

Title of the Invention.

PC Surround Mixer

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IPOS

Description

With the introduction of DVD and other audio sources into the PC market, there will be a trend that game titles deploy the surround format in three or more channels to give a realistic surround environment to the game players. However, games will still make use of the two common data (WAVE and MIDI) to create effects such as gun shootings, or dialogues So a possible good combination is a game title producing surround output signals and WAVE or MIDI signals. If both signals cannot be derived from the same output source, the game players will need two sets of speakers or a separate mixer to have the effect.

Block Diagram

The objective of the PC Surround Mixer is to mix signals (WAVE or MIDI) specific to PC together with signals from a surround stream. Figure 1 shows the block diagram.

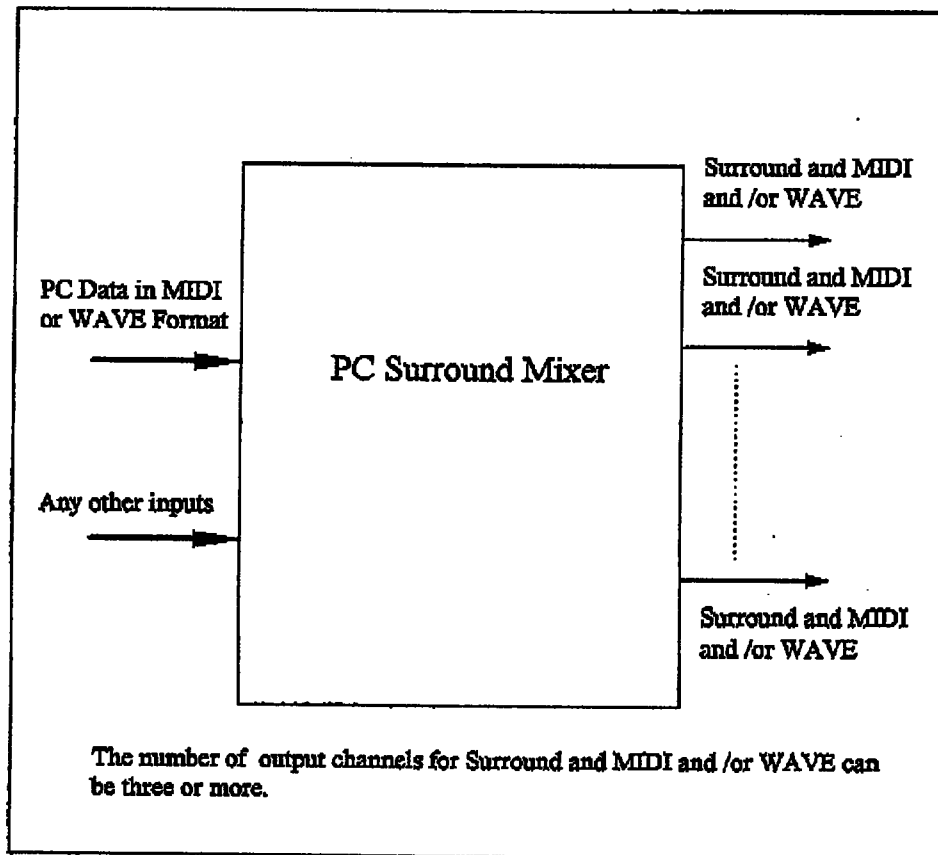


Figure 1. PC Surround Mixer

The inputs to the system include data in WAVE or MIDI format, and any other signals. The outputs will be at least 3 channels each having a output with surround and MIDI or WAVE. The PC data is in digital form while the other signals can be in analog or digital form. All the signals can be serial (within itself or multiplexed with other channels) or parallel, synchronous or asynchronous. The

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mixer can process the input signals and even generate any signals within itself. There can be many output channels, but as long as three of the output channels contains the information of surround signals and MIDI or WAVE signals, this will be regarded as a PC Surround Mixer.

Mathematical model

Figure 2 describes the system in a mathematical model so as to give a more precise definition.

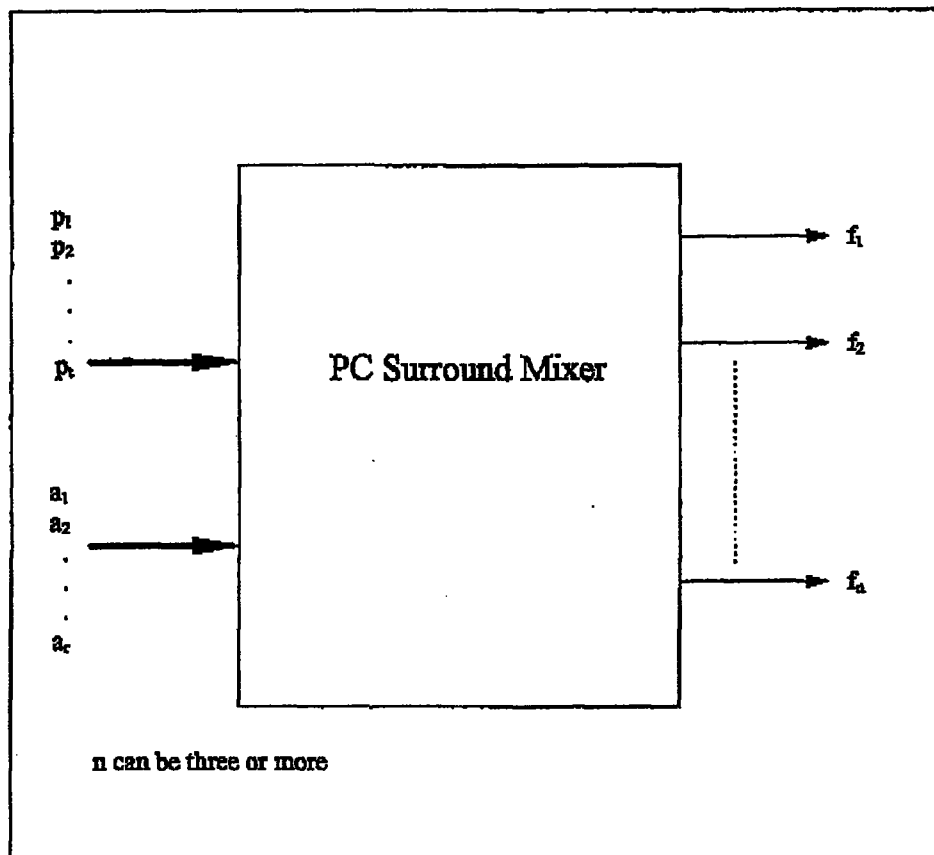


Figure 2. Mathematical Models of PC Surround Mixer.

In order to satisfy the PC Surround Mixer system the following applies:

1. At least one of the inputs is PC data in WAVE or MIDI format ($p_1, p_2, p_3, \dots, p_n$) and $t > 0$.
2. There may or may not be any other input signals: $a_1, a_2, a_3, \dots, a_n$.
3. The outputs are defined by:

$$f_i = F_i(s_1, s_2, s_3, \dots, s_n, p_1, p_2, p_3, \dots, p_n, b_1, b_2, b_3, \dots, b_n),$$

ie, it is a function depending on the s, p and b .

in which

$(p_1, p_2, p_3, \dots, p_n) \in (p_1, p_2, p_3, \dots, p_j)$ which are the channels of WAVE and/or MIDI

$(s_1, s_2, s_3, \dots, s_n) \in (s_1, s_2, s_3, \dots, s_j)$ which are the channels of an audio system, normally termed as surround system other than WAVE and MIDI, p_i

$(b_1, b_2, b_3, \dots, b_n)$ are any other signals



the number of s, p , and b can be zero in some of the F_i , i.e. F_i can be not depending on either s, p , or b

4. Three of the output $f_i = F_i(s_1, s_2, s_3, \dots, s_6, p_1, p_2, p_3, \dots, p_6, b_1, b_2, b_3, \dots, b_6)$ shall have a characteristic that there is at least a s term and a p term, i.e. the output depends on s and p .

Some of the possible practical examples of the system will be presented and the application of the patent is explained. These examples are not trying to describe all the possible combinations, instead they are only to give more insight of the PC Surround Mixer.

Example 1

Figure 3 is a mixer using a summing circuit to mix 6 surround channels with two channels of WAVE to give 3 channels of surround and WAVE contents, and 3 remaining channels of pure surround.

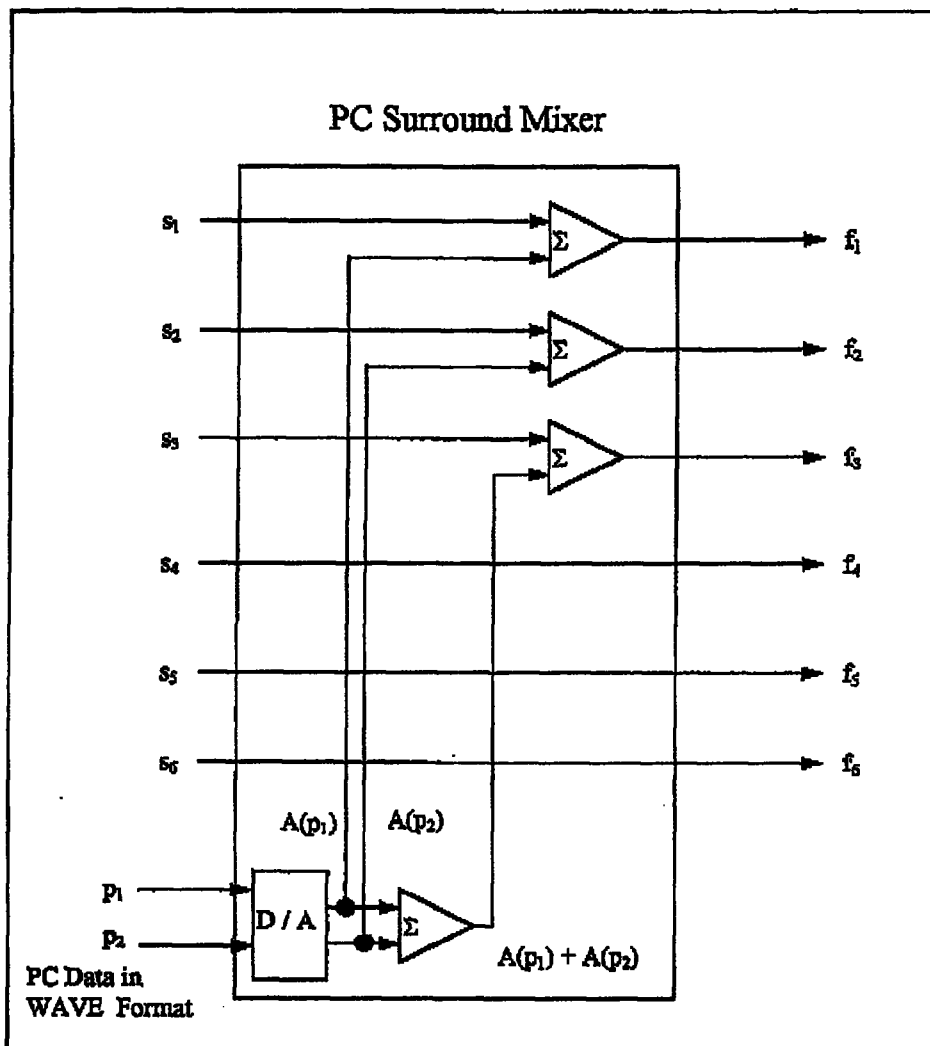


Figure 3. Example 1 of PC Surround Mixer.

In this case:

$(s_1, s_2, s_3, \dots, s_6)$ are six analog channels of a surround sound.

$$f_1 = s_1 + A(p_1)$$

$$f_2 = s_2 + A(p_2)$$



$$f_3 = s_3 + A(p_1) + A(p_2)$$

$$f_4 = s_4$$

$$f_5 = s_5$$

$$f_6 = s_6$$

in which $A(x)$ is a transformation of the x data into an analog WAVE form.

Comparing with our model, we can see that the criteria of the PC Surround Mixer are met by:

1. The inputs are PC WAVE data.
2. There are other inputs and they are:

$$(a_1, a_2, a_3, \dots, a_6) = (s_1, s_2, s_3, \dots, s_6)$$

3. The $f_i = F_i(s_1, s_2, s_3, \dots, s_6, p_1, p_2, p_3, \dots, p_6, b_1, b_2, b_3, \dots, b_6)$ are:

$$f_1 = s_1 + A(p_1)$$

$$f_2 = s_2 + A(p_2)$$

$$f_3 = s_3 + A(p_1) + A(p_2)$$

$$f_4 = s_4$$

$$f_5 = s_5$$

$$f_6 = s_6$$

It can be seen that b 's are not depended in all output, which is allowed in the PC Surround Mixer.

And finally,

4. The three output $f_i = F_i(s_1, s_2, s_3, \dots, s_6, p_1, p_2, p_3, \dots, p_6, b_1, b_2, b_3, \dots, b_6)$ having a characteristics of at least a s term and a p term are:

$$f_1 = s_1 + A(p_1)$$

$$f_2 = s_2 + A(p_2)$$

$$f_3 = s_3 + A(p_1) + A(p_2)$$

Example 2

Figure 4 is similar to the function of Figure 1 but the operations are in digital forms. The input $s_1, s_2, s_3, \dots, s_6$ are now in digital forms. The four criteria are satisfied similarly except that $A(p_i)$ are replaced by p_i .



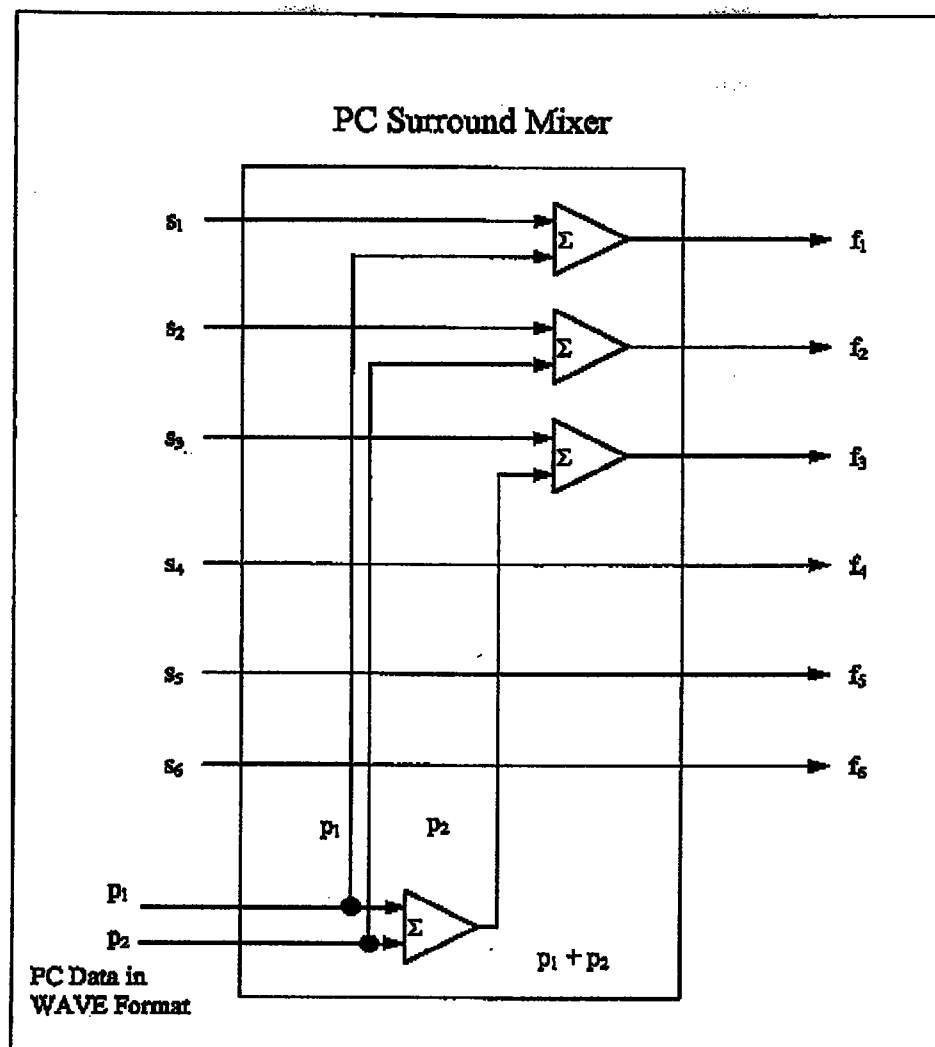


Figure 4. Example 2 of PC Surround Mixer.

Example 3

Figure 5 is similar to Figure 1 with the summation circuits Σ being replaced by multiplexers M . The operation of M is defined by if $b_1 = 0$, $f_i = x$; if $b_1 = 1$, $f_i = y$, and $b_1 = (a_7 \text{ AND } c)$ where c is an internally generated signal.

Note:

1. One (a7) of the inputs can be a control signal and not a surround, MIDI or WAVE signal.
2. The outputs also depend on $b_1 = (a_7 \text{ AND } c)$.



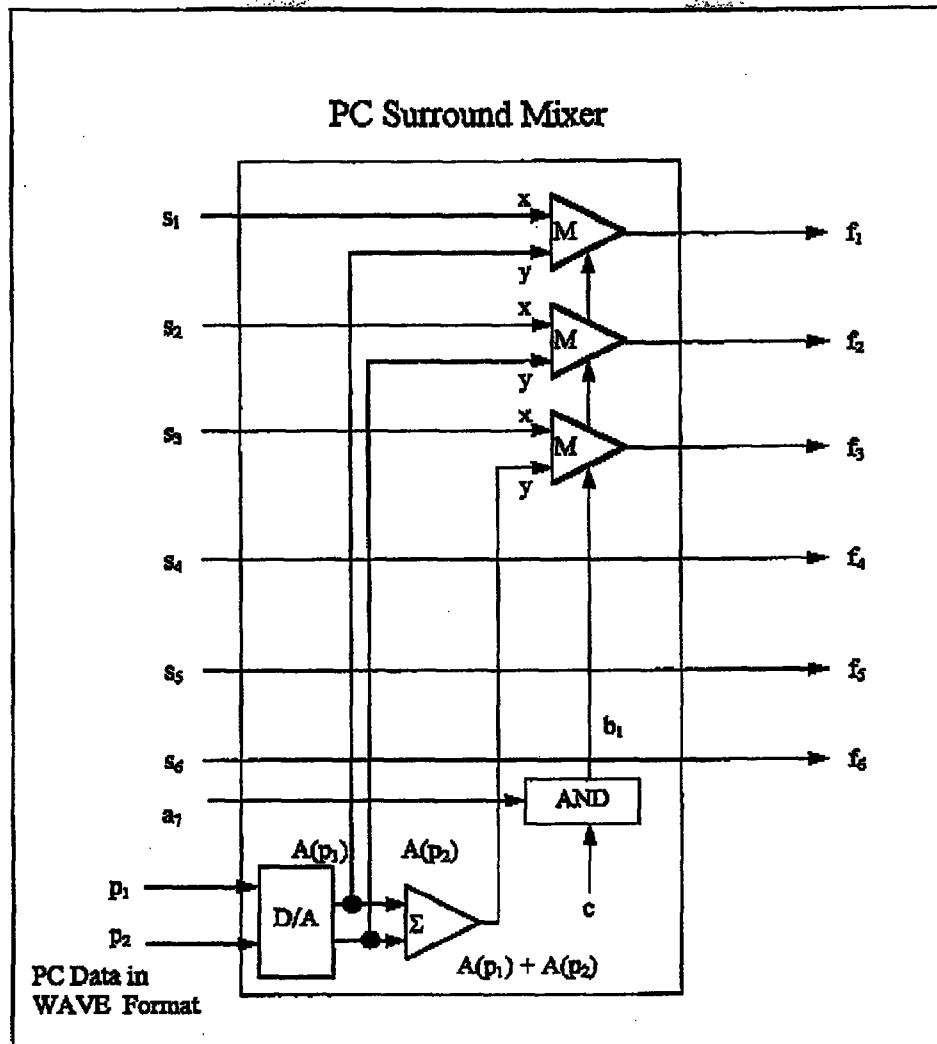


Figure 5. Example 3 of PC Surround Mixer.

Example 4

Figure 6 is similar to Figure 1, the six inputs: $(s_1, s_2, s_3, \dots, s_6)$ are analog channels of a surround sound. L is a low pass filter defined as:

for frequency $f < f_L$, output = input,
for frequency $f > f_L$, output = 0,

MIDI is a generator of MIDI analog signal by a table look up so that the frequency, duration, attack time, decay time, and amplitude of the analog output waveform are determined by the data supplied by the input PC data p_i .

so the outputs are given by:

$$\begin{aligned} f_1 &= s_1 + \text{MIDI}(p_1) \\ f_2 &= s_2 + \text{MIDI}(p_2) \\ f_3 &= s_3 + L(\text{MIDI}(p_1) + \text{MIDI}(p_2)) \\ f_4 &= s_4 + L(\text{MIDI}(p_1) + \text{MIDI}(p_2)) \\ f_5 &= s_5 + L(\text{MIDI}(p_1) + \text{MIDI}(p_2)) \\ f_6 &= s_6 + L(\text{MIDI}(p_1) + \text{MIDI}(p_2)) \end{aligned}$$



Comparing with our model, we can see that the criteria of the PC Surround Mixer are met by:

1. Two inputs are PC MIDI data.
2. There are other inputs and they are:

$$(s_1, s_2, s_3, \dots, s_6) = (s_1, s_2, s_3, \dots, s_6)$$

3. The $f_i = F_i(s_1, s_2, s_3, \dots, s_6, p_1, p_2, p_3, \dots, p_6, b_1, b_2, b_3, \dots, b_6)$ are:

$$f_1 = s_1 + \text{MIDI}(p_1)$$

$$f_2 = s_2 + \text{MIDI}(p_2)$$

$$f_3 = s_3 + L(\text{MIDI}(p_1) + \text{MIDI}(p_2))$$

$$f_4 = s_4 + L(\text{MIDI}(p_1) + \text{MIDI}(p_2))$$

$$f_5 = s_5 + L(\text{MIDI}(p_1) + \text{MIDI}(p_2))$$

$$f_6 = s_6 + L(\text{MIDI}(p_1) + \text{MIDI}(p_2))$$

Also, it can be seen that b's are not depended in all output, which is allowed in the PC Surround Mixer.

And finally,

4. The three output $f_i = F_i(s_1, s_2, s_3, \dots, s_6, p_1, p_2, p_3, \dots, p_6, b_1, b_2, b_3, \dots, b_6)$ having characteristics of at least a s term and a p term can be arbitrarily chosen as:

$$f_1 = s_1 + \text{MIDI}(p_1)$$

$$f_2 = s_2 + \text{MIDI}(p_2)$$

$$f_3 = s_3 + L(\text{MIDI}(p_1) + \text{MIDI}(p_2))$$

7

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WHAT IS CLAIMED IS :

1. A surround mixer for a personal computer substantially as herein described, with reference to and as illustrated in the accompanying drawings.

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