recording. Another desirable, but currently unavailable, feature is the capability for high speed, high quality transmission and reception by optical fiber, microwave or other communications means using the VCR.

It is known to store and transmit still images from a CD player to a CD-RAM (see for example I.E.E.E. Transactions on Consumer Electronics "1988 International Conference on Consumer Electronics, Part 1", 34 (1988) August, No.3, New York, US, pages 838-845; Hildering et al.: "Programmable Compact Disk Picture Memory and Video Processing System"). EP-A-0283727 discloses an electronic music centre for producing a custom audio tape by permitting the user to make selections from a music library and to duplicate these selections at high speed on a blank recording tape. US4400717 discloses a slow-scan TV system including video transceiver apparatus.

According to the present invention, there is provided an audio/video transceiver apparatus comprising: input means for receiving audio/video source information; compression means, coupled to said input means, for compressing said audio/video source information into a compressed digital representation thereof which is capable of being transmitted in a time compressed from having an associated burst transmission time period that is shorter than a time period associated with real time viewing by a receiver of said audio/video source information; storage means, coupled to said compression means, for storing the compressed digital representation of said audio/video source information; and output means, coupled to said storage means, for receiving the compressed audio/video source information stored in said storage means and for transmitting said compressed representation of said audio/video source information away from said audio/video transceiver apparatus in said burst transmission time period.

The invention also provides a corresponding method of handling audio/video source information, the method comprising: receiving audio/video source information; compressing the received audio/video source information into a compressed digital representation thereof which is capable of being transmitted in a time compressed form having an associated burst transmission time period that is shorter than a time period associated with a real time viewing by a receiver of the received audio/video source information; storing said compressed digital representation of the received audio/video source information; and transmitting, in said burst transmission time period, the stored compressed representation of the received audio/video source information to a selected destination.

An information transfer network is also provided, comprising a plurality of such transceivers.

Furthermore, the invention provides a method for handling audio/video source information, the method comprising: receiving audio/video source information as a compressed representation thereof, said audio/video source information comprising a multiplicity of frames in the form of one or more full motion video programs selected from a video library storing a multiplicity of full motion video programs in a compressed digital representation thereof for selective retrieval, said compressed digital representation of the received audio/video source information being received in an associated burst transmission time period that is shorter than a time period associated with a real time viewing by a receiver of said received audio/video source information; storing the compressed digital representation of said received audio/video source information; and transmitting, in said burst transmission time period, the stored compressed digital representation of said received audio/video source information to a selected destination.

In one embodiment, the video program is received via a fibre optic port, a microwave transceiver, an RF receiver, or other input means. The video signal is typically a digital compressed video signal which may be provided by another transceiver device in accordance with the invention or a centrally located video library.

The transceiver apparatus may comprise a video recording device which typically includes an editor for editing the digital compressed video signal stored in memory.

The transceiver device may include compression/decompression circuitry for decompressing a compressed digital video signal and converting the decompressed digital video signal to an analog signal for subsequent viewing. In one embodiment, the transceiver device also includes a second memory (which can be,

for example, a magnetic tape cassette, optical disc, or other recording media) for receiving the decompressed analog video signal for subsequent viewing.

In another embodiment, the transceiver device includes input means for receiving a video signal at conventional speeds, such as an RF tuner used to receive conventional analog video signals, a camera input line for receiving an input signal from a TV camera, or other type of input means. The signal received by this input means can be stored in the second memory, and/or digitized, compressed and stored in the first memory, and/or viewed on a television monitor.

In another embodiment, the transciever device can receive digital video signals at conventional speeds as well.

These and other advantages of my invention are better understood with reference to the drawings and detailed description below.

Fig. 1 is a perspective view of the housing of the audio/video recorder editor/transceiver ("VCR-ET") disclosed and embodying the invention.

Fig. 1A is an enlarged view of the circled area of Fig. 1.

Fig. 2 is a functional block diagram of the VCR-ET of Fig. 1.

Fig. 2A is a functional block diagram of the VCR-ET of Fig. 1 including circuitry for demodulating a video signal encoded using the Vokac technique.

Fig. 3 is a functional block diagram of a VCR-ET in accordance with another embodiment of the invention.

Fig. 4 is a functional block diagram of an audio recorder/transceiver constructed in accordance with the invention.

Fig. 5 illustrates a plurality of VCR-ET's adapted to receive video signals from a remotely located video library via a common communication channel.

Fig. 6 illustrates a carrier signal modulated using the Vokac modulation technique, described in greater detail below.

Referring to the drawing by reference characters, Figs. 1 and 2 illustrate an improved audio/video recorder editor/transceiver 10 (VCR-ET) comprising an audio/video recording unit (AVRU) 11, a video control unit (VCU) 12, memory 13, digital control unit (DCU) 14, video line or camera input line 15, TV RF tuner 16, auxiliary digital input port 17, fiber optic input/output port 18, RF modulator 19, RGB converter with synchronizer 21, and an audio/video transmitter/receiver 22 with keypad 45, all in a common housing.

The audio/video recording unit AVRU 11 may be a video cassette recorder similar to a conventional VCR in which the storage media 23 is a magnetic tape. Alternatively AVRU 11 may operate with other types of storage media including, but not limited to, optical discs, CD-ROMs or other magnetic tape formats. AVRU 11 has all the functions of the typical VCR including record, play, rewind, slow motion, fast-forward and single frame hold.

An alternate form of storage media for use in AVRU 11 is the CD-ROM, which is a disk using a derivative o glass or plastic in conjunction with an aluminum or othe metallic coating. Audio and video signals are stored i the form of irregularities in the aluminum coated surfac and are read using a low power laser. In this case, th user would not be able to store or write on the CD-ROM but would be able to play discs that have been recorde and distributed commercially. The storage of video an audio signals on the CD-ROM is in digital form which i readily accommodated by the video recorder of this in vention.

Instead of using a CD-ROM, VCR-ET 10 can us optical discs as media 23. Such optical discs are simil to a CD-ROM and use a variable power laser to rea from or write on the disc.

A first type of optical disc is a WORM (Write Onc Read Many) optical disc. This device has the unique c pability of writing on the disc permanently. A laser used to change the magnetic or optical properties of t media. A lower-powered laser is then used to read t data from the disc. Data, in this case, is permanen recorded; it may neither be erased nor written over. further description of this technology can be found in t November 1988 issue of The Electronic System Desi magazine (ESD) pages 55-56.

A second and preferred type of optical disc to used in AVRU 11 is an erasable optical disc. This d has full read/write/erase capabilities. With this di AVRU 11 has the same record/playback capabilities a conventional VCR. As an example, erasable opti discs are used in Steven Jobs' "Next" machine as scribed in Infoworld, Volume 10, issue 42, pages 51 a 93, October 17, 1988. In addition, the random acc capabilities of the erasable disc (and of the CD-R and WORM) provide additional benefits as will be cussed in a later part of this specification.

A key element of VCR-ET 10, which is partly sponsible for its improved functionality, is the video c trol unit or VCU 12. The VCU comprises an analo digital converter (ADC) 24, a digital to analog conve (DAC) 25, a compressor/decompressor 26, a contr 27, a central processing unit (CPU) 28 and a ran access memory (RAM) 29. VCU 12, using these ments, accomplishes the digitization and compres of analog signals as well as the reverse process in wh the compressed digital signals are decompressed converted back to analog signals.

As a first step in the processing of the comp video signals within VCU 12, the sync signals are coded to isolate signals for each picture frame processing.

The video signals defining each frame may the converted to a red analog signal, a green analog si and a blue analog signal in a conventional manner. red, green and blue analog signals are then conv to digital form by the analog to digital converter (24. The frame is divided into a set of closely positi rows and columns of picture elements or "pixels."

pixel has a color defined by a set of three digital values defining strength of the primary color components, red, green and blue (RGB) respectively. In one embodiment, each frame is divided into an array of 300 by 300 pixels, with the color and luminance of each pixel being defined by a seven bit word for the red component, a seven bit word for the blue component, and a seven bit word for the green component. These words are generated by ADC 24. The RGB video signal may also be processed by means of hue-saturation-intensity (HSI) color processing, where appropriate, as described in "Chips for Real-Time Comparisons," Electronic Engineering Times, issue 525, February 13, 1989, page 122.

If each frame includes 90,000 pixels (300 x 300), and each pixel is defined by 21 bits (7 bits per primary color), the digital representation of a single video frame utilizes a sizable block of digital information (i.e., 1.89 megabits/frame) which must be processed very rapidly. (Approximately 30 frames/second are received from AVRU 11.) Fortunately the analog to digital conversion of these signals may be accomplished at the desired speed using commercially available analog to digital converter integrated circuits. The analog to digital converter 24 (ADC) is a high-speed, high-accuracy, A to D "flash" converter available as a single IC (integrated circuit). Several different types of such A/D converters are available from Burr-Brown, one of which is the ADC 600. Part number TIC024, manufactured by Tektronix, Inc. is also appropriate. Other types of devices appropriate for this function are described in an article by K. Rogers entitled "8-bit A/D Flash Hits 500 Msamples", Electronic Engineering Times, Dec. 12, 1988, page 90.

Compression of the digital data defining a video frame and the reverse process (decompression) are accomplished by compressor/decompressor 26. Various algorithms may be employed in the compression process which enable the representation of a series of numbers by a reduced number of digits. As an example, compression algorithms like CCITT Group IV may be used.

In one optional embodiment, to further reduce the amount of memory required to store a program, the compression algorithm can simply record data corresponding to only those pixels which change color from one frame to the next. This results in considerable memory space savings, since not all pixels change color each frame. Basing calculation upon 10% of the pixels changing from one frame to the next, it is estimated that memory requirements using this technique are cut by about 90%. It is also estimated that on the average, the CCITT Group IV algorithm can cut memory requirements by another 95%. Thus, if no data compression technique is used, it would take approximately 51.03 gigabytes to store a 2 hour video program, but by using the above compression techniques, it is estimated that memory 13 will require only 250 megabytes.

Controller 27 handles timing and aids in the communication between the different elements of VCU 12, and between VCU 12, AVRU 11 and memory 13.

In one embodiment, the audio portion of the program is periodically sampled and digitized by analog to digital conversion. In one embodiment, this is done at a sample rate of 88,000/second, one byte per sample, to yield compact disc quality sound. The sampling rate could be dropped to reduce memory requirements. Also, the audio data can be compressed with conventional algorithms.

The process of converting either from analog to digital or from digital to analog requires memory for intermediate storage. Random Access Memory (RAM) 29 serves in this capacity. For this purpose either a DRAM (Dynamic RAM) or a SRAM (static RAM) may be employed. An example of a DRAM is the TI (Texas Instruments) TMX4C1024; an example of a SRAM is the INMOS IMS-1203. RAM 29 should have sufficient capacity to store at least two full uncompressed frames (e.g., about 472 KB).

The CPU (Central Processing Unit) 28 is a microprocessor which controls the digitization process of VCU 12. CPU 28 works with controller 27 to control and communicate with the other elements of the VCU. There are numerous commercially available microprocessors that are appropriate for this application. The Intel 80286, Intel 80386, Motorola 68020, and Motorola 68030 are examples. A more complete description of the microprocessors can be found in the October 27, 1988 issue of Electronic Design News (EDN), pages 231 and 242, or in the applicable data sheets.

Controller 27, CPU 28 and RAM 29 serve in the same manner during the reverse processes, i.e., decompression and digital to analog conversion. Decompression is first accomplished in compressor/decompressor 26. The decompressed digital signal is then converted to an analog signal by digital to analog converter (DAC) 24 (assuming its destination requires an analog form). In the course of converting the decompressed signals from the VCU 12 for use by the AVRU 11 the signals are synchronized by the time base generator (TBG) or corrector 48. TBG generator 48 inserts synchronization pulses into the signal provided by VCU 12 to identify individual raster scan lines and frames so that the resulting signal can be used by a conventional television set or VCR. TBG 48 can be bypassed by shunt switch 48' for the purpose of transmitting either compressed or decompressed signals from VCU 12 directly to the AVRU 11 in an uncorrected time based mode.

DAC 25 provides the inverse of the function performed by A/D converter 24. DAC 25 is a high-speed, high accuracy digital to analog converter. An example of such a converter is the Burr-Brown DAC60 digital to analog converter.

Different types of memory technologies are adaptable for use in memory 13. As mentioned earlier, DRAM and SRAM semiconductor memories are commonly used for applications of this type and are readily available.

One type of random access memory is CMOS (Complimentary Metal Oxide Semiconductor). The CMOS memory has the advantage of a relatively low power requirement and is readily adaptable for use with battery backup for semi-permanent data storage. Other types of memory include the above mentioned optical disc memories, bubble memories and magnetic discs. Another appropriate data storage media may be "Digital Paper" available from ICI Image data of Wilmington, Delaware.

Emerging memory technologies may also prove advantageous with capabilities for mass data storage in even smaller physical dimensions.

Digital Control Unit (DCU) 14 comprises a CPU (Central Processor Unit) 31, a ROM (Read Only Memory) 32 and a controller 32. DCU 14 is responsible for all of the digital editing processes. Through the use of DCU 14, video segments may be edited and rearranged. Thus, one may use DCU 14 to rearrange the scenes in a program, alter the program sound track, etc.

In addition, a program may be edited, one frame at a time, by changing the contrast, brightness, sharpness, colors, etc. (Alteration of the contrast, brightness, sharpness and colors can be automated as well.) In one embodiment, images can be rotated, scaled (i.e., made larger or smaller), etc. In addition, pixel by pixel editing can be accomplished by DCU 14, e.g., in a manner similar to a PC paint program. Similar editing features can be incorporated for the audio portion of each program. In one embodiment, a display such as a flat panel video display (not shown) is built into the VCR-ET. A user interface control panel of DCU 14 allows a user to select a desired frame number from a menu on the display. The VCR-ET then displays a strip of frames (including several frames before and after the selected frame). The user can delete frames in a strip, select a point where other frames are to be inserted into the program, or edit different frames (i.e., alter contrast, brightness, sharpness, colors, etc.). In one embodiment, a user input device such as a light pen or mouse can be used to select individual frames in a strip for editing.

Instead of incorporating a flat display into VCR-ET 10, in another embodiment, a television coupled to output lead 42 of RF modulator 19 can be used during editing.

CPU 31 is a microprocessor of the type described in connection with the CPU 28 of VCU 12. Controller 33 is an integrated circuit which handles the timing and interfacing between DCU 14 and memory 13. ROM 32 holds the necessary step-by-step editing programs which are installed at the factory. A currently available example of a suitable ROM for this application is the Texas Instruments part TMS47256. CPU 31 and controller 33 together control the editing process as they execute the programs stored in ROM 32.

The VCU 12, memory 13 and DCU 14 communicate with each other via a high speed data bus 34. The high speed data bus is required in order to meet bandwidth requirements. Examples of suitable data bus device: are Motorola's VME bus, Intel's Multibus and the Opto buss (U.S. Patent 4,732,446).

A video line or camera input line 15 is provided t enable VCR-ET 10 to receive an input signal from source such as a television camera, a conventiona VCR, a television tuner, or another VCR-ET, etc. Th signals received at input line 15 are typically carried b a coaxial cable and are in the form of a standard telev sion composite signal. As used throughout this specif cation, the words "standard television composite signa or its acronym STCS shall be read to include any on of the following: NTSC, PAL, SECAM, HDTV, or an American or European broadcast signal standards. (NT SC, PAL and SECAM are discussed in "Reference Dat for Radio Engineers", published by Howard W. Sams Co. in 1983.) An NTSC composite signal is defined a the analog signal that carries the chrominance (colo luminance (brightness), synchronization (timing) ar audio signals that make up the video signals receive and displayed by television and video cassette recor ers. These four components are combined into one si nal by modulating the components in different way (Amplitude modulation and phase modulation are e amples.) The standard video line signal is such a cor posite signal and may be received at input line 15 fro one of the above-mentioned sources.

TV RF tuner input port 16 also supplies a composi signal as described in regard to video input line 15. Th difference is that this signal is received from an antenn or cable TV coaxial cable. To receive such a signal, tun 16 is capable of being set or tuned to receive the desir carrier frequency or television channel.

Selector switch 35 is provided to select either vid input line 15 or TV RF tuner 16 as an input signal sour to AVRU 11.

Auxiliary digital input port 17 is employed to recei any acceptable digital signal such as a computer-ge erated video signal or as may be supplied by anoth VCR-ET. This signal, for example, may be an RGB vid signal such as that delivered to computer monitors, o may be a digitized audio signal. (As mentioned abo an RGB signal is a signal which communicates t strength of the red, green and blue color componei for the pixels that make up each video frame.) Swit 36 selects whether the digital video/audio input sig is chosen from auxiliary digital input port 17. Switch supplies the selected signal to high speed data bus which carries the signals in digital form.

Fiber optic port 18 incorporates a fiber optic tra ceiver. Port 18 is capable of transforming fiber op (light) signals to electrical signals or transforming el trical signals to fiber optic signals. Port 18 thus provic a capability for two-way communication between h speed data bus 34 and a fiber optic signal line. The corporation of fiber optic port 18 in the VCR-ET provic a capability for receiving audio/video signals from or livering audio/video signals to the fiber optic line s

as a fiber optic telephone line. The fiber optic line carries digital signals in the form of light waves over great distances with a high degree of accuracy and reliability and at a high speed (e.g., about 200 megabytes/second). The VCR-ET can receive/transmit a video program at an accelerated rate via fiber optic port 18 from/to a variety of sources. For example a video program may be communicated at an accelerated rate from the first VCR-ET to a second VCR-ET in less time than it would take to view the program. Thus, it is not necessary to access the optical fiber for long periods of time in order to transmit a long video program.

(Using fiber optic port 18, a movie can be downloaded in less than 10% of the time require to view the movie, and typically less than 1% of the time required to view the movie.) Thus, it is not necessary to access the optical fiber for long periods of time in order to transmit a long video program. Switch 37 is provided to select connection to the fiber optic input/output port 18. An OFF or open position is provided. The selected signal is delivered to or supplied from high speed data bus 34.

Switch 37 is provided to select connection to the fiber optic input/output port 18. An OFF or open position is provided. The selected signal is delivered to or supplied from high speed data bus 34.

Analog output signals from AVRU 11 are delivered to the common terminal 38 of a selector switch 39. When set to position A, switch 39 delivers the output signal of AVRU 11 directly to a video output line 41 as a standard STCS composite signal; when set to position B switch 39 delivers the output of AVRU 11 to the input of RF modulator 19. Modulator 19 converts the video signal to an RF-modulated composite signal for delivery to such devices as televisions and conventional VCR's. These types of devices play back the video program on a particular frequency channel (such as channel 4) on the television. Delivery to the television or VCR is via RF output line 42.

Digital output signals from VCR-ET 10 may be dispatched from high speed data bus 34 via line 43 to input leads of RGB converter 21 and audio/video transmitter/receiver 22.

RGB converter 21 converts the STCS signal into an RGB signal as required by computer monitors and similar display devices. The converted signal is received by a display device connected to RGB converter output line 44. (In another embodiment, digital signals may be dispatched from high speed data bus 34 via line 43 to the input lead of RGB converter 21.)

VCR-ET 10 includes audio/video transmitter/receiver 22 which is typically a built-in modem. Advantageously, the modem may be used to communicate an audio/video program over conventional phone lines in a manner similar to that described above with respect to optical fibers. The modem allows transfer of the audio/video signal in a digital format over the standard telephone line. Modems are commonly available for computers and are currently available in the form of a single integrated circuit. As an example, Sierra Semiconductor offers a 2400 baud single chip modem as part number SC111006. Representative manufacturers of these single modem IC's can be found in the April 14, 1988 issue of Engineering Design News (EDN), pages 124-125. Some of these single IC modems have the added capability of generating the tones for dialing a phone number. The destination phone number may be entered by means of an optional keyboard/keypad 45 incorporated in the video recorder 10 of the invention. Output port 46 of transmitter/receiver 22 connects directly to the telephone line.

Also associated with Modem 22 is an auxiliary keyboard 45' (Fig. 1A) of buttons for commanding the modem to perform tasks such as starting a transmission over phone lines (45a), terminating a transmission (45b), automatic telephone answering to receive transmissions (45c), using an optional speaker (not shown) to monitor phone lines (45d), using an optional microphone (not shown) to speak over the phone lines (45e) and for controlling the baud rate (45f).

The application and utilization of the VCR-ET may include a number of forms or operating modes. In its first and simplest operating mode, AVRU 11 may be operated in the manner of a conventional VCR with signals from an antenna being received by tuner 16 and recorded directly on media 23 in analog form. At the same time the received program may be viewed on the television screen with the television connected at video output terminal 42. An optional signal source for this type of operation is the video line or camera input line 15 selectable by switch 35.

In a second operating mode a program stored in media 23 of AVRU 11 may be played back and viewed on the connected television set.

When it is desired to copy a program from one recording media to another, the recording media holding the desired program is installed in the AVRU. The recording media is then played back with optional viewing on a connected television set or other TV monitor and/or listening through speakers (as appropriate). As the recording media is played back, the analog signals from the recording media (video and/or audio) are dispatched to VCU 12 via connection 47. The analog signals are converted to digital signals by ADC 24, compressed by compressor/decompressor 26 and the compressed digital signals are stored in memory 13. The foregoing operations are accomplished under the control of controller 27 and CPU 28. RAM 29 is used for interim data storage during this process. Once the complete video/audio program has been stored in memory 13, the recording media from which the stored program has just been read is replaced by blank recording media upon which the stored program is to be copied. CPU 28 in cooperation with controller 27 and RAM 29 then executes the decompression and digital to analog conversion of the program stored in memory 13, decompression taking place in compressor/decompressor 26, and digital to analog

conversion being accomplished by DAC 25. The resulting analog program is stored on the blank recording media which constitutes media 23 of AVRU 11.

In an alternate mode of operation, the decompression circuitry of VCU 12 can be bypassed. Thus, a user has the option of downloading the stored program from memory 13 onto recording media 23 in compressed digital format. The user can then reload the program from media 23 into memory 13 at a future time for viewing, editing or recording back onto recording media 23 in analog form. This capability allows the user to quickly clear memory 13 for other interim uses and also provides the user with a hard copy of the program in digital format. The hard copy in compressed digital format has a number of uses, e.g. it could be archived for later viewing, transmitted by an appropriate independent transmitter, etc.

During the foregoing procedures, DCU 14 may be utilized for editing operations. As the program is being read from the first or original recording media, it is simultaneously viewed on the TV screen, or listened to by means of an audio monitor, converted to digital signals, compressed and stored in memory 13. Once the digital audio/video program is stored in memory 13, editing is accomplished by the user through control of DCU 14, by means of a control panel (not shown) coupled to DCU 14. If desired, additional audio/video signals may be simultaneously entered into memory 13 and added to those received from VCU 12. The additional signals may be introduced from auxiliary digital input port 17 or from fiber optic input/output port 18 and may comprise video captions to be superimposed upon the stored video images, or they may be audio commentaries to be added to silent video presentations. In addition, as mentioned above, the order in which various segments appear in the video programs may be altered. Certain undesired segments, such as TV commercials, may be removed. This editing operation is accomplished under the control of DCU 14.

In still another operating mode, a program stored in media 23 of AVRU 11 or being received by AVRU 11 from input line 15 (as from a video camera) may be digitized and compressed by VCU 12 and routed via bus 34, to memory 13. The data from memory 13 is then routed to line 43, transmitter/ receiver 22 and to a telephone line (or to fiber optic port 18 and to an optical fiber). At the other end of the telephone line (or optical fiber) the signals received are processed by another VCR-ET.

Once received in the second VCR-ET's memory 13, the digitized program can then either be viewed directly from memory or transferred to storage medium 23, either in its entirety or in random segments, based on user preference.

In the case of video camera input at input 15 the transmitted signals may comprise a live transmission. Alternatively the transmitted program may be derived from a program stored in media 23 of AVRU 11. In this case the stored analog program is again decoded, di itized, compressed and transmitted via bus 34 to mer ory 13. The data in memory 13 is then communicat via line 43 and transmitter/receiver 22 to telephone lin or other output means (e.g. fiber optic port 18).

It follows, of course, that digitized video and aut signals from the remote VCR-ET at the other end of t telephone line may be received at line 46, entered ir memory 13 via transmitter/receiver 22, converted to a alog signals by VCU 12, and recorded on media 23 a then viewed, if desired, on a television set connectec output 42. A hard copy of the program may also be ma for later viewing.

As mentioned earlier, when any of the foregoing erations entail the processing of unmodulated video s nals, such signals must first be processed by RF m ulator 19 before they can be accepted by devices su as a conventional VCR or television set; when the m itoring means is a computer monitor or a similar disp device the signals are processed by RGB converter

All of the foregoing operations are performed v enhanced quality and efficiency by virtue of the dig rather than analog, storage and transmission mo and the compressed data storage mechanism, with ditional advantages of improved cost and reliability forded in the case of tape to tape (or other media to dia) program transfers by virtue of the requiremen only a single tape deck or other storage device.

In an alternative embodiment, either in place of f optic port 18 or in addition to fiber optic port 18, a mi wave transceiver 18' is provided for transmitting an receiving a video program via microwave. In con tional microwave technology, satellite systems anc crowave transmitters transmit data using a low po high frequency signal. In an embodiment of the in tion designed to receive microwaves, transceiver 1 cludes an amplifier for amplifying the microwave si and a demodulator for obtaining the video program nal from the microwave signal. Receiving, ampli and demodulating the microwave signal can be ac plished with conventional microwave transceiver e ment. The video program signal is typically in pressed digital form, and may be stored, viewed c ited as in the above-described embodiments. Videc gram data from memory 13 can also be transmitte the microwave transceiver, thereby providing the c bility for microwave transmission of stored video grams in compressed digital format. Thus, the inve can be used to receive and transmit programs vi crowaves at an accelerated rate similar to and abc fast as, the transmission and reception of programs optical fibers. This feature allows transmission ar ception of programs in a few minutes or seconds currently available technology. Both point-to-poi crowave transceivers and satellite transceivers m used.

In one embodiment, VCR-ET 10 receives vide grams which are downloaded from a remotely lc

video library 100 (Fig. 5) at an accelerated rate via microwave transceiver 18'. After downloading, the program may be viewed, stored in memory, edited and/or a hard copy of the program may be made on magnetic tape, optical disk, etc. Thus, a VCR-ET owner who subscribes to video library 100 may request (via telephone or other means) that a particular film be downloaded via microwave to the subscriber's VCR-ET, e.g., VCR-ET 10. Other subscribers may simultaneously request that other movies be downloaded into their VCR-ET's 10a to 10d (Fig. 5) via microwave. Library 100 transmits a video signal corresponding to the various movies requested by various users in series.

In one embodiment, each VCR-ET includes a memory device 90 (shown in phantom in Fig. 2) for storing a subscriber's identification code unique to that VCR-ET. As the video library broadcasts signals via microwaves, prior to commencement of each signal corresponding to a movie (or other video program), the library broadcasts a preamble signal including the subscriber's code corresponding to the VCR-ET for whom the movie signal is intended. Each VCR-ET includes a monitoring circuit 92 for monitoring the microwave signal received by microwave transceiver 18'. When transceiver 18' receives a preamble signal corresponding to the subscriber code stored in memory device 90, VCR-ET 10 stores the video signals received thereafter in memory 13 for subsequent viewing. In this way the video library may broadcast, in series, compressed video signals at an accelerated rate to be downloaded into VCR-ET's owned by various subscribers. If a plurality of subscribers request the same film, the library broadcasts a signal preamble containing the plurality of subscribers' codes corresponding to the VCR-ET's of each subscribing VCR-ET owner who requested that film, so that each requesting subscriber simultaneously receives the requested film. In one embodiment, the VCR library prioritizes the order in which films are broadcast based upon the number of subscribers requesting each film.

In another embodiment, a plurality of VCR-ET's are coupled via their optical fiber port 18 and a common optical fiber to the video library. In yet another embodiment, instead of receiving signals from the video library using microwaves or optical signals, such video signals are received via radio waves of a frequency such as are used to communicate conventional television signals. In one such embodiment, these radio wave signals are modulated using a technique described in U.S. patent 4,613,974, issued to Vokac et al. on September 23, 1986. In the Vokac modulation technique, the sine waves that make up the radio signals are modified to include what Vokac refers to as "audel levels" i.e. a relatively flat signal portion 110 between the peaks 112 and troughs 114 of the sine waves (see Figure 6). In one embodiment, TV RF tuner 16 is coupled to Vokac demodulation circuitry 16 (Fig. 2A) which is capable of demodulating signals encoded using Vokac's technique, and downloading these signals via lead 94 to memory 13.

The use of Vokac's technique in this embodiment is important because Vokac's technique allows for a single carrier signal to be modulated by two other signals. A first of these two other signals is used to modulate the carrier to encode data by introducing into the carrier Vokac's "audel levels" 110. In addition, the carrier may be phase, amplitude or frequency modulated using the second other signal. In this way, an electro-magnetic carrier signal in the radio or television band may be encoded with two information signals. The first of these signals may be a conventional commercial television program, impressed upon the carrier signal via phase modulation (or frequency or amplitude modulation) and destined for televisions owned by people who do not subscribe to the video library. The second signal may be audel-level encoded with data corresponding to a compressed digital video signal destined for subscribers, whose VCR-ET decodes the audel levels (using the circuitry disclosed in the Vokac patent) and loaded into memory 13 for subsequent viewing.

As described in the Vokac patent, between each peak 112 of Vokac's signal and an audel level is a first portion 116 of a first transition region, and between each audel level and a signal trough is a second portion 118 of the transition region. When demodulating signals modulated with Vokac's technique, the demodulation circuitry may be responsive to the slope of the first and second portions 116, 118 of the transition regions, or it may be responsive to the magnitude of the audel level 110, directly.

In the embodiment in which compressed video signals are transmitted by an electro-magnetic carrier signal in the radio or television band, monitoring circuit 92 may be coupled to TV RF tuner 16 instead of microwave transceiver 18'.

Fig. 3 illustrates an alternative embodiment invention in which AVRU 11 is not integral with VCU 12, memory 13 or editor 14. In this embodiment, AVRU 11 is a conventional, commercially available VCR which receives a modulated video input signal on an input cable 50. In this embodiment AVRU 11 includes a RF tuner 51 for demodulating the input signal so it can be stored in media 23. AVRU 11 also includes a RF modulator 52 for modulating the signal received from media 23 and providing the RF modulated output signal on an output cable 53, which can be coupled to a television set. (TV RF tuner 51 and RF modulator 52 are provided in typical commercially available VCR's.) A switch 54 is provided to couple input cable 50 to output cable 53 when media 23 is not serving as a video signal source. The VCR-ET of this embodiment includes a TV RF tuner 55 which receives and demodulates the signal on cable 53, and provides the resultant analog audio/video signal on a lead 56, which is digitized and compressed as described above. In this alternative embodiment, the digitized compressed signal may be processed as described above, e.g. stored in memory 13 (via high speed bus

34), edited, transmitted by the fiber optic port 18 to another VCR-ET, etc. When it is desired to view a program stored in memory 13, data from memory 13 is decompressed and converted to an analog signal by VCU 12, and the resulting signal is provided on an output lead 57 to a RF modulator 58, which modulates the video signal so that it can be received and stored by AVRU 11 or viewed on a television coupled to cable 53. (As mentioned above, in the Fig. 3 embodiment, AVRU 11 is a conventional VCR.)

One advantage of the embodiment of Fig. 3 is that many people already own VCR's. Rather than buying apparatus which duplicates much of the hardware already present in their VCR, the embodiment of Fig. 3 would provide to owners of conventional VCR's capabilities which are otherwise currently unavailable.

In one embodiment, analog auxiliary audio and video input terminals 62, 64 are provided so that analog signals may be provided by alternate sources to VCU 12.

The embodiments described include means for receiving, storing and transmitting both audio and video signals. However, the invention encompasses apparatus which can store and transmit video signals only and apparatus which can store and transmit audio signals only. An embodiment designed to store and compress audio signals is illustrated in Fig. 4. Referring to Fig. 4, an audio signal source 70 (a tape recorder, microphone, record player, etc.) is coupled to a digitizer and compressor circuit 72, which converts the analog signal to a digital signal and compresses the digital signal in a manner similar to VCU 12 described above. (Audio signal source 70 may also be a CD player which provides digital audio signals, in which case circuit 72 merely compresses but does not digitize the CD player output signal.) The digital compressed signal can then be stored in a memory 74. Of importance, data from memory 74 can be transmitted by a fiber optic transceiver 76, or by a microwave transceiver 78 at an accelerated rate. This is important not only in a home entertainment application, but in other applications as well. For example, a user can dictate an audio presentation and send it to a remote location (e.g. an office) at an accelerated rate without having to monopolize the transmission medium (e.g. the fiber optic cable) for an extended length of time.

The business uses of the embodiment illustrated in Fig. 4 makes home offices feasible for many workers now confined to more traditional offices and also opens new possibilities to business people who are traveling.

In the embodiment of Fig. 4, data can also be loaded from memory 74, via a modem 79 over a conventional phone line 80. Data can also be received from phone line 80, fiber optic transceiver 76 or microwave transceiver 78, loaded into memory 74, and converted to an analog signal by circuit 72, to be listened to via an audio monitor 82, or to be stored on an audio tape cassette 84 or other storage media.

An editor 86 is optionally provided so that the data in memory 74 may be edited, e.g., by rearranging th order of portions of the audio program, increasing or d creasing the volume of portions (or different frequen components) of the audio program, or enhancing the a dio program through filtering techniques (e.g. to remo static and noise).

It will be apparent to those skilled in the art that v ious changes and modifications may be made to t above-described embodiments without departing fr the spirit of the invention or from the scope of the a pended claims. For example, the VCR-ET can be c structed so as to be portable. Thus, it could be carri to a location where it is desired to record a program w a video camera, and used to edit the program after i recorded. Also, in one embodiment, video library 1 can download video programs via optical fiber or otl means. Also, in other embodiments, an audio librar provided to download digital compressed audio signa Other modifications will be apparent to those skilled the art in light of the present specification.

Claims

1. An audio/video transceiver apparatus comprisi

   input means (11) for receiving audio/vi source information;

   compression means (12), coupled to said ir means, for compressing said audio/vi source information into a compressed di representation thereof which is capable of ing transmitted in a time compressed form l ing an associated burst transmission time p od that is shorter than a time period associ with real time viewing by a receiver of saic dio/video source information;

   storage means (13), coupled to said comp sion means, for storing the compressed di representation of said audio/video source i mation; and

   output means (22) coupled to said sto means, for receiving the compressed d representation of said audio/video source i mation stored in said storage means an transmitting said compressed digital repre tation of said audio/video source inform away from said audio/video transceiver a ratus in said burst transmission time peric

2. An apparatus as claimed in claim 1 comprisin iting means (14), coupled to said storage m for editing the compressed representation of audio/video source information stored in said age means and for restoring the edited compre representation of said audio/video source inf tion in said storage means; and wherein said c means is operative for receiving the edited

pressed representation of said audio/video source information stored in said storage means for transmission away from said audio/video transceiver apparatus.

3. An apparatus as claimed in claim 2 comprising monitor means for enabling the user to selectively identify the compressed representation of said audio/video source information stored in said storage means during editing.

4. An apparatus as claimed in claim 2 comprising recording means, including a removable recording medium, coupled to said storage means, for storing the edited compressed representation of said audio/video source information stored in said storage means onto said removable recording medium.

5. An apparatus as claimed in claim 4 comprising monitor means for enabling the user to selectively view the compressed representation of said audio/video source information stored on said removable recording medium.

6. An apparatus as claimed in claim 2 comprising external video tape recorder means, coupled to said output means, for storing the edited compressed representation of said audio/video source information stored in said storage means onto magnetic tape.

7. An apparatus as claimed in claim 1 wherein the output means comprises a fiber optic output port for coupling the apparatus to a fiber optic transmission line.

8. An apparatus as claimed in claim 1 wherein the output means comprises a modem for coupling the apparatus to a telephone transmission line.

9. An apparatus as claimed in claim 1 wherein:

said audio/video source information comprises analog audio/video source information;
said audio/video transceiver apparatus further comprises analog to digital converter means for converting said analog audio/video source information to corresponding digital audio/video source information;
said compression means is operative for compressing said corresponding digital audio/video source information into a digital compressed representation thereof; and
said storage means is operative for storing said digital compressed representation of said corresponding digital audio-video source information.

10. An apparatus as claimed in claim 9 wherein said input means is coupled to an external television camera and said analog audio-video source information comprises information received from said external television camera.

11. An apparatus as claimed in claim 9 wherein said input means is coupled to an external analog video tape recorder and said analog audio/video source information comprises information received from said external analog video tape recorder.

12. An apparatus as claimed in claim 9 wherein said input means is coupled to an external television RF tuner and said analog audio/video source information comprises information received from said external television RF tuner.

13. An apparatus as claimed in claim 9 wherein said input means comprises television RF tuner means coupled to an external television antenna and said analog audio/video source information comprises information transmitted by a remotely located television transmitter.

14. An apparatus as claimed in claim 9 wherein said input means comprises television RF tuner means coupled to an external cable television system and said analog audio/video source information comprises information received from said external cable television system.

15. An apparatus as claimed in claim 9 comprising:

decompression means, coupled to said storage means, for selectively decompressing the digital compressed representation of said corresponding digital audio/video source information stored in said means; and
editing means, coupled to said storage means and decompression means, for editing the decompressed digital compressed representation of said corresponding digital audio/video source information and for then storing the edited decompressed digital compressed representation of said corresponding digital audio/video source information in said storage means.

16. An apparatus as claimed in claim 15 comprising monitor means for enabling the user to selectively view the decompressed digital compressed representation of said corresponding digital audio/video source information during editing.

17. An apparatus as claimed in claim 9 comprising:

decompression means, coupled to said storage

means, for selectively decompressing the digital compressed representation of said corresponding digital audio/video source information stored in said storage means; and
monitor means, coupled to said decompression means, for enabling the user to selectively view the decompressed digital compressed representation of said corresponding digital audio-video source information.

18. An apparatus as claimed in claim 9 comprising a video tape recorder for providing said analog audio/video source information.

19. An apparatus as claimed in claim 1 wherein:

said audio/video source information comprises digital audio/video source information;
said compression means is operative for compressing said digital audio/video source information into a digital compressed representation thereof; and
said storage means is operative for storing said digital compressed representation of said digital audio/video source information.

20. An apparatus as claimed in claim 19 wherein said input means is coupled to an external computer and said digital audio/video source information comprises computer-generated audio/video information.

21. An apparatus as claimed in claim 19 wherein said input means comprises a fiber optic input port coupled to a fiber optic transmission line and said digital audio/video source information comprises information received over said fiber optic transmission line.

22. An apparatus as claimed in claim 19 comprising:

decompression means, coupled to said storage means, for selectively decompressing the digital compressed representation of said digital audio/video source information stored in said storage means; and
editing means, coupled to said storage means and decompression means, for editing the decompressed digital compressed representation of said digital audio/video source information;
said storage means thereafter being operative for storing the edited decompressed digital compressed representation of said digital audio/video source information in said storage means.

23. An apparatus as claimed in claim 22 further comprising monitor means for enabling the user to selectively view the decompressed digital compressed representation of said digital audio-video source information during editing.

24. An apparatus as claimed in claim 19 comprising:

decompression means, coupled to said storag means, for selectively decompressing the dig ital compressed representation of said digit audio/video source information stored in sai storage means; and
monitor means, coupled to said decompressio means, for enabling the user to selectively vie the decompressed digital compressed repre sentation of said digital audio-video source ir formation.

25. An apparatus as claimed in claim 19 comprisin CD-ROM means for providing said digital audio/vi eo source information.

26. An apparatus as claimed in claim 19 comprisir erasable optical disc means for providing said di ital audio/video source information.

27. An apparatus as claimed in claim 1 comprising:

decompression means, coupled to said storag means, for selectively decompressing sa compressed representation of said audio/vide source information stored in said storag means; and
editing means, coupled to said storage mea and decompression means, for editing said s lectively decompressed compressed represe tation of said audio/video source informatic and for storing said edited selectively deco pressed compressed representation of said a dio/video source information in said stora means.

28. An apparatus as claimed in claim 27 comprising cording means, including a removable recordi medium, coupled to said storage means, for stori the edited decompressed compressed represen tion of said audio/video source information stor in said storage means.

29. An apparatus as claimed in claim 27 comprising ternal video tape recorder means, coupled to s output means, for storing the edited decompress compressed representation of said audio/vid source information stored in said storage mens o magnetic tape.

30. An apparatus as claimed in claim 1 comprising:

decompression means, coupled to said stora means, for selectively decompressing s compressed representation of said audio/vic

source information stored in said storage means; and
editing means, coupled to said storage means and decompression means, for editing said selectively decompressed compressed representation of said audio/video source information;
wherein said compression means is operative for recompressing the edited selectively decompressed compressed representation of said audio/video source information; and
wherein said storage means is operative for storing the recompressed selectively decompressed compressed representation of said audio/video source information.

31. An apparatus as claimed in claim 1 comprising:

decompression means, coupled to said storage means, for selectively decompressing the compressed representation of said audio/video source information stored in said storage means; and
monitor means for enabling the user to view the selectively decompressed compressed representation of said audio/video source information.

32. An apparatus as claimed in claim 31 comprising:

recording means, including a removable recording medium, coupled to said decompression means, for storing the selectively decompressed compressed representation of said audio/video source information on aid hard copy storage medium; and
wherein said monitor means is operative for enabling the user to view the selectively decompressed compressed representation of said audio/video source information stored on said removable recording medium.

33. An apparatus as claimed in claim 31 comprising external video tape recorder means, coupled to said output means, for storing the selectively decompressed compressed representation of said audio/video source information onto magnetic tape.

34. An apparatus as claimed in claim 1 comprising recording means, including a removable recording medium, coupled to said storage means, for storing the compressed representation of said audio/video source information stored in said storage means onto said removable recording medium.

35. An apparatus as claimed in claim 1 comprising:

decompression means, coupled to said storage means, for selectively decompressing the compressed representation of said audio/video source information stored in said storage means; and
recording means, including a removable recording medium, coupled to said decompression means, for storing the selectively decompressed compressed representation of said audio/video source information stored in said storage means.

36. An apparatus as claimed in claim 1 comprising:

decompression means, coupled to said storage means, for selectively decompressing the compressed representation of said audio/video source information stored in said storage means; and
external video tape recorder means, coupled to said output means, for storing the selectively decompressed compressed representation of said audio/video source information stored in said storage means.

37. An apparatus as claimed in claim 1 comprising editing means, coupled to said storage means, for editing said compressed representation of said audio/video source information and for then storing the edited compressed representation of said audio/video source information in said storage means.

38. An apparatus as claimed in claim 1 wherein said input means and output means comprises microwave transceiver means, coupled to a microwave link, for receiving said audio/video source information over said microwave link and for transmitting said compressed audio/video source information stored in said storage means over said microwave link.

39. An apparatus as claimed in any preceding claim wherein the storage means comprises an optical disc, a semiconductor memory, a bubble memory, digital paper, or one or more magnetic discs.

40. An audio/video information transfer network comprising a plurality of audio/video transceivers coupled via one or more communications links, each of the audio/video transceivers comprising:

input means (11) for receiving audio/video source information;
compression means (12), coupled to said input means, for compressing said audio/video source information into a compressed digital representation thereof which is capable of being transmitted in a time compressed form having an associated burst transmission time period that is shorter than a time period associated

with a real time viewing by a receiver of said audio-video source information;
storage means (13), coupled to said compression means, for storing the compressed digital representation of said audio/video source information;
output means (22) coupled to said storage means and to one of said one or more communications links, for receiving the compressed representation of said audio/video source information stored in said storage means for transmission in said burst transmission time period to another one of said plurality of audio/video transceivers.

41. A network as claimed in claim 40 wherein said input means of one of said plurality of audio/video transceivers comprises a fibre optic input port, said output means of another one of said plurality of audio/video transceiver apparatus comprises a fibre optic output port, and one of said one or more communication links comprises a fibre optic transmission line coupled between said fibre optic input port and said fibre optic output port.

42. A network as claimed in claim 40 wherein said output means of one of said plurality of audio/video transceiver apparatus comprises a modem and one of said one or more communications links comprises a telephone transmission line.

43. A network as claimed in claim 40 wherein at least one of said audio/video transceivers comprises recording means, including a removable recording medium, coupled to said storage means, for storing the compressed representation of said audio/video source information stored in said storage means onto said removable recording medium.

44. A network as claimed in claim 40 wherein at least one of said audio/video transceivers comprises:

decompression means, coupled to said storage means, for decompressing the compressed representation of said audio/video source information stored in said storage means; and
recording means, including a removable recording medium, coupled to said decompression means, for storing the decompressed compressed representation of said audio/video source information onto said removable recording medium.

45. A network as claimed in claim 43 or 44 wherein said recording means comprises a video tape recorder and said removable recording medium comprises magnetic tape.

46. A network as claimed in claim 43 or 44 wherein sai recording means comprises a write once read man (WORM) optical disc drive and said removable re cording medium comprises one or more WORI discs.

47. A network as claimed in claim 43 or44 wherein sa recording means comprises an erasable optic disc drive and said hard copy storage medium cor prises one or more erasable optical discs.

48. A network as claimed in any one of claims 40 - wherein the storage means comprises an optic disc memory or a semiconductor memory.

49. A network as claimed in any one of claims 40 - wherein said storage means of one of said plural of audio/video transceiver apparatus stores a brary comprising a multiplicity of items of audio/v eo source information in said compressed rep sentation for selective transmission in said asso ated burst transmission time period to another o of said audio/video transceivers.

50. An audio/video transceiver apparatus as claimec claim 1, in which

said input means is arranged for receiving alog and/or digital audio/video source inform tion; and comprising
analog to digital converter means for conver analog audio/video source information ceived at said input means to correspond digital audio/video source information;
digital to analog converter means for conver digital audio/video source information recei at said input means to corresponding ana audio/video source information; and whe said
compression means comprises compres decompressor means for compressing di audio/video source information received at input means or said corresponding digital dio/video source information received from analog to digital converter means into a c pressed representation of said digital or cc sponding digital audio/video source infor tion, said compressor/decompressor me being further operative for decompressing compressed representation into a dec pressed real time representation of said di or corresponding digital audio/video sourc formation; and comprising
central processing unit means for contr operation of said compressor/decompre means;
wherein said storage means for storing compressed representation of said digit

corresponding digital audio/video source information further being arranged for storing said decompressed real time representation of said digital or corresponding digital audio/video source information; and comprising
controller means for enabling communication between said compressor/decompressor means, said central processing unit means, and said storage means; and wherein
said output means is arranged for receiving said time compressed representation of said digital or corresponding digital audio/video source information stored in said random access storage means for transmission away from said audio/video transceiver apparatus.

51. An apparatus as claimed in claim 50 comprising time base generator mean for supplying timing information for association with the compressed representation of the digital or corresponding digital audio/video source information.

52. An apparatus as claimed in claim 50 comprising audio/video recording means including a recording medium for recording said analog or corresponding analog audio/video source information onto the recording medium.

53. An apparatus as claimed in claim 50 further comprising audio/video recording means, including a recording medium, for recording said digital or corresponding digital audio/video source information onto said recording medium.

54. An apparatus as claimed in claim 52 or 53 wherein the recording medium comprises magnetic tape.

55. An apparatus as claimed in claim 53 wherein the recording medium comprises a CD-ROM or a WORM or an erasable optical disc.

56. An apparatus as claimed in any one of claims 50 -55 comprising audio/video recording and playback means coupled to the input means for providing said analog and/or digital audio/video source information.

57. An apparatus as claimed in any of claims 50 - 55 comprising high speed bus means coupled to the input means, and wherein the input means comprises auxiliary digital input means for receiving the digital audio/video source information.

58. An apparatus as claimed in claim 57 wherein the high speed bus means comprises an optical bus.

59. An apparatus as claimed in any one of claims 50 - 55 comprising high speed bus means coupled to said input means, and wherein said input means comprises fiber optic means for receiving said digital audio/video source information.

60. An apparatus as claimed in any one of claims 50 - 56 comprising high speed bus means, and wherein said analog to digital converter means, digital to analog converter means, compressor/decompressor means, central processing unit means, and controller means are coupled to said storage mean via said high speed bus means.

61. An apparatus as claimed in claim 60 comprising RGB converter means for converting information stored in said storage means to an RGB format, and wherein said output means comprises RGB output means for receiving RGB format information from said RGB converter means.

62. An apparatus as claimed in claim 60 wherein said output means comprise audio/video transmitter/receiver means coupled to said high speed bus for receiving said compressed representation of said digital or corresponding digital audio/video source information stored in said audio/video transceiver apparatus.

63. An apparatus as claimed in claim 62 wherein the audio/video transmitter/receiver mean comprises a modem for coupling to a telephone transmission line, or a fiber optic transceiver for coupling to a fiber optic transmission line.

64. An apparatus as claimed in claim 50 comprising:

digital control unit means, said digital control unit means comprising:

additional central processing unit means;
read-only memory means coupled to said additional central processing unit means for storing microinstructions defining a plurality of selected editing functions; and
additional controller means for enabling communication between said additional central processing unit means and said read-only memory means; and

said additional central processing unit means being operative for selectively executing the microinstructions stored in said read-only memory means to perform one or more of said plurality of selected editing functions.

65. An apparatus as claimed in claim 64 wherein said digital control unit means is coupled to said storage means.

66. A method for handling audio/video source information, the method comprising:

receiving audio/video source information;
compressing the received audio/video source information into a compressed digital representation thereof which is capable of being transmitted in a time compressed form having an associated burst transmission time period that is shorter than a time period associated with a real time viewing by a receiver of the received audio/video source information;
storing said compressed digital representation of the received audio/video source information; and
transmitting, in said burst transmission time period, the stored compressed digital representation of the received audio/video source information to a selected destination.

67. A method as in claim 66 further comprising the steps of:

editing the stored compressed representation of said audio/video source information; and
storing the edited compressed representation of said audio/video source information.

68. A method as in claim 67 further comprising the step of monitoring the stored compressed representation of said audio/video source information during editing.

69. A method as in claim 66 wherein the step of transmitting comprises transmitting said compressed representation of said audio/video source information over an optical channel.

70. A method as in claim 66 wherein the step of transmitting comprises transmitting said compressed representation of said audio/video source information over a telephone transmission channel.

71. A method as in claim 66 wherein the step of storing comprises storing the compressed representation of said audio/video source information on an optical disk.

72. A method as in claim 66 wherein the step of storing comprises storing the compressed representation of said audio/video source information in a semiconductor memory.

73. A method as in claim 66, wherein the audio/video source information comprises a multiplicity of video frames in the form of one or more full motion video programs.

74. A method as in claim 73, wherein the step of transmitting comprises transmitting said compressed representation of said audio/video source information over a microwave channel.

75. A method as in claim 73, wherein the step of storing comprises storing the compressed representation of said received audio/video source information in a bubble memory.

76. A method as in claim 73, wherein the step of storing comprises storing the compressed representation of said received audio/video source information in a digital paper memory.

77. A method as in claim 73, wherein the step of storing comprises storing the compressed representation of said received audio/video source information on one or more magnetic disks.

78. A method as in claim 66 wherein:

said audio/video source information comprises analog audio/video source information;
said method further comprises the step of converting said analog audio/video source information to corresponding digital audio/video source information;
said step of compressing comprises compressing said corresponding digital audio/video source information into a digital compressed representation thereof; and
said step of storing comprises storing said digital compressed representation of said corresponding digital audio/video source information.

79. A method as in claim 66 wherein:

said audio/video source information comprises digital audio/video source information;
said step of compressing comprises compressing said digital audio/video source information into a digital compressed representation thereof; and
said step of storing comprises storing said digital compressed representation of said digital audio/video source information.

80. A method as in claim 78 wherein said audio/video source information comprises information received from a television camera.

81. A method as in claim 78 wherein said audio/video source information comprises information received from an analog video tape recorder.

82. A method as in claim 78 wherein said audio/v

source information comprises information received from a television RF tuner.

83. A method as in claim 78 wherein said audio/video source information comprises information transmitted by a remotely located television transmitter.

84. A method as in claim 78 wherein said audio/video source information comprises information received from a cable television system.

85. A method as in claim 79 wherein said audio/video source information comprises information received from a computer.

86. A method as in claim79 wherein said audio/video source information comprises information received over a fiber optic transmission line.

87. A method as in claim 66 comprising:

providing a network that includes a plurality of audio/video transceivers, coupled via one or more communication links;
said selected destination comprising one or more of said plurality of audio/video transceivers.

88. A method as in claim 87 wherein said audio/video source information is received over one or more optical transmission channels and the stored compressed representation of the received audio/video source information is transmitted over one or more optical transmission channels.

89. A method as in claim 87 wherein the stored compressed representation of the received audio/video source information is transmitted over one or more telephone transmission channels.

90. A method as in claim 87 wherein the compressed representation of the received audio/video source information is stored in an optical disk memory.

91. A method as in claim 87 wherein the compressed representation of the received audio/video source information is stored in a semiconductor memory.

92. A method as in claim 87 wherein one of said plurality of audio/video transceivers stores a library containing a multiplicity of programs of audio/video source information as compressed representations thereof for selective transmission, in an associated burst transmission time period, to one or more of the remaining plurality of audio/video transceivers.

93. A method as in claim 87 further comprising the step of recording the stored compressed representation of said audio/video source information onto a removable recording medium.

94. A method as in claim 87 further comprising the steps of:

decompressing the stored compressed representation of said audio/video source information; and
recording the decompressed compressed representation of said audio/video source information onto a removable storage medium.

95. A method as in claim 93 or 94 wherein the stored compressed representation of said audio/video source information is recorded onto a magnetic tape within a video tape recorder.

96. A method as in claim 93 or 94 wherein the stored compressed representation of said audio/video source information is recorded onto one or more write-once read-many (WORM) optical disks within an optical disk drive.

97. A method as in claim 93 or 94 wherein the stored compressed representation of said audio/video source information is recorded onto one or more erasable optical disks within an optical disk drive.

98. A method as in claim 66 further comprising the step of recording the stored compressed representation of said audio/video source information onto a removable recording medium.

99. A method as in claim 66 further comprising the steps of:

selectively decompressing the stored compressed representation of said audio/video source information; and
recording the selectively decompressed compressed representation of said audio/video source information onto a removable recording medium.

100. A method as in claim 79 wherein said digital audio/video source information is received from a CD-ROM.

101. A method as in claim 79 wherein said digital audio/video source information is received from an erasable optical disk.

102. A method as in claim 66 further comprising the step of recording the stored compressed representation of said audio/video source information onto a magnetic recording medium.

103. A method as in claim 67 further comprising the step of recording the stored edited compressed representation of said audio/video source information onto a magnetic recording medium.

104. A method as in claim 66 further comprising the steps of:

selectively decompressing the stored compressed representation of said audio/video source information; and
recording the selectively decompressed stored compressed representation of said audio/video source information onto a magnetic storage medium.

105. A method as claimed in claim 66 for handling analog and/or digital audio/video source information, the method comprising the steps of:

receiving analog and/or digital audio/video source information;
converting received analog audio/video source information to corresponding digital audio/video source information;
converting received digital audio/video source information to corresponding analog audio/video source information;
compressing said received digital or converted corresponding digital audio/video source information into said compressed representation thereof;
storing said compressed representation;
decompressing said compressed representation into a real time representation of said received digital or converted corresponding digital audio/video source information;
storing said real time representation; and
transmitting said compressed representation to a selected destination.

106. A method as in claim 105 further comprising the step of supplying timing information for association with said compressed representation.

107. A method as in claim 105 further comprising the step of recording said received analogue or corresponding analogue audio/video source information onto a recording medium.

108. A method as in claim 105 further comprising the step of recording said received digital or corresponding digital audio/video source information onto a recording medium.

109. A method as in claim 105 wherein said received analogue or corresponding analogue audio/video source information is recorded onto a magnetic tape recording medium.

110. A method as in claim 108 wherein said received dig ital of corresponding digital audio/video source i formation is recorded onto a magnetic tape recor ing medium.

111. A method as in claim 108 wherein said received di ital or corresponding digital audio/video source i formation is recorded onto a CD-ROM.

112. A method as in claim 108 wherein said received di ital or corresponding digital audio/video source i formation is recorded onto a WORM optical disk

113. A method as in claim 108 wherein said received di ital or corresponding digital audio/video source i formation is recorded onto an erasable optical dis

114. A method as in claim 108 wherein said received a alog and/or digital audio/video source informati is received from an audio/video recording and pla back apparatus.

115. A method as in claim 105 wherein said digital aud video source information is received over a hi speed bus.

116. A method as in claim 105 wherein said digital auc video source information is received over an opti bus.

117. A method as in claim 105 further comprising t step of selectively editing the received analog a or digital audio/video source information.

118. A method for handling audio/video source infom tion, the method comprising:

receiving audio/video source information a compressed representation thereof, said dio/video source information comprising a m tiplicity of frames in the form of one or more motion video programs selected from a vi library storing a multiplicity of full motion vi programs in a compressed digital represer tion thereof for selective retrieval, said c pressed digital representation of the recei audio/video source information being recei in an associated burst transmission time pe that is shorter than a time period associa with a real time viewing by a receiver of received audio/video source information;
storing the compressed digital representa of said received audio/video source infor tion; and
transmitting, in said burst transmission time riod, the stored compressed digital represe

tion of said received audio/ video source information to a selected destination.

Patentansprüche

1. Eine Audio-/Videotransceiverapparatur, die enthält:

   ein Eingabemittel (11) für den Empfang von Audio-/Videoquellinformationen;
   ein Komprimierungsmittel (12), das an das obengenannte Eingabemittel gekoppelt ist und zur Komprimierung der obengenannten Audio-/Videoquellinformationen in eine komprimierte digitale Darstellung dient, wodurch diese in einer zeitkomprimierten Form mit einer zugehörigen Burst-Transmissions-Zeitspanne übertragen werden kann, die kürzer ist als die Zeitspanne, die mit der Betrachtung der empfangenen Audio-/Videoquellinformationen in Echtzeit durch einen Receiver verbunden ist;
   ein Speichermittel(13), das mit dem obengenannten Komprimierungsmittel gekoppelt ist und zum Speichern der komprimierten digitalen Darstellung der obengenannten Audio-/Videoquellinformationen dient; und
   ein Ausgabemittel (22), das mit dem obengenannten Speichermittel gekoppelt ist und das dazu dient, die auf dem obengenannten Speichermittel gespeicherte komprimierte digitale Darstellung der komprimierten Audio-/Videoquellinformationen zu empfangen und die obengenannte komprimierte digitale Darstellung der obengenannten Audio-/Videoquellinformationen von obengenannter Audio-/Videotransceiverapparatur in der obengenannten Burst-Transmissions-Zeitspanne wegzusenden.

2. Eine Apparatur nach Anspruch 1, die ein Bearbeitungsmittel (14) enthält, das mit dem obengenannten Speichermittel gekoppelt ist, und das zur Bearbeitung der auf dem obengenannten Speichermittel gespeicherten, komprimierten Darstellung der obengenannten Audio-/Videoquellinformationen und dem erneuten Speichern der bearbeiteten komprimierten Darstellung der obengenannten Audio-/Videoquellinformationen auf dem obengenannten Speichermittel dient; wobei das obengenannte Ausgabemittel wirksam wird für den Empfang der bearbeiteten komprimierten Darstellung der obengenannten Audio-/Videoquellinformationen, die auf dem obengenannten Speichermittel gespeichert sind, für die Übertragung weg von der obengenannten Audio-/Videotransceiverapparatur.

3. Eine Apparatur nach Anspruch 2, die ein Monitormittel enthält, mit dem der Benutzer während der Bearbeitung selektiv die komprimierte Darstellung der obengenannten Audio-/Videoquellinformationen identifizieren kann, die auf dem obengenannten Speichermittel gespeichert wurden.

4. Eine Apparatur nach Anspruch 2, die ein Aufzeichnungsmittel einschließlich eines auswechselbaren Aufzeichnungsmediums enthält, das mit dem obengenannten Speichermittel gekoppelt ist und dazu dient, die bearbeitete komprimierte Darstellung der obengenannten Audio-/Videoquellinformationen, die auf dem obengenannten Speichermittel gespeichert sind, auf dem obengenannten auswechselbaren Aufzeichnungsmedium zu speichern.

5. Eine Apparatur nach Anspruch 4, die ein Monitormittel enthält, mit dem der Benutzer selektiv die komprimierte Darstellung der obengenannten Audio-/Videoquellinformationen betrachten kann, die auf auswechselbaren Aufzeichungsmedium gespeichert sind.

6. Eine Apparatur nach Anspruch 2, die ein externes Videobandaufzeichnungsmittel enthält, das mit dem obengenannten Ausgabemittel gekoppelt ist, und dazu dient, die bearbeitete komprimierte Darstellung der obengenannten Audio-/Videoquellinformationen, die auf dem obengenannten Speichermittel gespeichert sind, auf Magnetband zu speichern.

7. Eine Apparatur nach Anspruch 1, bei der das Ausgabemittel einen glasfaseroptischen Ausgang enthält zum Anschluß der Apparatur an eine glasfaseroptische Übertragungsleitung.

8. Eine Apparatur nach Anspruch 1, bei der das Ausgabemittel ein Modem enthält zum Anschluß der Apparatur an eine Telefonübertragungsleitung.

9. Eine Apparatur nach Anspruch 1, in welcher:

   die obengenannte Audio-/Videoquellinformationen analoge Audio-/Videoquellinformationen enthalten;
   die obengenannte Audio-/Videotransceiverapparatur außerdem ein Analog-Digital-Konvertermittel enthält, das der Umwandlung der obengenannten analogen Audio-/Videoquellinformationen in die korrespondierenden digitalen Audio-/Videoquellinformationen dient;
   das obengenannte Komprimierungsmittel wirksam wird für die Komprimierung der obengenannten korrespondierenden digitalen Audio-/Videoquellinformationen in eine digitale komprimierte Darstellung derselben;
   und obengenanntes Speichermittel wirksam wird für die Speicherung der obengenannten

digitalen komprimierten Darstellung der obengenannten korrespondierenden digitalen Audio-/Videoquellinformationen.

10. Eine Apparatur nach Anspruch 9, bei der das Eingabemittel mit einer externen Fernsehkamera verbunden ist und die obengenannten analogen Audio-/Videoquellinformationen Informationen enthalten, die von der obengenannten externen Fernsehkamera empfangen wurden.

11. Eine Apparatur nach Anspruch 9, bei der das obengenannte Eingabemittel mit einem externen analogen Videorecorder verbunden ist und die obengenannten analogen Audio-/Videoquellinformationen Informationen enthalten, die von dem obengenannten externen Videorecorder empfangen wurden.

12. Eine Apparatur nach Anspruch 9, bei der das obengenannte Eingabemittel mit einem externen Fernsehfrequenztuner gekoppelt ist und die obengenannten analogen Audio-/Videoquellinformationen Informationen enthalten, die von dem obengenannten externen Fernsehfrequenztuner empfangen wurden.

13. Eine Apparatur nach Anspruch 9, bei der das obengenannte Eingabemittel ein Fernsehfrequenztunermittel enthält, das mit einer externen Fernsehantenne verbunden sind und die obengenannten analogen Audio-/Videoquellinformationen Informationen enthalten, die von einem entfernten Fernsehsender versandt wurden.

14. Eine Apparatur nach Anspruch 9, bei der das obengenannte Eingabemittel ein Fernsehfrequenztunermittel enthält, das mit einem externen Kabelfernsehsystem verbunden sind und die obengenannten analogen Audio-/Videoquellinformationen Informationen enthalten, die von besagtem Kabelfernsehsystem empfangen wurden.

15. Eine Apparatur nach Anspruch 9, die enthält:

ein Dekomprimierungsmittel, das mit dem obengenannten Speichermittel gekoppelt ist und zur selektiven Dekomprimierung der digitalen komprimierten Darstellung der obengenannten korrespondierenden digitalen Audio-/Videoquellinformationen dient, die auf dem obengenannten Mittel gespeichert sind; und
ein Bearbeitungsmittel, das mit dem obengenannten Speichermittel und Dekomprimierungsmittel gekoppelt ist und zur Bearbeitung der dekomprimierten digitalen komprimierten Darstellung der obengenannten korrespondierenden digitalen Audio-/Videoquellinformationen und zur anschließenden Speicherung der bearbeiteten dekomprimierten digitalen ko
primierten Darstellung der obengenannten k
respondierenden digitalen Audio-/Videoqu
informationen auf dem obengenannten Sp
chermittel dient.

16. Eine Apparatur nach Anspruch 15, die ein Monit
mittel enthält, mit dem der Benutzer selektiv die
komprimierte digitale komprimierte Darstellung
obengenannten korrespondierenden digitalen
dio-/Videoquellinformationen während der Beart
tung betrachten kann.

17. Eine Apparatur nach Anspruch 9, die enthält:

ein Dekomprimierungsmittel, das mit d
obengenannten Speichermittel gekoppelt
und zur selektiven Dekomprimierung der d
talen komprimierten Darstellung der oben
nannten korrespondierenden digitalen Aud
Videoquellinformationen dient, die auf d
obengenannten Speichermittel gespeich
sind; und
ein Monitormittel, das mit dem obengenann
Dekomprimierungsmittel gekoppelt ist und
dem der Benutzer selektiv die dekomprimi
digitale komprimierte Darstellung der oben
nannten korrespondierenden digitalen Aud
Videoquellinformationen betrachten kann.

18. Eine Apparatur nach Anspruch 9, die ein Vid
bandaufnahmegerät enthält, um die obengena
ten analogen Audio-/Videoquellinformationen
liefern.

19. Eine Apparatur nach Anspruch 1, bei dem:

die obengenannten Audio-/Videoquellinfon
tionen digitale Audio-/Videoquellinformatio
enthalten;
das obengenannte Komprimierungsmittel w
sam wird für die Komprimierung der ober
nannten digitalen Audio-/Videoquellinforma
nenin eine digitale komprimierte Darstell
derselben; und
das obengenannte Speichermittel wirk
wird für das Speichern der obengenannter
gitalen komprimierten Darstellung der ober
nannten digitalen Audio-/Videoquellinforma
nen.

20. Eine Apparatur nach Anspruch 19, bei der
obengenannte Eingabemittel an einen exter
Computer gekoppelt ist und die obengenannte
gitalen Audio-/Videoquellinformationen mit
Computer erzeugte Audio-/Videoinformationen
halten.