

UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE PATENT TRIAL AND APPEAL BOARD

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Sony Corporation,  
Petitioner,

v.

One-E-Way, Inc.  
Patent Owner.

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Patent No. , 7,412,294 - %

Issue Date: March 2018

Title: Wireless Digital Audio Ai gWSystem

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**EXHIBIT 1010**

**COMPARISON OF 2003 APPLICATION  
SPECIFICATION AS ORIGINALLY FILED  
AND ISSUED U.S. PATENT NO. 7,412,294**

**No. IPR2018-00218**

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On the following pages, the as-filed specification of U.S. App. No. 10/648,012, filed on Aug. 26, 2003 (“the 2003 specification”) is compared to the U.S. Patent No. 7,412,294 (“the ’294 patent”) issued from that application. Blue text in square brackets appears in the ’294 patent but not in the 2003 specification. Red text in strikeout appears in the 2003 specification but not in the ’294 patent.

~~FUZZY AUDIO WIRELESS MUSIC~~  
[DIGITAL AUDIO] SYSTEM

This [utility patent application] is a continuation-in-part of [U.S. patent] application Serial No. [10/027,391] ~~10/027,739~~ ~~which patent application is pending~~ [filed Dec. 21, 2001, now abandoned for “Wireless Digital Audio System,” published under US 2003/0118196/A1 on Jun. 26, 2003, now abandoned, which is incorporated herein in its entirety by reference].

BACKGROUND OF THE INVENTION

[0001] This invention relates to [ music ] audio player devices and more particularly to systems that include headphone listening devices. The new audio [music] system uses [an] existing ~~audio-player device~~ headphone ~~jacks~~ [jack (i.e., this is the standard analog headphone jack that connects to wired headphones) of a music audio player (i.e., portable CD player, portable cassette player, portable A.M./F.M. radio, laptop/desktop computer, portable MP3 player, and the like)] to connect a battery ~~to~~ powered transmitter for [digital] wireless transmission of a signal to a [set of ] battery powered [receiver] ~~receiving~~ headphone[s].

[0002] Use of [ music ] audio headphones with [music] audio player devices such as ~~radio, tape players,~~ [portable] CD players, [portable cassette players, portable A.M./F.M. radios, laptop/desktop computer, portable MP3 players] ~~and the computers, television audio~~ and the like, have been in use for [many] ~~may~~ years. These systems ~~usually~~ incorporate an audio source having a [an analog] headphone jack to which ~~a~~ headphone[s] may be connected by wire. ~~and connector.~~

[0003] There are also known wireless headphones that may receive A.M.

and F.M. radio transmissions. However, [they] ~~these systems~~ do not allow use of a simple plug in [(i.e. plug in to the existing analog audio headphone jack)] battery powered transmitter for connection to any [music] audio player device jack, such as [the above mentioned music audio player devices, for coded] ~~laptop and desktop computers, portable compact disc players, portable MP3 players, portable cassette players and the like,~~ for wireless transmission and reception [by headphones] of audio music for private listening [without interference where] ~~to~~ multiple users occupying the same space [are operating wireless transmission devices]. Existing audio systems make use of electrical wire connections between the audio source and the headphones to accomplish private listening to multiple users.

[0004] There is a need for a battery powered simple connection system for existing [music] audio player devices [(i.e., the previously mentioned music devices)], to allow [coded digital ] wireless transmission [ (using a battery powered

transmitter)] to a headphone receiver [(using battery powered receiver headphones)] that accomplishes private listening to multiple users occupying the same space [without the use of wires].

### SUMMARY OF THE INVENTION

[0005] The present invention is [generally] directed to [a wireless] ~~FAWM (Fuzzy Audio Wireless Music) systems for coded~~ digital [audio system for coded digital] transmission of an audio signal from any audio player [with an analog ~~device with a~~ headphone jack to a receiver headphone [located away from the audio player. Fuzzy logic technology may be utilized by the system to enhance bit detection.]. ~~using fuzzy logic technology.~~ A battery-powered digital transmitter may include a headphone plug in communication with any [suitable music] ~~of the previously mentioned~~ audio source ~~s, laptop and desktop computers, portable compact disc players, portable MP3 players, portable cassette players and the like.~~ [For reception, a battery-powered headphone receiver may use embedded fuzzy logic to enhance user code bit detection. Fuzzy logic detection may be used to enhance user code bit detection during decoding of the transmitted audio signal.] The [wireless digital] ~~FAWM system converts the~~ audio music signal [provides] ~~that may be supplied by the source, into a digital signal. This conversion takes place in the small battery powered transmitter that connects to the headphone jack of the source. The transmitter then adds a unique user code and transmits it to the battery-powered receiver headphones where the fuzzy logic detector decodes only the unique user code to allow~~ private listening without interference from other users [or wireless devices and without the use of conventional cable connections.]

[0006] These and other features, aspects and advantages of the present invention will become better understood with reference to the following drawings, description and claims.

### BRIEF DESCRIPTION OF THE DRAWINGS

[Some aspects of the present invention are generally shown by way of reference to the accompanying drawings in which:]

[FIG.] ~~Figure-1~~ [schematically ] illustrates a [wireless digital audio system in accordance with the present invention;] ~~schematic diagram representation of the FAWM system;~~

[FIG.] ~~Figure 2~~ [ is a block diagram of an audio transmitter portion of the wireless digital audio system of FIG. 1;] ~~illustrates a graph of the high and low-bit fuzzy logic if-then part fuzzy set according to an embodiment of the invention.~~

[FIG. 3 is a block diagram of an audio receiver portion of the wireless digital audio system of FIG. 1; and

FIG. 4 is an exemplary graph showing the utilization of an embedded fuzzy logic coding algorithm according to one embodiment of the present invention.]

### DETAILED DESCRIPTION

**[0008]** The following detailed description is the best currently contemplated modes for carrying out the invention. The description is not to be taken in a limiting sense, but is made merely for the purpose of illustrating the general principles of the invention.

**[0009]** Referring to [FIGS. 1 through 3, a wireless digital audio music] ~~Figure 1, a FAWM~~ system 10 may include a battery powered transmitter 20 connected to a portable [music] audio player or [music] audio source 80. The battery powered [wireless digital audio music] transmitter 20 [utilizes an analog to digital converter or ADC 32] and may be connected to the [music] audio source 80 [analog] headphone jack 82 using a headphone plug 22. The battery powered transmitter 20 may have a transmitting antenna 24 that may be omni-directional for transmitting [a spread spectrum ]~~a coded-digital~~ modulated signal to a receiving antenna 52 of a battery powered [headphone] receiver 50. ~~that may be a headphone receiver.~~ The battery powered receiver 50 may have headphone speakers [75]~~54~~ in headphones 55 for listening to the [spread spectrum ] demodulated and decoded [communication]~~digital~~ signal. [In the headphone receiver 50, fuzzy logic detection may be used to optimize reception of the received user code.] The ~~FAWM~~ transmitter 20 may digitize the audio signal [using ADC 32]. ~~This digital~~ [The digitized] signal ~~has a throughput of approximately 1.4 Mbps, which~~ may be [processed downstream by an encoder 36. After digital conversion, the digital signal may be processed by a digital low pass filter.]~~determined by the analog to-digital A/D converter sampling rate of 44.1kHz multiplied by 16 bit quantization.~~ To reduce the effects of channel noise, the battery powered transmitter 20 may use [a channel encoder 38]. [A modulator 42 modulates the digital signal to be transmitted.] For further noise immunity, [a] spread spectrum [DPSK (differential phase shift key) transmitter or module 48 is] ~~modulation may be~~ utilized. The battery powered transmitter 20 may contain a ~~shift register~~ [code] generator [44]~~(SRG)~~ that may be used to create a unique user code. The unique user code generated is specifically associated with one [wireless digital audio system] ~~FAWM~~ user, and it is the only code recognized by the battery powered ~~FAWM~~ headphone receiver 50 [operated by a ]~~of that~~ particular user. The radio frequency (RF) spectrum utilized (as taken from the Industrial, Scientific and Medical (ISM) band), may be approximately 2.4 GHz. ~~And~~ The power radiated by the transmitter adheres to the ISM standard.

**[0010]** [Particularly, the received spread spectrum signal may be communicated to a 2.4 GHz direct conversion receiver or module 56.] Referring to ~~Figure 1,~~ [FIGS 1 through 4,] the ~~digital~~ [spread spectrum] modulated signal from transmit antenna 24 may be received by receiving antenna 52 and then [processed by spread

spectrum direct conversion receiver or module 56 with a receiver code generator 60 that contains the same transmitted unique code, in the battery powered receiver 50 headphones. The transmitted signal from antenna 24 may be received by receiving antenna 52 and communicated to a wideband bandpass filter (BPF).] ~~demodulated, decoded and deinterleaved in the battery powered receiver 50 headphones.~~ The battery powered receiver 50 may utilize [embedded] fuzzy logic [61 (as graphically depicted in FIGS. 1, 4) ] to optimize the [ bit ] detection of the received user code. [The down converted output signal of direct conversion receiver or module 56 may be summed by receiver summing element 58 with a receiver code generator 60 signal. The receiver code generator 60 may contain the same unique wireless transmission of a signal code word that was transmitted by audio transmitter 20 specific to a particular user. Other code words from wireless digital audio systems 10 may appear as noise to audio receiver 50. This may also be true for other device transmitted wireless signals operating in the wireless digital audio spectrum of digital audio system 10. This code division multiple access (CDMA) may be used to provide each user independent audible enjoyment. The resulting summed digital signal from receiving summary element 58 and direct conversion receiver or module 56 may be processed by a 64-Ary demodulator 62 to demodulate the signal elements modulated in the audio transmitter 20. A block deinterleaver 64 may then decode the bits of the digital signal encoded in the block interleaver 40. Following such, a Viterbi decoder 66 may be used to decode the bits encoded by the channel encoder 38 in audio transmitter 20. A source decoder 68 may further decode the coding applied by encoder 36.]

**[0011]** Each receiver [headphone] 50 user may be able to listen (privately) to high fidelity audio music, using any of the audio devices listed previously, without the use of wires, and without interference from any other receiver [headphone] 50 user [, even when operated with a shared space]. ~~Because of the [The] fuzzy logic detection technique [61]used in the [receiver 50 could provide greater] wireless digital audio system,~~ user separation through [optimizing] code division [in the headphone receiver.] ~~may be achieved.~~

**[0012]** The battery powered transmitter 20 sends the audio [music]information to the battery powered receiver 50 in digital packet format. ~~Each packet may consist of, at minimum, a start bit to indicate the beginning of a packet, the unique user code, the digitized audio information and a stop bit to indicate the end of a packet.~~ These packets may flow to create a digital bit stream rate of less than or equal to  $\pm$  [1.0 ]Mb/s.

**[0013]** The user code bits in each packet may [also] be received and detected by a fuzzy logic [detection sub-system 61 (as an option) embedded in headphone receiver 50 to optimize audio receiver performance.] ~~detector~~ For each consecutive packet received, ~~the~~ fuzzy logic ~~detector~~ [detection sub-system 61] may compute a conditional density with respect to the context and fuzziness of the user code vector, i.e., the received ~~user~~ code bits in each packet. [Fuzziness may describe the ambiguity of the high bit (1)/low bit (0 or -1) event in the received user code within the packet.] The fuzzy logic [detection sub-system 61 may measure the degree to which a high/low bit occurs in the user code vector, which produces a low probability of bit error in the presence of noise.] ~~detector is the key component to the FAWM system 10. Because the fuzzy logic detector enables the battery~~

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