

Exhibit A

'058 Patent:

1. A system for detecting voiced and unvoiced speech in acoustic signals having varying levels of background noise, comprising:
 - at least two microphones that receive the acoustic signals;
 - at least one voicing sensor that receives physiological information associated with human voicing activity; and
 - at least one processor coupled among the microphones and the voicing sensor, wherein the at least one processor:
 - generates cross correlation data between the physiological information and an acoustic signal received at one of the microphones;
 - identifies information of the acoustic signals as voiced speech when the cross correlation data corresponding to the acoustic signal received at **the one receiver** exceeds a correlation threshold;
 - generates difference parameters between the acoustic signals received at each of **the two receivers**, wherein the difference parameters are representative of the relative difference in signal gain between portions of the received acoustic signals;
 - identifies information of the acoustic signals as unvoiced speech when the difference parameters exceed a gain threshold;
 - identifies information of the acoustic signals as noise when the difference parameters are less than the gain threshold.
2. A method for removing noise from acoustic signals, comprising:
 - receiving the acoustic signals at two receivers and receiving physiological information associated with human voicing activity from a voicing sensor;
 - generating cross correlation data between the physiological information and an acoustic signal received at one of the receivers;
 - identifying information of the acoustic signals as voiced speech when the cross correlation data corresponding to the acoustic signal received at the one receiver exceeds a correlation threshold;

generating difference parameters between the acoustic signals received at each of the two receivers, wherein the parameters are representative of the relative difference in signal gain between portions of the received acoustic

identifying information of the acoustic signals as unvoiced speech when the difference parameters exceed a gain

identifying information of the acoustic signals as noise when the difference parameters are less than the gain threshold

3. The method of claim 2, further comprising generating the gain threshold using standard deviations corresponding to the generation of the difference parameters.

4. The method of claim 2, further comprising performing denoising on the identified noise.

'091 Patent

1. A method for removing noise from acoustic signals, comprising:

receiving at least two acoustic signals using at least two acoustic microphones positioned in a plurality of locations;

receiving a voice activity signal that includes information on vibration of human tissue associated with human voice; and

generating a voice activity detection (VAD) signal using the voice activity signal;

generating at least two transfer functions representative of a ratio of energy of the acoustic signal received using the at least two acoustic microphones when the VAD indicates that user voice activity is present; and

removing **acoustic noise** from at least one of the acoustic signals by applying the first transfer function and at least one combination of the first transfer function and the second transfer function to the acoustic signals and generating denoised acoustic signals

2. The method of claim 1, wherein removing noise further comprises:

generating one transfer function of the at least two transfer functions to be representative of a ratio of energy of the acoustic signal received when the VAD indicates that user voice activity is present; and

removing noise from the acoustic signals using at least one combination of the at least two transfer functions to generate the denoised acoustic signals.

3. The method of claim 1, wherein the acoustic signals include at least one reflection of at least one associated acoustic source signal and at least one reflection of at least one acoustic source signal.

4. The method of claim 1, wherein generating the at least two transfer functions comprises recalculating the at least two transfer functions during at least one prespecified interval.

5. The method of claim 1, wherein generating the at least two transfer functions comprises use of at least one technique from a group consisting of adaptive techniques and recursive techniques.

11. A system for removing **acoustic noise** from the acoustic signals, comprising:

a receiver that receives at least two acoustic signals via at least two acoustic microphones positioned in a plurality of

at least one sensor that receives human tissue vibration information associated with human voicing activity of a

a processor coupled among the receiver and the at least one sensor that generates a plurality of transfer functions; the plurality of transfer functions includes a first transfer function representative of a ratio of energy of acoustic signals received at least two different acoustic microphones of the at least two acoustic microphones, wherein the first transfer function is generated in response to a determination that voicing activity is absent from the acoustic signals for a period of time; the plurality of transfer functions includes a second transfer function representative of the acoustic signals, wherein the second transfer function is generated in response to a determination that voicing activity is present in the acoustic signals for a period of time, wherein **acoustic noise** is removed from the acoustic signals using the first transfer function and at least one of the second transfer functions to produce the denoised acoustic data stream.

12. The system of claim 11, wherein the sensor includes a mechanical sensor in contact with the skin.

13. The system of claim 11, wherein the sensor includes at least one of an accelerometer, a skin surface microphone, a microphone in contact with skin of a user, a human tissue vibration detector, a radio frequency (RF) vibration detector, and a laser Doppler vibrometer.

15. The system of claim 11, further comprising:

dividing acoustic data of the acoustic signals into a plurality of subbands;

generating a transfer function representative of the ratio of acoustic energies received in each microphone in each of the plurality of subbands;

removing **acoustic noise** from each of the plurality of subbands using a transfer function, wherein a plurality of denoised acoustic data streams are generated; and

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