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(54) **VIDEO/AUDIO SYSTEM AND METHOD ENABLING A USER TO SELECT DIFFERENT VIEWS AND SOUNDS ASSOCIATED WITH AN EVENT**

(76) Inventors: **Tazwell L. Anderson JR.**, Atlanta, GA (US); **Mark A. Wood**, Decatur, GA (US)

Correspondence Address:
Evan R. Sotiriou
Armstrong Teasdale LLP
Suite 2600
One Metropolitan Square
St. Louis, MO 63102 (US)

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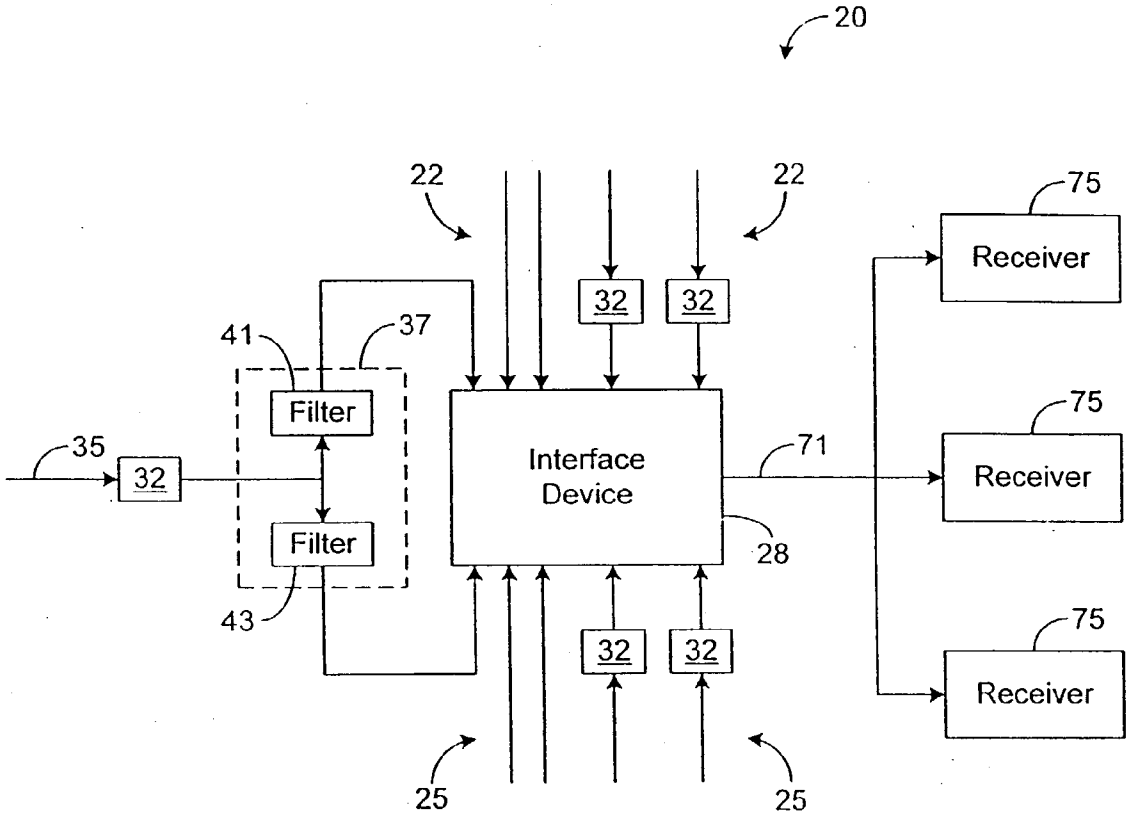
(57) **ABSTRACT**

A video/audio system includes an interface device that receives a plurality of audio and video signals from a plurality of sources. The interface device combines these signals into various combinations and transmits the combinations to a receiver. The receiver is configured to interface one of the combinations of signals with a user. In this regard, the receiver allows the user to select one of the combinations, and in response, the receiver separates the video signal(s) of the selected combination from the audio signal(s) of the selected combination. Then, the receiver renders the video signal(s) via a display device and produces a sound defined by the audio signal(s) via a speaker. Accordingly, the user is able to control which set of audio and video signals are interfaced with the user.



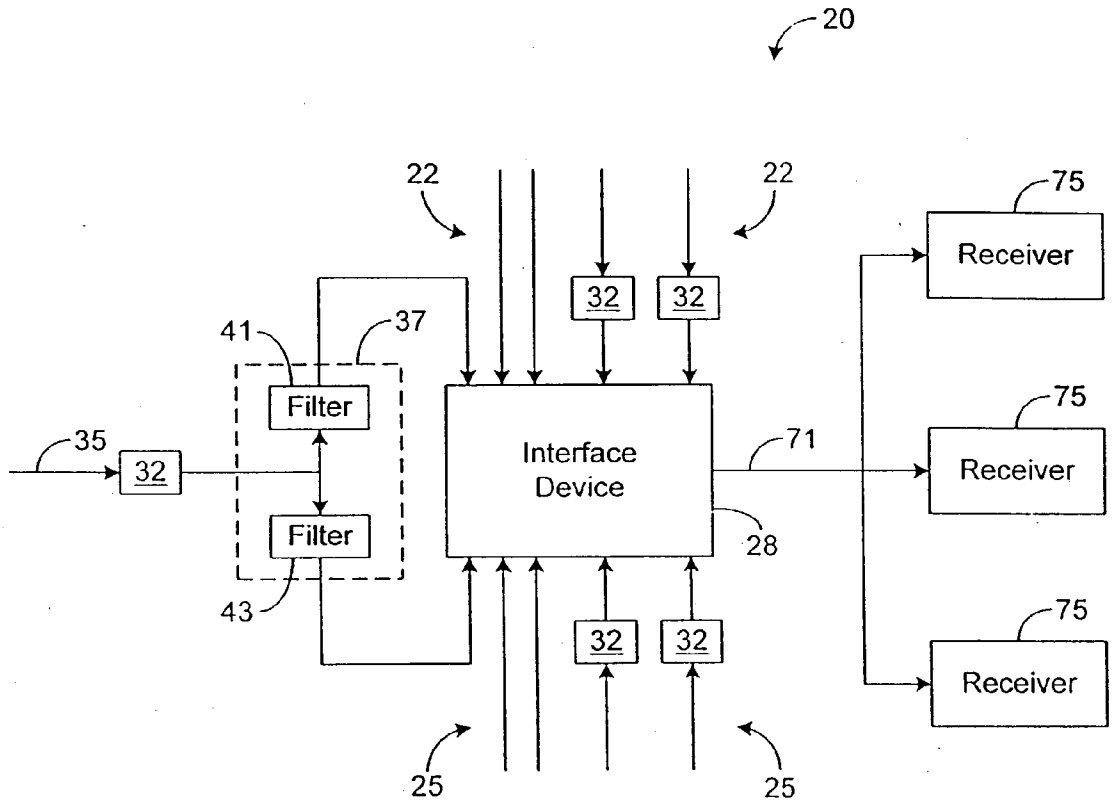

20
22
22
75
Receiver
32
32
41
37
Filter
35
32
Interface
Device
71
75
Receiver
Filter
28
43
75
32
32
Receiver
25
25

FIG. 1

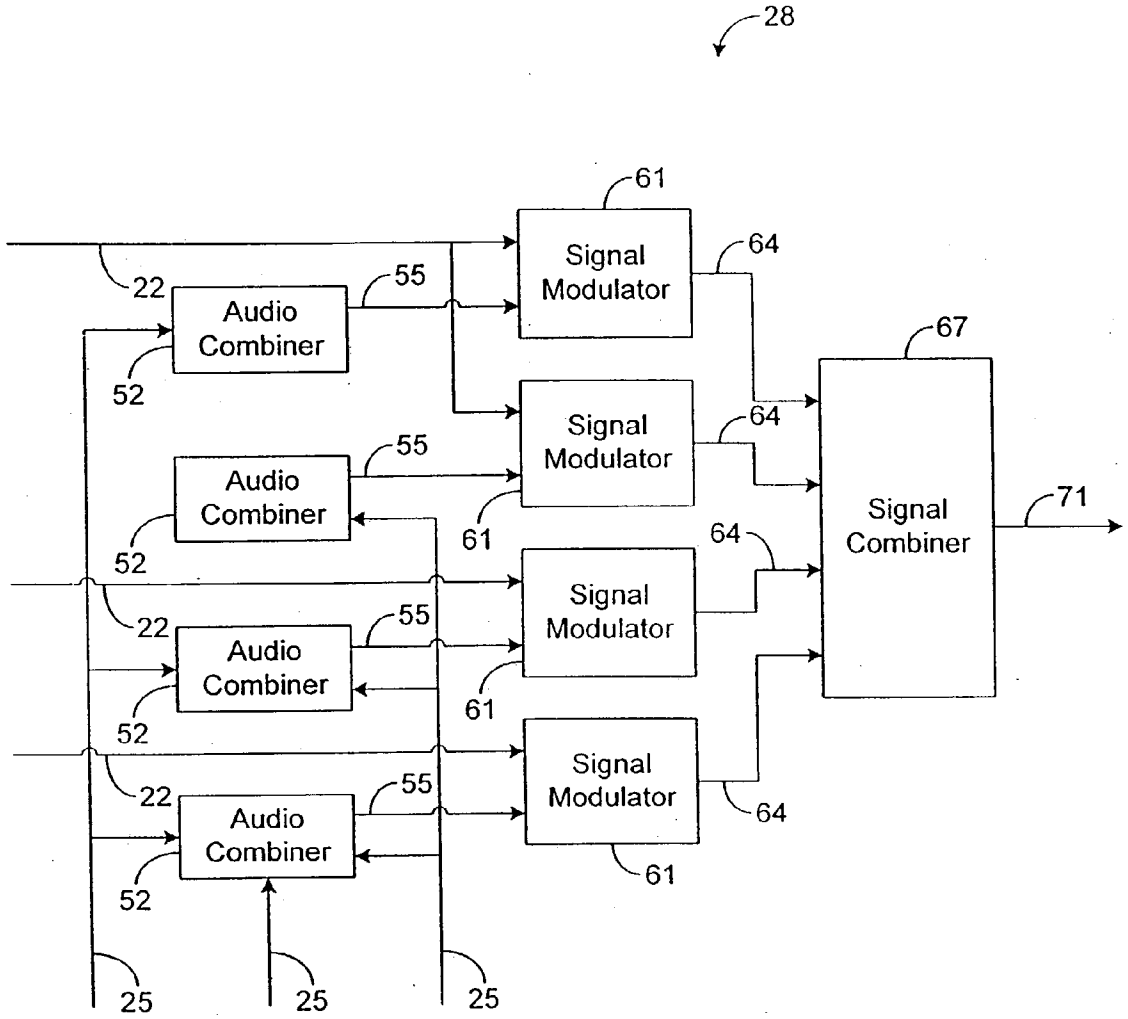

28
61
Signal Modulator
64
22
55
Audio Combiner
52
67
Signal Combiner
71
25

FIG. 2

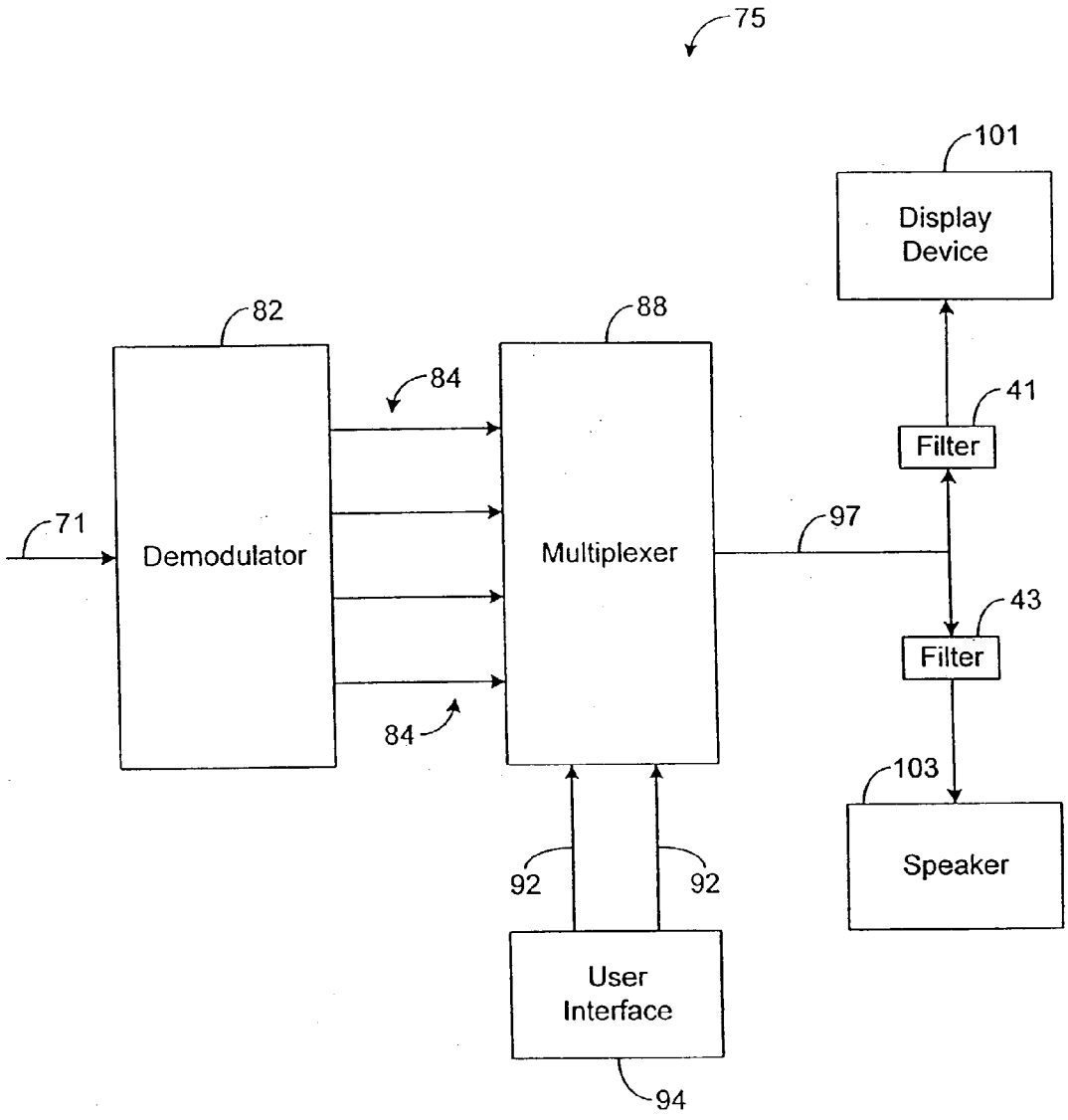

75
101
Display Device
82
88
84
41
Filter
71
Demodulator
Multiplexer
97
43
Filter
84
103
Speaker
92
92
User Interface
94

FIG. 3

VIDEO/AUDIO SYSTEM AND METHOD ENABLING A USER TO SELECT DIFFERENT VIEWS AND SOUNDS ASSOCIATED WITH AN EVENT

CROSS REFERENCE TO RELATED APPLICATION

[0001] This document claims priority to and the benefit of the filing date of copending provisional application entitled "Audio/Video Signal Distribution System for Head Mounted Displays," assigned serial No. 60/123,341, and filed Mar. 8, 1999, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention generally relates to video and audio signal processing techniques and, in particular, to a system and method for receiving video and audio signals from a plurality of sources and for providing a user with multiple combinations of these signals to select from.

[0004] 2. Related Art

[0005] Audio and video signals are generated from a plurality of sources during many events. For example, at an auto race, television crews usually position cameras at various locations within view of a race track. These cameras generate video signals defining views of the race track from various perspectives. In addition, microphones positioned at various locations generate audio signals defining different sounds at the auto race. For example, microphones may be located close to the race track to receive sounds produced by the vehicles participating in the race, and microphones may be located close to television commentators to receive the comments of the commentators as they observe and comment on the race.

[0006] One of the video signals and one or more of the audio signals are usually selected and combined together at a television station to form a combined video/audio signal. This signal is then modulated and transmitted so that users having a television can receive the combined signal via the television. The television demodulates the combined signal and displays an image defined by the video signal on a display screen and reproduces the sounds defined by the audio signals via speakers. Therefore, the sights and sounds of the race can be viewed and heard via the television.

[0007] In addition, one or more of the audio signals, such as audio signals defining the comments of radio commentators, are usually selected and modulated at a radio station to form a radio signal. This radio signal is then transmitted as a wireless signal so that users having radios can receive the signal via a radio. The radio demodulates the signal and reproduces the sounds defined by the radio signal via speakers.

[0008] However, users viewing and/or hearing the sights and sounds of the race via televisions and/or radios are not usually given the opportunity to select which video and/or audio signals are modulated and transmitted to the television and/or radio. Therefore, the user is only able to receive the signals modulated and transmitted to the television and/or radio, even though the user may prefer to receive the other audio and/or video signals that are generated at the auto race.

[0009] Spectators who actually attend the auto race are usually given more options to view and/or hear the sights and/or sounds of the race from different perspectives. In this regard, a plurality of monitors are usually located at a particular location in the stadium. As used herein, "stadium" shall be defined to mean any non-movable structure having a large number (i.e., thousands) of seats, wherein an event occurs at (i.e., within a close proximity) of the seats such that spectators sitting in the seats can view the event. An "event" is any occurrence viewed by a spectator.

[0010] Each monitor within the stadium receives one of the aforementioned video signals and displays an image defined by the received video signal. Therefore, a spectator can view the monitor displaying the image that has a perspective desirable to the spectator. However, the monitor having the desired perspective is often not located in a convenient location for the spectator. In this regard, the spectator usually must leave his seat (or other location) in the stadium and go to a location where the spectator, along with other spectators, can view the monitor displaying the desired perspective.

[0011] Thus a heretofore unaddressed need exists in the industry for providing a system and method that enables a spectator to conveniently view an event from different perspectives.

SUMMARY OF THE INVENTION

[0012] The present invention overcomes the inadequacies and deficiencies of the prior art as discussed hereinbefore. Generally, the present invention provides a video/audio system and method for receiving video and audio signals from a plurality of sources and for providing a user with multiple combinations of these signals to select from.

[0013] The present invention include an interface device that receives a plurality of audio and video signals from a plurality of sources. The interface device combines these signals into various combinations and transmits the combinations to a receiver. The receiver is configured to interface one of the combinations of signals with a user. In this regard, the receiver allows the user to select one of the combinations, and in response, the receiver separates the video signal(s) of the selected combination from the audio signal(s) of the selected combination. Then, the receiver renders the video signal(s) via a display device and produces a sound defined by the audio signal(s) via a speaker. Accordingly, the user is able to control which set of audio and video signals are interfaced with the user.

[0014] Other features and advantages of the present invention will become apparent to one skilled in the art upon examination of the following detailed description, when read in conjunction with the accompanying drawings. It is intended that all such features and advantages be included herein within the scope of the present invention and protected by the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The invention can be better understood with reference to the following drawings. The elements of the drawings are not necessarily to scale relative to each other,

emphasis instead being placed upon clearly illustrating the principles of the invention. Furthermore, like reference numerals designate corresponding parts throughout the several views.

[0016] **FIG. 1** is a block diagram illustrating a video/audio system in accordance with the present invention.

[0017] **FIG. 2** is a block diagram illustrating a detailed view of an interface device depicted in **FIG. 1**.

[0018] **FIG. 3** is a block diagram illustrating a detailed view of a receiver depicted in **FIG. 1**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0019] The preferred embodiment of the present invention will be described hereafter in the context of auto racing applications. However, the scope of the present invention should not be so limited, and it should be apparent to one skilled in the art that the principles of the present invention may be employed in the context of other applications, particularly in the context of other sporting events (e.g., football games, basketball, games, baseball games, hockey matches, etc.).

[0020] **FIG. 1** depicts a video/audio system **20** implementing the principles of the present invention. At least one video signal **22** and at least one audio signal **25** are received by an interface device **28**. Each of the received video signals **22** defines a view of the race from a different perspective. For example, the video signals **22** may be generated by different video cameras located at different locations around the stadium, including inside at least some of the vehicles participating in the race.

[0021] Furthermore, each of the audio signals **25** defines different sounds associated with the race. For example, at least one of the audio signals **25** may be generated from a microphone located close to the track or in one of the vehicles such that the audio signal **25** defines noise from the vehicles participating in the race. Alternatively, at least one of the audio signals **25** may define the comments of television commentators, and at least one of the audio signals **25** may define the comments of radio commentators. Furthermore, at least one of the audio signals **25** may define the comments between one of the drivers participating in the race and the driver's pit crew.

[0022] Some of the video and audio signals **22** and **25** can be unmodulated when transmitted to the interface device **28** and, therefore, do not need to be demodulated by the system **20**. However, some of the video and audio signals **22** and **25** may need to be demodulated by the system **20**. For example, at least one of the audio signals **25** defining the comments of the radio commentators may be modulated as a radio signal for transmission to radios located at or away from the stadium, and at least one of the video signals **25** may be modulated as a television signal for transmission to televisions located at or away from the stadium. In addition, the comments between a driver and the driver's pit crew are usually transmitted via ultra high frequency (UHF) radio waves, which are known to be modulated signals. Therefore, as shown by **FIG. 1**, the system **20** preferably includes demodulators **32** configured to receive and demodulate the video and/or audio signals **22** and **25**.

[0023] It is possible for some of the video and audio signals **22** and **25** to be received from a combined signal **35**, which is comprised of at least one video signal **22** combined with at least one audio signal **25**. For example, the combined signal **35** may be a television signal modulated for transmission to televisions located at or away from the track stadium. To facilitate the combination of different audio signals **25** with the video signal(s) **22** defined by the combined signal **35**, a separator **37** preferably separates the combined signal **35** into its respective video signal **22** and audio signal **25**, as shown by **FIG. 1**.

[0024] Various configurations of the separator **37** may exist without departing from the principles of the present invention. **FIG. 1** depicts a possible implementation of the separator **37**. In this regard, the separator **37** includes an audio signal filter **41** designed to filter out any audio signals **25** from the combined signal **35** and to transmit the resulting video signal(s) **22** to interface device **28**. Furthermore, the separator **37** also includes a video signal filter **43** designed to filter out any video signals **22** from the combined signal **35** and to transmit the resulting audio signal(s) **25** to interface device **28**. If more than one video signal **22** or more than one audio signal **25** is included in the combined signal **35**, then the separator **37** may include additional filters (not shown) to separate the multiple video and/or audio signals **22** and **25** into individual signals before transmitting the signals **22** and **25** to the interface device **28**.

[0025] **FIG. 2** depicts a more detailed view of the interface device **28**. The interface device **28** includes audio combiners **52** configured to receive audio signals **25** and to combine the received audio signals **25** into a single combined audio signal **55**. As shown by **FIG. 2**, each audio combiner **52** preferably receives a different combination of audio signals **25**, although it is possible for any one of the combined signals **55** to include the same combination of audio signals **25** as any other combined signal **55**. Note that when an audio combiner **52** receives only one audio signal **25**, the combined signal **55** output by the combiner **52** matches the one signal **25** received by the combiner **52**.

[0026] As an example, one of the combined signals **55** may include an audio signal **25** defining comments between a driver and the driver's pit crew and also an audio signal **25** defining sounds (i.e., vehicular noises) received by a microphone located in the driver's vehicle. Another of the combined signals **55** may include the aforementioned audio signals **25** as well as an audio signal **25** defining a radio commentator's comments. Another combined signal **55** may only include an audio signal **25** defining a television commentator's comments. Accordingly, the combined signals **55** preferably define different combinations of sounds. It should be noted that combinations of audio signals **25** other than those described hereinabove are possible.

[0027] As shown by **FIG. 2**, each combined signal **55** is transmitted to a respective signal modulator **61**. Each signal modulator **61** is also configured to receive a respective one of the video signals **25** received by the interface device **28**. Each signal modulator **61** is configured to combine the received combined signal **55** and video signal **25** and to modulate the received signals **55** and **25** on a unique frequency range. The signal modulator **61** is then designed to transmit the modulated signal **64**, which comprises the combined signal **55** and the video signal **25** received by the

signal modulator **61**, to a combiner **67**. The combiner **67** is configured to combine each of the modulated signals **64** transmitted from each of the signal modulators **61** into a single combined (i.e., multiplexed) signal **71**. This combined signal **71** is then transmitted to a plurality of receivers **75**.

[**0028**] Various techniques exist for transmitting combined signal **71** to receivers **75**. For example, a coaxial cable may be used to transmit the combined signal **71** to each of the receivers **75**. In another example, the system **20** may include a wireless transmitter (not shown) that transmits the combined signal **71** to the receivers **75**. Any technique for transmitting the combined signal **71** to the receivers **75** should be suitable for implementing the present invention.

[**0029**] A more detailed view of receiver **75** is shown by **FIG. 3**. Receiver **75** preferably includes a demodulator **82**. The demodulator **82** is configured to demodulate the combined signal **71** and to separate (i.e., demultiplex) the combined signal **71** into signals **84** based on frequency, such that each signal **84** respectively corresponds with one of the modulated signals **64**. In this regard, the demodulator **82** recovers the individual signals **64** as signals **84**, and each signal **84** is, therefore, defined by the same video and audio signals **22** and **25** that define its corresponding modulated signal **64**. Therefore, like modulated signals **64**, each signal **84** is preferably comprised of a unique combination of video and audio signals **22** and **25**.

[**0030**] Signals **84** are transmitted from demodulator **82** to a multiplexer **88**, which also receives control signals **92** from a user interface **94**. The user interface **94** preferably includes buttons or other types of switches that enable a spectator to select one of the signals **84** via control signals **92**. In this regard, the multiplexer **88**, through techniques well known in the art, selects one of the signals **84** based on control signals **92** and outputs the selected signal **84** as output signal **97**, as shown by **FIG. 3**.

[**0031**] The receiver **75** includes an audio signal filter **41** configured to filter the audio signal(s) **25** out of signal **97**. Therefore, only the video signal(s) **22** within signal **97** are transmitted to a display screen **101**, which is configured to render the received video signal(s) **22** (i.e., display an image defined by the received video signal(s) **22**) to the spectator.

[**0032**] The receiver **75** also includes a video signal filter **43** configured to filter the video signal(s) **22** out of signal **97**. Therefore, only the audio signal(s) **25** within signal **97** are transmitted to a speaker **103**, which is configured to produce sounds defined by the received audio signal(s) **25**, through techniques well known in the art.

[**0033**] In the preferred embodiment, the display screen **101** and speaker **103** are included within a head mounted display (HMD), which is a well known device of the prior art. An example of a head mounted display suitable for implementing the, present invention is fully described in U.S. Pat. No. 5,844,656, entitled "Head Mounted Display with Adjustment Components" and filed on Nov. 7, 1996, by Ronzani et al., which is incorporated herein by reference. Furthermore, when the combined signal **71** is transmitted via a coaxial cable, the receiver **75** may be located at a spectator's stadium seat or other convenient location. When the combined signal **71** is transmitted via a wireless transmitter, the receiver **75** is portable, and a spectator may carry the receiver **75** with him and choose where he would like to view the images and hear the sounds produced by the receiver **75**.

[**0034**] Accordingly, the spectator may remain in his seat (or other convenient location) and control, by manipulating buttons or other types of switches in the user interface **94**, which combination of video and audio signals **22** and **25** are respectively transmitted to display screen **101** and speaker **103**. Therefore, the system **20** gives the spectator more flexibility in how the spectator views the race and, as a result, makes the race a more enjoyable experience.

OPERATION

[**0035**] The preferred use and operation of the video/audio system **20** and associated methodology are described hereafter.

[**0036**] Assume for illustrative purposes only that a spectator would like to attend an auto race and would like to have access to an in-car view from a camera within his favorite driver's car. In addition, the spectator would also like to continuously hear the dialogue between the aforementioned driver and the driver's pit crew, as well as the comments provided by his favorite radio commentator. It should be apparent that other views and/or sounds may be desirable in other examples.

[**0037**] In the past, the spectator would have to attend the race and acquire (as well as tune) a radio to receive the commentator's comments and a radio to receive the radio signals transmitted between the driver and the driver's pit crew. Then, the spectator would have to locate a monitor at the stadium displaying the in-car view that he desires to see. The spectator would then remain within sight of the monitor and listen to the two radios. If the monitor is not located in a desirable location for viewing the race, the spectator would have to choose between viewing the monitor and viewing the race at a desirable location. Furthermore, the handling of multiple radios is generally cumbersome and distracting.

[**0038**] However, in accordance with the present invention, the user attends the race and is provided a receiver **75** for his individual use. In the preferred embodiment, the receiver **75** is located at the spectator's seat within the stadium. However, the receiver **75** may be located at other convenient locations, and when the combined signal **71** is transmitted via a wireless transmitter, the spectator may carry the receiver **75** around with him to any desirable location in or around the stadium.

[**0039**] The spectator then manipulates buttons or other types of switches at user interface **94** to control which signal **84** is output by multiplexer **88** and, therefore, which signals **22** and **25** are respectively received by display **101** and speaker **103**. Accordingly, the spectator may use the receiver **75** to see the desired view of the race (i.e., the in-car view) and to hear the desired sounds of the race (i.e., the sounds received by the microphone in his favorite driver's car, the dialogue between the driver and the driver's pit crew, and the comments from the radio commentator).

[**0040**] In this regard, the interface device **28** preferably receives at least a video signal **22** defining the in-car view of his favorite driver and a plurality of audio signals **25** defining the sounds received by the microphone in his favorite driver's car, the dialogue between the driver and the driver's pit crew, and the comments from the radio commentator. At least one of the audio combiners **52** combines these audio signals **25** into a combined signal **55**. One of the

signal modulators **61** receives this combined signal **55** and the video signal **22** defining the desired in-car view. This video signal **22** is modulated and combined with the foregoing combined signal **55** by one of the signal modulators **61** to create a modulated signal **64**. This modulated signal **64** is combined with other modulated signals **64** and transmitted to the spectator's receiver **75** via combiner **67**.

[**0041**] The demodulator **82** in the spectator's receiver **75** demodulates and separates the received signal **71** into separate signals **84**. Based on the control signals **92** received from user interface **94**, the multiplexer **88** allows only the signal **84** defined by the aforementioned video and audio signals **22** and **25** to pass. Therefore, these video and audio signals **22** and **25** are respectively transmitted to the display **101** and speaker **103** and the spectator may enjoy the view and sounds that he selected.

[**0042**] It should be noted that it is not necessary for the spectator to keep the receiver **75** within the stadium. In this regard, the signal **71** may be transmitted via satellites and/or communication networks to various locations around the world, and the spectator may select the view and sounds he prefers the most from just about any location capable of receiving signal **71**.

[**0043**] It should also be noted that the receiver **75** may be retrieved from the spectator after the spectator is finished viewing the event so that the receiver can be provided to another spectator for another event at the stadium. Each spectator is preferably charged a usage fee for spectator's use of the receiver **75**.

[**0044**] Furthermore, the present invention has been described herein in the context of auto racing. However, the system **20** may be useful in other applications as well. The system **20** would be useful in any application where it is desirable for the user to control the types of views and sounds of an event that are presented to the user. For example, the present invention could be particularly useful in any type of sporting event or other type of event attended by a large number of people.

[**0045**] It should be emphasized that the above-described embodiments of the present invention, particularly, any "preferred" embodiments, are merely possible examples of implementations, merely set forth for a clear understanding of the principles of the invention. Many variations and modifications may be made to the above-described embodiment(s) of the invention without departing substantially from the spirit and principles of the invention. All such modifications and variations are intended to be included herein within the scope of the present invention and protected by the claims.

Now, therefore, the following is claimed:

1. A system, comprising:

a plurality of audio combiners, each of said audio combiners configured to receive audio signals and to combine said audio signals into a combined signal;

a plurality of signal modulators, each of said signal modulators configured to receive a video signal and said combined signal from one of said audio combiners and to combine and modulate said received video signal and combined signal into a modulated signal; and

a signal combiner configured to receive modulated signals from said signal modulators and to combine said modulated signals into a multiplexed signal, said signal combiner further configured to transmit said multiplexed signal.

2. The system of claim 1, wherein at least one of said audio signals is combined by each of said audio combiners.

3. The system of claim 1, further comprising:

a plurality of receivers, each of said receivers configured to receive said multiplexed signal, to demultiplex said multiplex signal, to receive inputs from a user, to select at least one of said video signals and one of said combined signals based on said inputs, to render said one video signal, and to produce sounds based on said one audio signal.

4. The system of claim 3, wherein said each receiver includes a head mounted display to render said one video signal.

5. The system of claim 3, further comprising:

a signal separator configured to receive a combined signal, to separate a first audio signal from said combined signal, to separate a first video signal from said combined signal, to transmit said first audio signal to one of said audio combiners, and to transmit said first video signal to one of said signal modulators.

6. A method, comprising the steps of:

receiving a plurality of audio signals;

receiving a plurality of video signals;

combining said audio and video signals to form a plurality of combined signals, said combined signals defining different combinations of said video and audio signals;

combining said combined signals into a single multiplexed signal;

transmitting said multiplexed signal;

receiving said multiplexed signal;

receiving inputs from a user;

demultiplexing said multiplexed signal to recover said combined signals;

selecting one of said recovered combined signals based on said inputs from said user;

rendering at least one video signal included in said one recovered combined signal based on said selecting step; and

producing sound defined by at least one audio signal included in said one recovered combined signal based on said selecting step.

7. The method of claim 6, further comprising the step of performing said rendering step via a head mounted display.

8. The method of claim 6, wherein at least one of said audio signals is transmitted from an ultra high frequency (UHF) radio.

9. The method of claim 6, wherein said plurality of audio signals includes a first audio signal defining a sound and a second audio signal defining said sound and wherein said first audio signal is included within one of said combined signals and said second audio signal is included in another one of said combined signals.

10. The method of claim 6, wherein said plurality of video signals includes a first video signal defining an image and a second video signal defining said image and wherein said first video signal is included within one of said combined signals and said second video signal is included in another one of said combined signals.

11. A method of doing business, said method comprising the steps of:

providing receivers to users attending an event at a stadium;

receiving a plurality of audio signals associated with said event;

receiving a plurality of video signals associated with said event;

combining said audio and video signals to form a plurality of combined signals, said combined signals defining different combinations of said video and audio signals;

transmitting said combined signals to said receivers; and

retrieving said receivers from said users.

12. The method of claim 11, wherein each of said combined signals includes at least one of said audio signals and at least one of said video signals.

13. The method of claim 11, wherein said plurality of audio signals includes a first audio signal defining a sound and a second audio signal defining said sound and wherein said first audio signal is included within one of said combined signals and said second audio signal is included in another one of said combined signals.

14. The method of claim 11, wherein said plurality of video signals includes a first video signal defining an image and a second video signal defining said image and wherein said first video signal is included within one of said combined signals and said second video signal is included in another one of said combined signals.

15. The method of claim 11, wherein one of said audio signals is transmitted from a radio station.

16. The method of claim 11, wherein one of said audio signals is transmitted from a ultra high frequency (UHF) radio located at said event.

17. The method of claim 11, wherein said event is a sporting event.

18. The method of claim 11, wherein said event is an auto race.

19. The method of claim 11, further comprising the step of requesting payment from said users.

20. The method of claim 11, wherein each of said receivers includes a head mounted display for rendering said video signals.

21. The method of claim 11, further comprising the steps of:

receiving said combined signals at one of said receivers;

receiving inputs from one of said users at said one receiver;

selecting one of said combined signals based on said inputs;

rendering at least one of said video signals defined by said one combined signal to said user; and

generating sound based on at least one of said audio signals defined by said one combined signal.

22. The method of claim 21, further comprising the steps of:

combining said combined signals into a single multiplexed signal; and

demultiplexing said multiplexed signal after receiving said multiplexed at said one receiver,

wherein said transmitting step includes the step of transmitting said multiplexed signal and said receiving said combined signals step includes the step of receiving said multiplexed signal.

* * * * *