PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: KOKKA & BACKUS, PC
703 HIGH STREET
PALO ALTO, CA 94301

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing (*day/month/year*)	29 DEC 2014
Applicant's or agent's file reference ALI-144PCT	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/US 14/48974	30 July 2014 (30.07.2014)	30 July 2013 (30.07.2013)

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - H04R 5/00(2014.01)
CPC - H04S 1/002

Applicant ALIPHCOM

1. This opinion contains indications relating to the following items:

- [x] Box No. I Basis of the opinion
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [x] Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [ ] Box No. VII Certain defects in the international application
- [ ] Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1 *bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to th IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Fom PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	04 December 2014 (04.12.2014)	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 14/48974

Box No. I **Basis of this opinion**

1. With regard to the **language**, this opinion has been established on the basis of:
   - [x] the international application in the language in which it was filed.
   - [ ] a translation of the international application into ______________ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. [ ] This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

   a. (means)
   - [ ] on paper
   - [ ] in electronic form

   b. (time)
   - [ ] in the international application as filed
   - [ ] together with the international application in electronic form
   - [ ] subsequently to this Authority for the purposes of search

4. [ ] In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No. PCT/US 14/48974

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	3, 5-6	YES
	Claims	1-2, 4, 7-19	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-19	NO
Industrial applicability (IA)	Claims	1-19	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-2, 4, and 7-19 lack novelty under PCT Article 33(2) as being anticipated by US 2012/0001875 A1 to Li et al. (hereinafter Li).

Regarding claim 1, Li teaches a method (systems and methods for touchless sensing and gesture recognition suitable for use as a user interface using continuous wave ultrasound signals, para [0004]) comprising: generating unique ultrasonic signals (Fig. 2, ultrasound emitter 101, para [0044]), at least a unique ultrasonic signal being generated for emission from corresponding an acoustic probe transducer (a processor may generate a pseudorandom noise or pseudorandom number code, or other temporal encoding information, and encode that information in a spread spectrum modulation with pulse compression in step 504. This encoded signal is then emitted as a continuous wave ultrasound from an ultrasound emitter in step 506, para [0113]); emitting the unique ultrasonic signal in a direction associated with the acoustic probe transducer (Fig. 2, emits continuous wave ultrasound 206, while the other device 800b is in a receive mode receiving the continuous wave ultrasound 206 via the device's receivers 102a, 102b, and 102c, para [0122]); sensing reflected ultrasonic signals from one or more surfaces, a subset of surfaces being associated with an object (Reflected ultrasound signals may be received by ultrasound microphones, para [0004]); identifying a position of the object relative to the point in space as a function of characteristics of the reflected ultrasonic signals (track the motion of the reflecting object as a series of positions, para [0004]); determining a displacement of at least a portion of the object (ultrasound may propagate through the air and reflect off of a user's hand if the hand is positioned within a reflection detection zone. The reflected ultrasound may be received by one, two, three, or more ultrasound detectors or microphones positioned about the computing device, para [0038]); identifying an action responsive to the displacement (computing device may compare measured patterns to patterns stored in memory in order to identify a closest matching pattern using well known pattern recognition algorithms. The closest matching pattern may then be correlated to a user input gesture, para [0074]); and performing the action to modify operation of an audio system (Patterns extracted from difference channel impulse response images of known gestures or features can be input to train and develop parameter values of the model in a learning phase, para [0101]).

Regarding claim 2, Li further teaches wherein performing the action comprises: changing directivity of sound beams (Once relative coordinates between devices are determined, these coordinates may be mathematically converted into distances or angular directions, para [0124]) configured to provide spatial audio to an audio space including a recipient of audio as the object (As another example, a user may want to transfer a song from an audio player to a stereo. If the stereo is in a room full of other appliances with similar touchless interfaces, the user could rely on relative coordinates or direction determined from such ultrasound tracking systems to pick the stereo rather than the microwave or the dishwasher, para [0126]).

Regarding claim 4, Li further teaches wherein determining the displacement comprises: determining values representative of modified characteristics (a user may control a computing device by pointing or moving a hand above or within the vicinity of a computing device similar to how user commands can be input using known pointing devices or touchscreen displays, para [0041]).

Regarding claim 7, Li further teaches wherein determining the values representative of the modified characteristics comprises: detecting a variation in a distance (coordinates of a reflection point may be determined by converting the time of flight values of three or more receivers into distances based on an ultrasound speed and using the distances in an elliptical intersect method, para [0094]).

Regarding claim 8, Li further teaches detecting locomotion of the object based on the displacement (Since the angle of the pattern in the impulse response can be easily determined, this angle can be used as a recognizable feature that can be linked to a particular movement, para [0106]).

Regarding claim 9, Li further teaches sensing reflected ultrasonic signals from the subset of surfaces associated with the object (Reflected ultrasound signals may be received by ultrasound microphones, para [0004]); calculating one or more variations of distances between the point in space and the subset of surface to form one or more calculated distance variations (track the motion of the reflecting object as a series of positions, para [0004]); and identifying a next position of the portion of the object based on the one or more calculated distance variations that is either closer or farther relative to the point in space (ultrasound may propagate through the air and reflect off of a user's hand if the hand is positioned within a reflection detection zone. The reflected ultrasound may be received by one, two, three, or more ultrasound detectors or microphones positioned about the computing device, para [0038]).

---continued in supplemental box---

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No. PCT/US 14/48974

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:
Box No. V.2. Citations and explanations.

Regarding claim 10, Li further teaches sensing a first subset of reflected ultrasonic signals from the subset of surfaces associated with the object at a first time point (Reflected ultrasound signals may be received by ultrasound microphones, para [0004]); sensing a second subset of reflected ultrasonic signals from the subset of surfaces associated with the object at a second time point (computing device processor may calculate the difference channel impulse response over time, and maintain a series of those values as difference channel impulse response images using calculation methods, para [0113]); calculating one or more variations of directions between the subset of surfaces at the first time point and the subset of surfaces at the second time point to form one or more calculated direction variations (track the motion of the reflecting object as a series of positions, para [0004]); and identifying a next position of the portion of the object based on the one or more calculated direction variations that is either in a first lateral direction or in a second lateral direction relative to the point in space (ultrasound may propagate through the air and reflect off of a user's hand if the hand is positioned within a reflection detection zone. The reflected ultrasound may be received by one, two, three, or more ultrasound detectors or microphones positioned about the computing device, para [0038]).

Regarding claim 11, Li further teaches wherein the one or more variations of directions comprise: one or more angles, wherein the one or more calculated direction variations is either in a negative angular direction or in a positive angular direction relative to the point in space (angular second order correlation performed for the situation where a user finger moves away from a microphone, para [0088]).

Regarding claim 12, Li further teaches detecting a gesture based on the displacement of the at least a portion of the object (computing device may compare measured patterns to patterns stored in memory in order to identify a closest matching pattern using well known pattern recognition algorithms. The closest matching pattern may then be correlated to a user input gesture, para [0074]), detecting the gesture comprising: determining a first subset of the unique ultrasonic signals associated with another portion of the object (a processor may generate a pseudorandom noise or pseudorandom number code, or other temporal encoding information, and encode that information in a spread spectrum modulation with pulse compression in step 504. This encoded signal is then emitted as a continuous wave ultrasound from an ultrasound emitter in step 506, para [0113]); identifying the first subset of the unique ultrasonic signals indicate that the another portion of the object is non-transitory (reflected ultrasound arriving at a detector 102 thus encodes information regarding the location, shape and orientation of a user.s hand, para [0044]); determining a second subset of the unique ultrasonic signals associated with the portion of the object (use of location, shape and orientation information that is encoded in received ultrasound by processing changes in the channel impulse response, para [0045]); and identifying the second subset of the unique ultrasonic signals indicate that the another portion of the object is transitory (track the motion of the reflecting object as a series of positions, para [0004]).

Regarding claim 13, Li further teaches characterizing motion of the another portion of the object to form characterized motion (para [0074]); comparing the characterized motion against data representing patterns of motion each of which is associated with a gesture; and detecting a match of the characterized motion to a pattern of motion to determine an identified gesture (computing device may compare measured patterns to patterns stored in memory in order to identify a closest matching pattern using well known pattern recognition algorithms. The closest matching pattern may then be correlated to a user input gesture, para [0074]).

Regarding claim 14, Li further teaches translating the identified gesture to a control action (para [0041]); and generating control action signal associated with the control action, wherein the control action signal is configured to cause modified operation of the audio system (a user may control a computing device by pointing or moving a hand above or within the vicinity of a computing device similar to how user commands can be input using known pointing devices or touchscreen displays, para [0041]).

Regarding claim 15, Li further teaches characterizing motion of the another portion of the object to form characterized motion (changes in the channel impulse response over time can be analyzed to reveal patterns that can be compared to known patterns stored in memory in order to recognize intended user input gestures, para [0038]); comparing the characterized motion against data representing patterns of motion each of which is associated with a gesture (computing device may compare measured patterns to patterns stored in memory in order to identify a closest matching pattern using well known pattern recognition algorithms. The closest matching pattern may then be correlated to a user input gesture, para [0074]); detecting no match of the characterized motion to the patterns of motion; and identifying that the characterized motion is indicative of a change in orientation of the object (reflected ultrasound arriving at a detector 102 thus encodes information regarding the location, shape and orientation of a user's hand. In a conventional imaging ultrasound system, the echo arrival time measured by detectors 102 may be used to generate an image of the reflecting surface, para [0044]).

Regarding claim 16, Li teaches an apparatus (systems and methods for touchless sensing and gesture recognition suitable for use as a user interface using continuous wave ultrasound signals, para [0004]) comprising: a plurality of transducers configured to emit audible acoustic signals (a processor may generate a pseudorandom noise or pseudorandom number code, or other temporal encoding information, and encode that information in a spread spectrum modulation with pulse compression in step 504. This encoded signal is then emitted as a continuous wave ultrasound from an ultrasound emitter in step 506, para [0113]) into a region including one or more audio sources (ultrasound signals could be used to select a destination or source of the file, para [0126]); a plurality of acoustic probe transducers configured to emit ultrasonic signals, at least a subset of the acoustic probe transducers each is configured to emit a unique ultrasonic signal (Fig. 2, emits continuous wave ultrasound 206, while the other device 800b is in a receive mode receiving the continuous wave ultrasound 206 via the device's receivers 102a, 102b, and 102c, para [0122]); a plurality of acoustic sensors configured to sense received ultrasonic signals reflected from the one or more audio sources (Reflected ultrasound signals may be received by ultrasound microphones, para [0004]): and a controller configured to determine a displacement of at least a portion of an audio source of the one or more audio sources (computing device may compare measured patterns to patterns stored in memory in order to identify a closest matching pattern using well known pattern recognition algorithms. The closest matching pattern may then be correlated to a user input gesture, para [0074]).

---continued in supplemental box---

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 14/48974

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:
Box No. V.2. Citations and explanations.

Regarding claim 17, Li further teaches wherein the controller comprises: a locomotion detector configured to detect locomotion of the audio source based on the displacement (Since the angle of the pattern in the impulse response can be easily determined, this angle can be used as a recognizable feature that can be linked to a particular movement, para [0106]); and a gesture detector configured to detect a gesture based on the displacement of the portion of the audio source (computing device may compare measured patterns to patterns stored in memory in order to identify a closest matching pattern using well known pattern recognition algorithms. The closest matching pattern may then be correlated to a user input gesture, para [0074]).

Regarding claim 18, Li further teaches a motion correlator configured to correlate the displacement with data representing a gesture (computing device may compare measured patterns to patterns stored in memory in order to identify a closest matching pattern using well known pattern recognition algorithms. The closest matching pattern may then be correlated to a user input gesture, para [0074]); and a gesture identifier configured to identify the gesture (ultrasound may propagate through the air and reflect off of a user's hand if the hand is positioned within a reflection detection zone. The reflected ultrasound may be received by one, two, three, or more ultrasound detectors or microphones positioned about the computing device, para [0038]); a gesture translator configured to translate the gesture to a control action command (Patterns extracted from difference channel impulse response images of known gestures or features can be input to train and develop parameter values of the model in a learning phase, para [0101]); and a control action data generator configured to generate the control action command to control operation of the apparatus (a user may control a computing device by pointing or moving a hand above or within the vicinity of a computing device similar to how user commands can be input using known pointing devices or touchscreen displays, para [0041]).

Regarding claim 19, Li further teaches a phase-shift key signal modulator (continuous wave ultrasound signal may be modulated in a manner that enables received reflected signals to be correlated with the emitted signal. Matching signals may allow the system to determine the channel impulse response or calculate the difference in time between transmission and reception, or time of flight, para [0040]) configured to generate the unique ultrasonic signal (a processor may generate a pseudorandom noise or pseudorandom number code, or other temporal encoding information, and encode that information in a spread spectrum modulation with pulse compression in step 504. This encoded signal is then emitted as a continuous wave ultrasound from an ultrasound emitter in step 506, para [0113]).

Claims 3, and 5-6 lack an inventive step under PCT Article 33(3) as being obvious Li in view of US 2012/0101610 A1 to Ojala et al. (hereinafter Ojala).

Regarding claim 3, Li teaches the elements of claim 1. Li further teaches wherein performing the action comprises: detecting a gesture based on the displacement of the at least a portion of the object (computing device may compare measured patterns to patterns stored in memory in order to identify a closest matching pattern using well known pattern recognition algorithms. The closest matching pattern may then be correlated to a user input gesture, para [0074]). Li does not expressly teach modifying generation of spatial audio based on the gesture. However Ojala, in an analogous art, teaches modifying generation of spatial audio (spatial audio rendering , para [0022]) based on the gesture (disambiguating control information 9 for controlling spatial rendering of the captured audio channels, para [0037]). It would have been obvious to one skilled in the art to combine the teachings of Li with those of Ojala in order to more efficiently render spatial audio directionally in the ultrasound gesture detection system of Li (see Ojala para [0004]-[0005]).

Regarding claim 5, Li teaches the elements of claim 4. Li does not expressly teach wherein determining the values representative of the modified characteristics comprises: detecting a variation in a direction. However Ojala, in an analogous art, teaches wherein determining the values representative of the modified characteristics comprises: detecting a variation in a direction (the direction of arrival of a sound source is determined for each time-frequency component of the multi-channel audio using e.g. inter-channel time and level differences, para [0104]). It would have been obvious to one skilled in the art to combine the teachings of Li with those of Ojala in order to more efficiently render spatial audio directionally in the ultrasound gesture detection system of Li (see Ojala para [0004]-[0005]).

Regarding claim 6, Ojala further teaches wherein detecting the variation in the direction comprises: detecting a variation in an angle (Thus when the audio source 16 is located `forward` of the linear array 12, the phase difference .phi. has the same sense as the orientation angle .theta, para [0034]).

Claims 1-19 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.