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(54) Title: A SYSTEM AND METHOD FOR GENERATING A STATUS OUTPUT BASED ON SOUND EMITTED BY AN ANIMAL

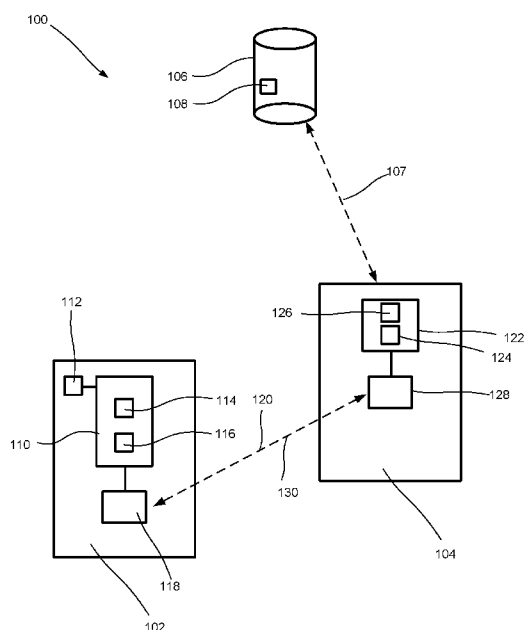


FIG. 1

(57) Abstract: The disclosure relates to a system for generating a status output based on sound emitted by an animal. The system comprising: a client (102), a server (104) and a database (106); the database (106) is accessible (107) by the server (104) and comprises historic sound data pertaining to the animal (302) or animals of the same type as the animal; the client (102) comprising circuitry (110) configured to: detect (202) sound emitted (308, 312) by the animal (302); record (204) the detected sound (308, 312); analyze (206) the recorded sound for detecting whether the sound (308, 312) comprises a specific sound characteristic out of a plurality of possible sound characteristics, wherein the sound characteristic includes at least one of intensity, frequency and duration of the detected sound; transmit (208), in response to detecting that the sound (308, 312) comprises the specific sound characteristic, the recorded sound to a server (104); the server (104) comprises circuitry (122) configured to: receive (210) the recorded sound; classify (212) the recorded sound by comparing one or more sound characteristics of the recorded sound with the historic sound data comprised in the database (106); generate (214) the status output based on the classification of the recorded sound. A method (200) for generating a status output based on sound emitted by an animal is also provided.

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A SYSTEM AND METHOD FOR GENERATING A STATUS OUTPUT  
BASED ON SOUND EMITTED BY AN ANIMAL

Field of invention

The invention relates to a system and a method for generating a status output based on sound emitted by an animal. Also a client and a server is  
5 presented.

Technical Background

Feeling safe is of fundamental importance to humans. Discomfort or stress is therefore caused if one worries that an event such as a break-in or a  
10 trespass should occur, when one is away. Knowledge about the current status of one's home is consequently desirable. It is also reassuring to know that systems such as power, heat and water systems are as they should at home and to know that no damage or destruction is taking place to the home while one is away. It is further comforting to know that a companion animal  
15 staying at home is feeling fine.

Many home owners therefore invest in different electronic security systems to feel secure. Prevention of burglary or trespassing is, for instance, hoped to be achieved by monitoring their homes or properties with such systems. The monitoring also allows for detection of failures which may occur  
20 at home such as a power cut or a broken heater. The electronic security systems installed in a home are typically built with a control unit configured to communicate with different hardware components such as cameras, thermometers, different types of sensors for windows and doors, and alarms for detecting and alerting in case of a malfunction or safety risk. Most sensors  
25 are passive sensors based on "activation", meaning that they will alarm when e.g. a window is broken, a door is opens, the temperature increases or in case of fire or smoke.

Surveillance systems utilizing, for example, network cameras may alternatively or in combination be used to monitor the status of a home.

30 These security systems are, however, complex as they typically require number of dedicated sensors to provide an adequate surveillance of the home. The wealth of information provided by the hardware components, especially by the cameras, may, moreover, be demanding to handle. Large amount of information may, for instance, put demands on the needed

bandwidth and speed for the communication between the security system or surveillance system and a remotely located homeowners or a security company.

- There is therefore a need for novel security and surveillance systems
- 5 having less complexity and which requires reduced amount of information when monitoring the status of a home or the status of an animal such as a dog or cat in the home.

#### Summary of invention

- 10 It is an object of the invention to provide a system making it technically possible to generate a status output based on sound emitted by an animal.

This object has been achieved by providing a system comprising:  
a client, a server and a database;

- the database is accessible by the server and comprises historic sound
- 15 data pertaining to the animal or animals of the same type as the animal;

the client comprising circuitry configured to:

detect sound emitted by the animal;

record the detected sound;

- analyze the recorded sound for detecting whether the sound
- 20 comprises a specific sound characteristic out of a plurality of possible sound characteristics, wherein the sound characteristic includes at least one of intensity, frequency and duration of the detected sound;

transmit, in response to detecting that the sound comprises the specific sound characteristic, the recorded sound to a server;

- 25 the server comprises circuitry configured to:

receive the recorded sound;

classify the recorded sound by comparing one or more sound characteristics of the recorded sound with the historic sound data comprised in the database;

- 30 generate the status output based on the classification of the recorded sound.

An advantage is that an improved accuracy in generating the status output is obtained. More specifically, knowledge on the status of the animal or of the status of an environment in which the animal is located is efficiently

obtained by utilizing the sound emitted by an animal and in particular by utilizing a specific sound characteristic of the sound emitted by an animal. In other words, the provided classification allows for an accurate evaluation of the situation by comparing the specific sound characteristic of the sound emitted by the animal and the historic sound data, i.e. prerecorded sound of the animal or an animal of the same type. The system thereby takes advantage of that the specific sound characteristic of the sound emitted by an animal is indicative of a status of the animal or its surrounding. The type of sound, e.g. the type of barking may thereby be determined.

10           The complexity of the client is further reduced allowing for a simpler, smaller and more cost effective client. The need for system comprising a number of different sensors is, moreover, reduced. The system further allows for a reduction in usage of bandwidth between the client and the server as the action of transmitting is performed in response to detecting that the sound  
15           comprises the specific sound characteristic.

          The status output may, for example, be an output such as an alarm indicative of trespassing, break-in, smoke or fire. The status output may be indicative of that the environment of the animal or the animal itself is in an expected normal condition, i.e. the status is status quo. The status output  
20           may be indicative of that the behavior of the animal. The status output may indicated if the animal is healthy, ill, sad, happy or distressed. The status output may, for example, be an alarm indicative of that the animal is ill, distressed, angry, sad, or afraid. The status output may, for example, be a sound signal, a text message or a visual indication such as an icon describing  
25           or illustrating the status which may be communicated to human having access to the client and/or server via for instance an application software.

          The sound emitted by the animal may, for example, be a groan, a scream, a bellow, a whining, a squeak, a mew or a roar. The skilled person realizes that various animals may emit other sounds that may be detected  
30           and recorded.

          The specific sound characteristic of the sound emitted by an animal may be associated with a mood or behavior of the animal.

The sound emitted by an animal may be a dog barking. As an example, a distressed dog may, for example, emit characteristic sound, which may also be referred to as a guard bark, when the dog feels the need to defend himself/herself against a perceived threat as will be described further below. The intensity, frequency and/or duration of the guard bark may thereby be analyzed and classified based on which the status output threat may be generated. The specific sound characteristic may be construed as a sound which in its intensity, frequency, and/or duration is distinctive to other sounds emitted by the animal. A change in the frequency, intensity and or duration of the sound may be indicative of a mood change of the animal. As an example, an increased loudness and duration of the sound emitted by the animal may be characteristic indicating that the animal is upset.

The historic sound data may comprise recorded sounds generated previously by the animal. The historic sound data may in addition or alternatively comprise recorded sounds generated by animals of the same type as the animal. The animals of the same type may be animals of the same species of animals and/or the same breed of the animal. The animal may, for example, be a dog and the same breed of the animal may e.g. be the same breed of dog.

The environment may, for example be a property or a home.

The client may be configured as a wearable device to be worn by the animal. The client may be arranged separately from the animal.

The circuitry of the client may further comprise a motion sensor configured to sense a motion of the animal, and wherein the circuitry of the client further is configured to transmit the sensed motion to the server;

wherein the circuitry of the server is further configured to:

receive the sensed motion;

generate the status output based on the classification of the recorded sound and the sensed motion.

The circuitry of the client may further comprise a motion sensor configured to sense a motion of the animal, and wherein the circuitry of the client further is configured to transmit, in response to detecting that the sound comprises the specific sound characteristic, the sensed motion to the server;

wherein the circuitry of the server is further configured to:  
receive the sensed motion;  
generate the status output based on the classification of the  
recorded sound and the sensed motion.

5       The circuitry of the server may further be configured to store the  
sensed motion.

The circuitry of the client may further comprise a motion sensor  
configured to sense a motion of the animal, wherein the circuitry of the client  
is further configured to:

10       determine whether the movement of the animal is above a  
predetermined threshold; and  
transmit, in response to detecting that the sound comprises the specific  
sound characteristic and that the movement is determined to be above the  
predetermined threshold, the recorded sound to a server.

15       The speed and/or acceleration of the animal may thereby be  
measured. An advantage is that the motion of the animal may be determined  
which may be associated with a behavior or mood of the animal.

The circuitry of the client may further comprise a location sensor  
configured to sense a location of the animal, and wherein the circuitry of the  
20   client further is configured to transmit the location of the animal to the server;  
wherein the circuitry of the server is further configured to:  
receive the location of the animal;  
generate the status output based on the classification of the  
recorded sound and the location of the animal.

25       The circuitry of the client may further comprise a location sensor  
configured to sense a location of the animal, and wherein the circuitry of the  
client further is configured to transmit, in response to detecting that the sound  
comprises the specific sound characteristic, the location of the animal to the  
server;

30       wherein the circuitry of the server is further configured to:  
receive the location of the animal;  
generate the status output based on the classification of the  
recorded sound and the location of the animal.

The circuitry of the server may further be configured to store the location of the animal.

The circuitry of the client may further comprise a location sensor configured to sense a location of the animal, wherein the circuitry of the client  
5 is further configured to:

determine whether the location of the animal is within a predetermined area; and

transmit, in response to detecting that the sound comprises the specific sound characteristic and that the location of the animal is determined to be  
10 within the predetermined area, the recorded sound to a server.

The location of the animal may thereby be determined. An advantage is that the system may determine where the animal is located in for instance a room or a house. It is further possible to determine if the animal is at a given location. The location may further be a predetermine area. The predetermine  
15 area may be a sub-portion of a room, a house or a garden. The location may thereby be determined to be within a predetermined area of a house such as an area in the vicinity of a window, a door, or in the kitchen or at an attic. The location of the animal may be indicative of if an event is occurring at a given location. A comparison or correlation between the location of the animal and  
20 the detected sound emitted by the animal may further be used for the classification. An improved classification and generation of status output may thereby be provided.

The system may further comprise a camera configured to capture images of a scene comprising the animal, wherein the circuitry of the server is  
25 further configured to:

retrieve images captured by the camera;

analyze the images captured by the camera for identifying action behavior of the animal;

generate the status output based on the classification of the recorded  
30 sound and the identified action behavior of the animal.

A comparison or correlation between identified action behavior of the animal and the detected sound emitted by the animal may thereby be used for the classification. The action behavior of the animal may, for example, be a pose, a movement, a gait or a grimace of the animal. The action behavior

may be a turning of the head, a yawning, a shaking a tail position, a shivering, a blinking, a paw lift etc. An improved determination of the status of a scene or the status of the animal in a scene may thereby be provided. The accuracy of the generated status output may thereby be increased. The probability for a  
5 false alarm is thereby reduced. Demands on the needed bandwidth and speed for the communication between the system and a remotely located homeowners or a security company is further reduced.

The camera may be activated by the, by the client, detected sound emitted by the animal.

10 The server may be configured to activate the camera based on receiving the recorded sound.

Advantage enhanced privacy in the premises comprising the camera.

The system may further comprise a sensor configured to monitor premises wherein the animal is located, wherein the sensor is accessible by  
15 the server, wherein the circuitry of the server is further configured to:

generate the status output based on the classification of the recorded sound and monitoring data monitored by the sensor.

The system may thereby acquire additional information on the status of an environment where the sensor is arranged. The sensors may, for example,  
20 be a temperature sensor, water sensor, a smoke sensor, a contact sensors or a glass break sensor allowing for determination if related events has occurred.

The circuitry of the client may comprise a communication module configured to transmit the recorded sound to the server, wherein the  
25 communication module is further configured to be activated in response to the circuitry of the client detecting that the sound comprises the specific sound characteristic.

An advantage is that prolonged battery life time of the client may thereby be obtained.

30 The circuitry of the client may comprise a piezo microphone configured to detect the sound emitted by the animal.

An advantage is that a battery life time of the client is prolonged because the piezo microphone will be active by the sound itself.

According to a second aspect a method for generating a status output  
35 based on sound emitted by an animal is provided. The method comprising:

detecting, at a client, sound emitted by the animal;  
recording, at the client, sound emitted by the animal;  
analyzing, at the client, the recorded sound for detecting whether the  
sound comprises a specific sound characteristic out of a plurality of possible  
5 sound characteristics, wherein the sound characteristic includes at least one  
of intensity, frequency and duration of the detected sound;

in response to detecting that the sound comprises the specific sound  
characteristic transmitting, by the client, the recorded sound to a server;

receiving the recorded sound at the server;

10 classifying, at the server, the recorded sound by comparing one or  
more sound characteristics of the recorded sound with historic sound data  
pertaining to the animal or animals of the same type as the animal, the  
historic sound data being stored in a database accessible by the server;

generating, at the server, the status output based on the classification  
15 of the recorded sound.

The above mentioned features of the system, when applicable, apply  
to this second aspect as well. In order to avoid undue repetition, reference is  
made to the above.

The act of classifying may further comprise taking into account location  
20 specific event data.

The location event data may comprise information on planned activities  
in the area such as construction, garbage and recycling collection. The  
location event data may comprise information on crime activity e.g. burglary  
activity in the area, national holidays, or ongoing events in the area such as  
25 demonstrations, parades or festivals.

Information on location specific event which may influence the behavior  
of an animal may thereby be use in the classification. A more accurate status  
output may thereby be generated.

The status output may be an alarm signal, wherein the method further  
30 comprises sending the alarm signal from the server to a monitoring center.  
The monitoring center may be a security company. The monitoring center  
may be in the form of a software application on an electronic device such as a  
computer, a digital assistant, a smart phone, a mobile phone or a wearable  
device such as a smart watch or a smart wrist band.

The alarm may be designed to warn of burglaries or trespassers. The alarm may be a silent alarm sent to a monitoring center provided by the police or security guards which are warned without indication to the burglar. The alarm may alternatively or in combination be an alarm which gives an audible,  
5 visual or other form of alarm signal about a status to indicate if an event such condition has occurred. The alarm may be sent out as a visible and/or audible signal by a siren.

The status output may be a health indicator for the animal. The health indicator may be a characteristic of the animal such as calm, happy,  
10 distressed, afraid, angry, hungry, sleepy, healthy or ill.

The health indicator may be indicative of health, mood, or behavioral changes that develop in response to an illness causing, for example, an animal to limit its movement or location, changing its stance, gait or vocalization.

15 The method may further comprise upon generating the status output, updating the historic data in the database.

An improved and more reliable database may thereby be built up. Subsequent classification using the database may thereby be improved in accuracy.

20 A further scope of applicability of the present invention will become apparent from the detailed description given below. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the scope of  
25 the invention will become apparent to those skilled in the art from this detailed description.

Hence, it is to be understood that this invention is not limited to the particular component parts of the device described or steps of the methods described as such device and method may vary. It is also to be understood  
30 that the terminology used herein is for purpose of describing particular embodiments only, and is not intended to be limiting. It must be noted that, as used in the specification and the appended claim, the articles "a," "an," "the," and "said" are intended to mean that there are one or more of the elements unless the context clearly dictates otherwise. Thus, for example, reference to

"a unit" or "the unit" may include several devices, and the like. Furthermore, the words "comprising", "including", "containing" and similar wordings do not exclude other elements or steps.

5 Brief description of the drawings

The invention will by way of example be described in more detail with reference to the appended schematic drawings, which shows a presently preferred embodiment of the invention.

Figure 1 is a schematic drawing of a system for generating a status  
10 output based on sound emitted by an animal.

Figure 2 illustrates a block diagram of a method 200 for generating a status output based on sound emitted by an animal.

Figure 3 illustrates an example of a system 300 for generating a status output based on sound emitted by an animal.

15 Figure 4 illustrates an example of a system 300 for generating a status output based on sound emitted by an animal.

Detailed description of preferred embodiments

The present invention will now be described more fully hereinafter with  
20 reference to the accompanying drawings, in which currently preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided for thoroughness and completeness, and to fully convey the scope of the  
25 invention to the skilled person.

In the following a system and a method for generating a status output based on sound emitted by an animal are described in relation to figures 1 – 3. Figure 1 illustrates a schematic view of the system 100 and figure 2 illustrates a block diagram of a method 200.

30 The system 100 comprises a client 102, a server 104 and a database 106. The database 106 is here illustrated as a separate unit to the server 104 but may alternatively be comprised in the server 104. In case the database 106 is a separate unit to the server 104, the database 106 is accessible 107 by the server 104 via wireless or wired communication over a communication

network. The database 106 may comprise a memory 108 on to which historic sound data pertaining to the animal or animals of the same type as the animal may be stored.

The client 102 comprises circuitry 110. The circuitry 102 may comprise  
5 different modules such as a microphone 112, a memory 114, a processor 116 and a communication module 118. Modules of the circuitry are implemented as a dedicated hardware portion, a hardware portion configured to run software such as firmware, resident software, micro-code, etc, or a combination thereof.

10 The microphone 112 is configured to detect 202 and record 204 sound emitted by an animal. The recorded sound may be stored on the memory 114.

The processor 116 is configured to run software analyzing 206 the recorded sound for detecting whether the sound comprises a specific sound  
15 characteristic out of a plurality of possible sound characteristics, wherein the sound characteristic includes at least one of intensity, frequency and duration of the detected sound.

The communication module 118 is configured to, in response to detecting that the sound comprises the specific sound characteristic, transmit  
20 120 the recorded sound to the server 104, see also the action of transmitting 208 of the method 200.

Thus, the processor 116 may be understood to be configured to identify and filter out or to select a sound comprising the specific sound characteristic out of a plurality of possible sound characteristics. The amount  
25 of data pertaining to the sound transmitted 120 from the client 102 to the server 104 may thereby be reduced.

The processor 116 and the memory 114 may further be configured to only store sounds comprising the specific sound characteristic out of a plurality of possible sound characteristics. The data storage capacity of the  
30 memory 114 may thereby be reduced.

The server 104 comprises circuitry 122. The circuitry 122 may comprise different modules such as a processor 124, a memory 126 and a communication module 128. Modules of the circuitry are implemented as a

dedicated hardware portion, a hardware portion configured to run software such as firmware, resident software, micro-code, etc, or a combination thereof. The server 104 is configured to receive 130, 210, via the communication module 128, the recorded sound transmitted 120, 208 from the client 104. The received 130, 210 recorded sound may be stored on the memory 126. The processor 124 of the server may be configured to run software classifying 212 the recorded sound by comparing one or more sound characteristics of the recorded sound with the historic sound data comprised in the database 106; The processor 124 may further be configured to run software generating 214 the status output based on the classification of the recorded sound.

With reference to figures 3 and 4 an example is provided illustrating a system 300 for generating a status output based on sound emitted by an animal. The animal is in this example a dog 302 located in the living room 304 of a house. The living room has furniture 303 comprising a sofa, a table and a television system. The system 300 comprises a client 102 and a server 104, the server comprising a data base 106. The client 102 and the server 104 are in communication 305 via wireless communication system 306. The wireless communication system 306 may be a cloud based communication system.

The client 102 is configured as a wearable device to be worn by the dog 302 as a collar. The client 102 comprises, as discussed in relation to figure 1, circuitry 110 configured to detect 202 sound 308 emitted by the animal and to record 204 the sound 308. The circuitry of the client 102 is further configured to analyze 206 the recorded sound 308 for detecting whether the sound 308 comprises a specific sound characteristic out of a plurality of possible sound characteristics, wherein the sound characteristic includes at least one of intensity, frequency and duration of the detected sound. The sound 308 may, for example, comprise sound characteristics which are in intensity, frequency or duration indicative of a harmonic play bark for the dog 302. The client 102 may, as in this example, be configured to upon detection of this sound 308 ignore and delete it from the memory of the client as it indicative of that the status for the dog 302.

Figure 4 illustrated the same dog 302 and the same living room 304 at another point in time. The dog 302 has now identified a person 310 attempting to break into the living room 304. The dog 302 has moved towards the window 311 and barks intensively. The sound 312 emitted by the dog 302  
5 may in this example be described as a threat bark or warning bark having a characteristic low-pitched sound. The sound 312 may, for example, be higher in intensity, longer in duration and lower frequency than the sound 308 described above.

The client 102 detects 202 and records 204 the sound 312. The  
10 circuitry 110 of the client 102 analyzes 206 the recorded sound for detecting whether the sound comprises a specific sound characteristic out of a plurality of possible sound characteristics, wherein the sound characteristic includes at least one of intensity, frequency and duration of the detected sound. The sound 312 may thereby be identified as comprising a specific sound  
15 characteristic. The client 102 then transmit 208, in response to detecting that the sound comprises the specific sound characteristic, the recorded sound to a server. The server 104 receives 210 the recorded sound and classifies 212 it by comparing one or more sound characteristics of the recorded sound with the historic sound data comprised in the database. The sound 312 is thereby  
20 identified as a warning sound and the server 104 generates 214 status output based on the classification of the recorded sound. The status output is here a warning or alarm signal sent to the owner of the dog and/or a monitoring center such as a security company having access to information pertaining to the status output generated by the system 300.

25 The status output of the system 300 may trigger a siren or a loud speaker in order to frighten the burglar 310. The loud speaker may be configured to amplify the sound emitted 312 by the dog 302.

It should be noted that the sound 308 disclosed above may alternatively be analyzed and detected as a sound comprising a specific  
30 sound characteristic which is transmitted 305 to a server 306. The server may thereafter classify the recorded sound by comparing one or more sound characteristics of the recorded sound with the historic sound data comprised in the database and generate the status output based on the classification of

the recorded sound. The status output may be indicative of that the dog is having a good time at home which may be reassuring to the owner of the dog. The status output may, moreover, a health indicator for the animal.

The circuitry 110 of the client 102 may further comprise a motion  
5 sensor 314 configured to sense a motion of the dog 302. The circuitry 110 of the client 102 may further be configured to transmit 305, the sensed motion to the server 104. The circuitry 122 of the server 104 may also be configured to receive the sensed motion and generate the status output based on the classification of the recorded sound and the sensed motion.

10 The motion sensor 314 may further be configured to sense a motion of the dog 302. The circuitry of the client 102 may further be configured to determine whether the movement of the dog 302 is above a predetermined threshold. The predetermined threshold may, for example, be a normal acceleration or speed at which the dog moves in the house under normal  
15 circumstances, e.g. in when the animal is not angry or afraid. The circuitry 110 of the client 102 may further be configured to transmit, in response to detecting that the sound comprises the specific sound characteristic and that the movement is determined to be above the predetermined threshold, the recorded sound to the server 104.

20 The client 102 may thereby detect an acceleration or speed of the dog 302, for instance, when the dog 302 runs to the window 311. The detected motion may thereby trigger a transmission 305 of recorded sound from the client 102 to the server 104.

A comparison or correlation between the detected sound and the  
25 detected motion may further be provided. An improved classification and generation of status output may additionally be provided.

The circuitry 110 of the client 102 may further comprise a location  
sensor 316 such as a GPS or a local area network location estimator. The location sensor 316 may be configured to sense a location of the dog, and the  
30 circuitry of the client 102 may be configured to transmit the location of the dog to the server 104.

The circuitry 110 of the server 104 may further configured to receive the location of the animal and generate the status output based on the classification of the recorded sound and the location of the dog 302.

5 The location sensor 316 may further be configured to sense a location of the animal 302, and the circuitry 110 of the client 102 may be configured to determine whether the location of the animal is within a predetermined area; and transmit, in response to detecting that the sound comprises the specific sound characteristic and that the location of the animal is determined to be within the predetermined area, the recorded sound to a server 104.

10 The location sensor 314 may thereby detect that the dog 302, which is normally located in the centre of the living room 304, preferably lying on the sofa, but when hearing the burglar 310 moves to a location at the window.

The system 300 may further comprise a camera 318. The camera 318 may be configured to capture images of a scene comprising the animal, e.g. 15 to image the living room 304 and the dog 302. The circuitry of the server 104 may further be configured to retrieve images captured by the camera 318 and analyze the images captured by the camera 318 for identifying action behavior of the dog 302 such as the aggressive behavior of the dog 302 described above. The server 104 may generate a status output based on the 20 classification of the recorded sound and the identified action behavior of the dog 302. An improved determination of the status in the room 304 or the status of the dog 302 may thereby be provided.

The server 104 may be configured to activate the camera 318 based on receiving the recorded sound. The recorded sound may thereby trigger the 25 camera 318 to switch from non-imaging to an imaging mode. Advantage being that enhanced privacy in the premises comprising the camera 318 is obtained. The amount of data, e.g. as images or video content, for monitoring the room 304 may further be reduced.

The data generated by the camera 318 may be accessible to the 30 server 104, not shown.

The system 300 may comprise a sensor 320 configured to monitor premises wherein the dog 302 is located, i.e. the living room 304. The sensor 320 may be accessible, not shown, by the server 104. The circuitry of the

server 104 may further be configured to generate the status output based on the classification of the recorded sound and monitoring data monitored by the sensor 320. The sensor 320 may, for example, be a glass break sensor sensing if the burglar 310 breaks the window 311.

- 5           The act of classifying may further comprise taking into account location specific event data. The person 310 may, for example, be a carpenter or a window cleaner which is scheduled to fix or clean the window.

Information on the location specific event which may influence the behavior of an animal may thereby be taken into account in the classification.

- 10          A more accurate status output may thereby be generated. The probability to generate status output being a false alarm may thereby be reduced.

The circuitry of the client may comprise a communication module configured to transmit the recorded sound to the server, wherein the communication module is further configured to be activated in response to the  
15          circuitry of the client detecting that the sound comprises the specific sound characteristic.

Advantage prolonged battery life time of the client may thereby be obtained.

- 20          The circuitry of the client comprises a piezo microphone configured to detect the sound emitted by the animal.

An advantage is that a battery life time of the client is prolonged because the piezo microphone will be active by the sound itself.

- 25          The person skilled in the art realizes that the present invention by no means is limited to the preferred embodiments described above. On the contrary, many modifications and variations are possible within the scope of the appended claims.

- 30          For example, the method described above may further comprise upon generating the status output, updating the historic data in the database. The information comprised in the database may thereby be improved. A better classification may thereby be made. A change to the characteristics of the sounds emitted by the animal, for instance as a result of aging, may thereby be taken into account.

- 35          The scene described above is illustrated as a living room 304 of a house, but the scene at which the animal is located may, for example, be an office building, or an animal day care or a property surrounding a building.

The animal is described above as being a dog. The skilled person realizes that sounds emitted from other animals may be detected and analyzed. The animal may, for example, be a horse, a cow, a cat, a pig or a sheep. Knowledge on the status of an animal or on the status of an environment in which the animal is located may thereby be efficiently obtained. The system and method may thereby take advantage of that the specific sound characteristic of the sounds emitted by the animals are indicative of a status of the animal or its surrounding.

The client may be comprised in or attached to a harness or band attached to the animal.

The client may be arranged at a distance to the animal. The client may be arranged in the premises of the animal.

The server may be arranged in the same premises as the client.

The database may be comprised in the server or separate from, but accessible to the server.

The method may further comprise, in response to detecting that the sound comprises the specific sound characteristic, activating a communication module of the client, wherein the act of transmitting the recorded sound to a server is performed by the communication module.

The system and method described above takes advantage of that the hearing range of an animal may be greater than the hearing range of a human. Hearing range describes the range of frequencies that can be heard by humans or animals, though it can also refer to the range of levels. The human range is commonly given as 20 to 20,000 Hz. The hearing ability of a dog is dependent on breed and age, though the range of hearing is usually around 67 Hz to 45 kHz, which is a range of 9 octaves. Humans hear a range of about 10 octaves. As dogs may hear higher frequency sounds than humans, they have a different acoustic perception of the world.

The server may use machine learning to classify the recorded sound emitted by the animal. The sound emitted may, for example, be a barking of a dog. The server may then use machine learning on the barking and compare it with the dog's history, dogs of the same type, etc.

Additionally, variations to the disclosed embodiments can be understood and effected by the skilled person in practicing the claimed

invention, from a study of the drawings, the disclosure, and the appended claims.

## CLAIMS

1. A system for generating a status output based on sound emitted by an animal, the system comprising:
  - 5 a client (102), a server (104) and a database (106);  
the database (106) is accessible (107) by the server (104) and comprises historic sound data pertaining to the animal (302) or animals of the same type as the animal;  
the client (102) comprising circuitry (110) configured to:
    - 10 detect (202) sound emitted (308, 312) by the animal (302);  
record (204) the detected sound (308, 312);  
analyze (206) the recorded sound for detecting whether the sound (308, 312) comprises a specific sound characteristic out of a plurality of possible sound characteristics, wherein the sound  
15 characteristic includes at least one of intensity, frequency and duration of the detected sound;  
transmit (208), in response to detecting that the sound (308, 312) comprises the specific sound characteristic, the recorded sound to a server (104);
    - 20 the server (104) comprises circuitry (122) configured to:  
receive (210) the recorded sound;  
classify (212) the recorded sound by comparing one or more sound characteristics of the recorded sound with the historic sound data comprised in the database (106);  
25 generate (214) the status output based on the classification of the recorded sound.
2. The system according to claim 1, wherein the client (102) is configured as a wearable device to be worn by the animal (302).
- 30 3. The system according to claim 2, wherein the circuitry (110) of the client (102) further comprises a motion sensor (314) configured to sense a motion

of the animal (302), and wherein the circuitry (110) of the client (102) further is configured to transmit, the sensed motion to the server (104);

wherein the circuitry (120) of the server (104) is further configured to:  
receive the sensed motion;

5                   generate the status output based on the classification of the recorded sound and the sensed motion.

4. The system according to claim 2, wherein the circuitry (110) of the client (102) further comprises a motion sensor (314) configured to sense a motion  
10 of the animal (302), wherein the circuitry (110) of the client (102) is further configured to:

determine whether the movement of the animal (302) is above a predetermined threshold; and

transmit, in response to detecting that the sound comprises the specific  
15 sound characteristic and that the movement is determined to be above the predetermined threshold, the recorded sound to a server (104).

5. The system according to any one of claims 2-4, wherein the circuitry of the client further comprises a location sensor (316) configured to sense a location  
20 of the animal (302), and wherein the circuitry (110) of the client (102) further is configured to transmit the location of the animal to the server (104);

wherein the circuitry (122) of the server (104) is further configured to:  
receive the location of the animal (302);

generate the status output based on the classification of the  
25 recorded sound and the location of the animal (302).

6. The system according to any one of claims 2-4, wherein the circuitry (110) of the client (102) further comprises a location sensor (316) configured to sense a location of the animal (302), wherein the circuitry (110) of the client  
30 (102) is further configured to:

determine whether the location of the animal is within a predetermined area; and

transmit, in response to detecting that the sound comprises the specific sound characteristic and that the location of the animal is determined to be within the predetermined area, the recorded sound to a server (104).

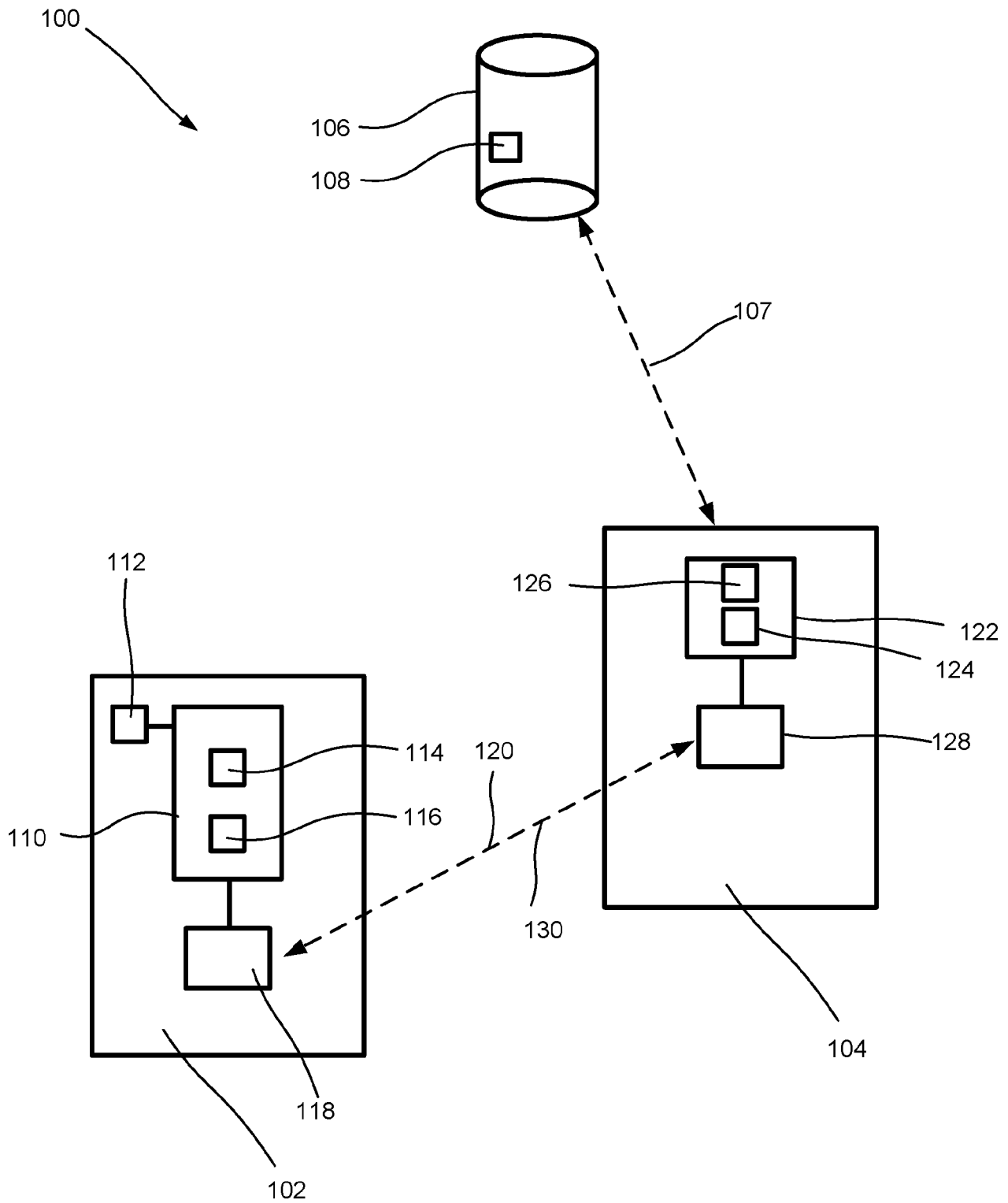
- 5     7. The system according to any one of claims 1-6, wherein the system (300) further comprises a camera (318) configured to capture images of a scene comprising the animal (302), wherein the circuitry (122) of the server (104) is further configured to:
- 10             retrieve images captured by the camera (318);
- analyze the images captured by the camera (318) for identifying action behavior of the animal;
- generate the status output based on the classification of the recorded sound and the identified action behavior of the animal (302).
- 15     8. The system according to any one of claims 1-7, wherein the system (300) further comprises a sensor (320) configured to monitor premises wherein the animal (302) is located, wherein the sensor (320) is accessible by the server (104), wherein the circuitry (122) of the server (104) is further configured to:
- 20             generate the status output based on the classification of the recorded sound and monitoring data monitored by the sensor (320).
9. The system according to any one of claims 1-8, wherein the circuitry (110) of the client (102) comprises a communication module (118) configured to transmit the recorded sound to the server (104), wherein the communication
- 25     module (118) is further configured to be activated in response to the circuitry (110) of the client (102) detecting that the sound comprises the specific sound characteristic.
10. The system according to any one of claims 1-9, wherein the circuitry (110)
- 30     of the client (102) comprises a piezo microphone configured to detect the sound emitted by the animal.

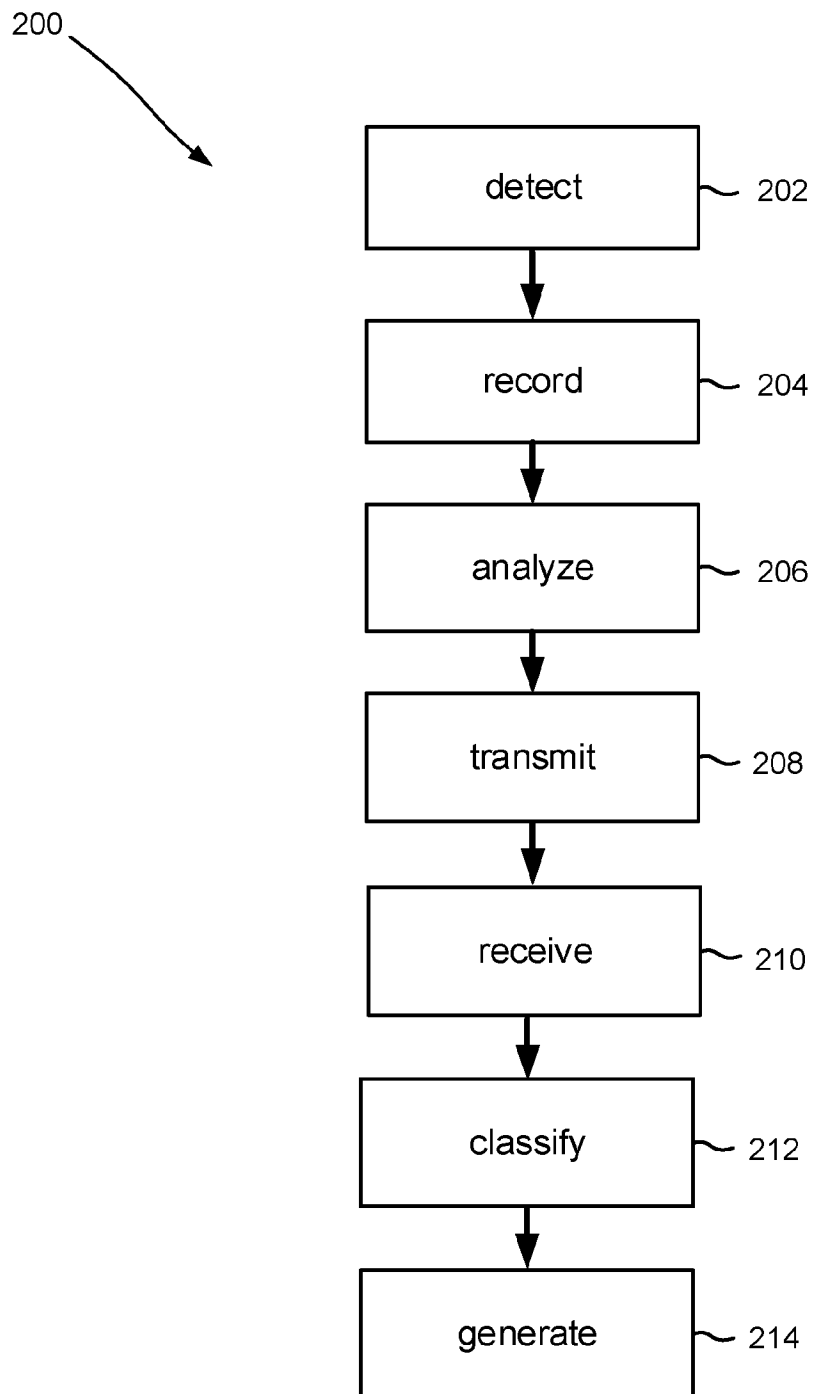
11. A method for generating a status output based on sound emitted by an animal, the method comprising:
- detecting (202), at a client, sound emitted (308, 312) by the animal (302);
- 5 recording (204), at the client, sound emitted by the animal;
- analyzing (206), at the client, the recorded sound for detecting whether the sound comprises a specific sound characteristic out of a plurality of possible sound characteristics, wherein the sound characteristic includes at least one of intensity, frequency and duration of the detected sound;
- 10 in response to detecting that the sound comprises the specific sound characteristic transmitting (208), by the client, the recorded sound to a server;
- receiving (210) the recorded sound at the server;
- classifying (212), at the server, the recorded sound by comparing one or more sound characteristics of the recorded sound with historic sound data
- 15 pertaining to the animal or animals of the same type as the animal, the historic sound data being stored in a database accessible by the server;
- generating (214), at the server, the status output based on the classification of the recorded sound.
- 20 12. The method according to claim 11, wherein the act of classifying further comprises taking into account location specific event data.
13. The method according to claim 11 or 12, wherein the status output is an alarm signal, wherein the method (200) further comprises sending the alarm
- 25 signal from the server (104) to a monitoring center.
14. The method according to claim 11 or 12, wherein the status output is a health indicator for the animal (302).
- 30 15. The method according to any one of claims 10-14, further comprises upon generating the status output, updating the historic data in the database (106).
16. A client comprising:

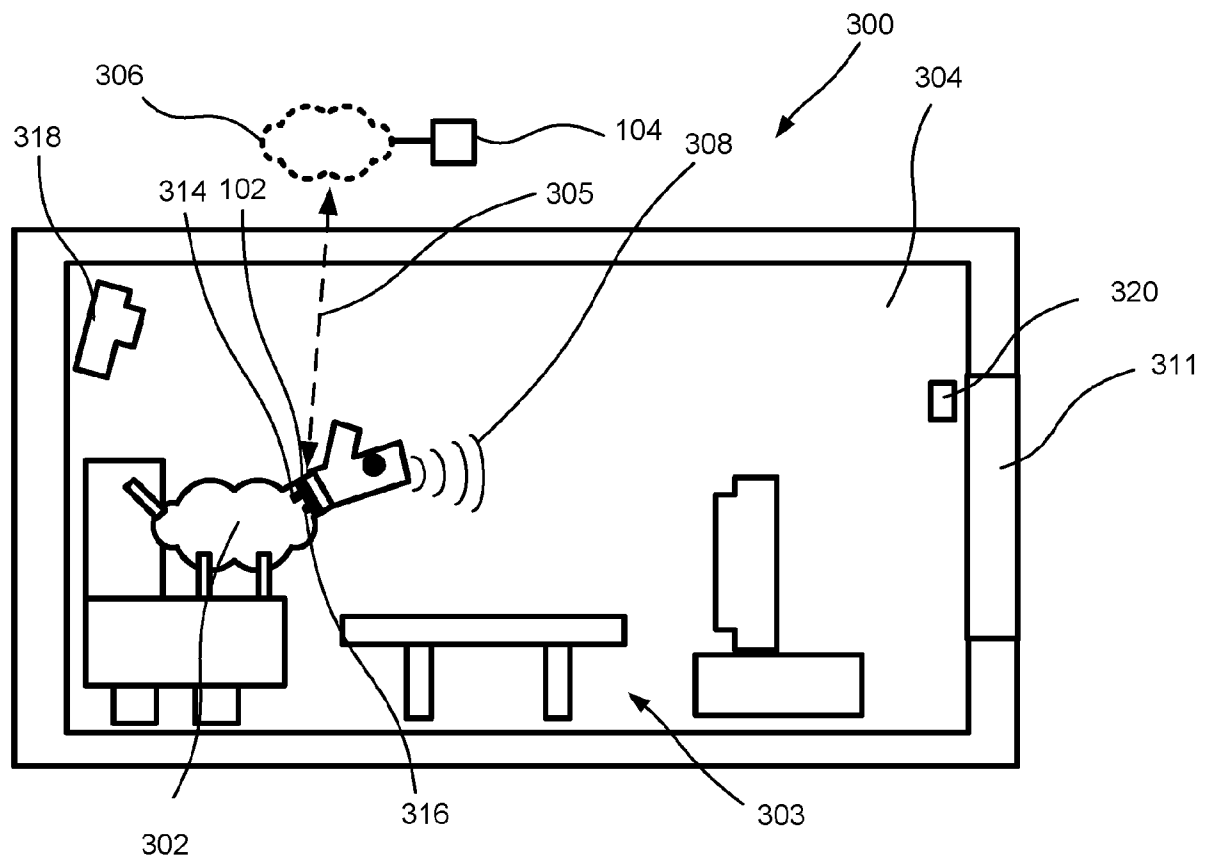
- a microphone (112) configured to detect sound emitted by an animal;  
a memory (114) configured to record the detected sound;  
a processor (116) configured to analyze the recorded sound for  
detecting whether the sound comprises a specific sound characteristic out of  
5 a plurality of possible sound characteristics, wherein the sound characteristic  
includes at least one of intensity, frequency and duration of the detected  
sound;  
a communication module (118) configured to, in response to detecting  
that the sound comprises the specific sound characteristic, transmit the  
10 recorded sound.
17. The client according to claim 16, wherein the client is configured as a  
wearable device to be worn by the animal.
- 15 18. The client according to claim 16 or 17, further comprising a motion sensor  
(314) configured to sense a motion of the animal, wherein the communication  
module (118) is further configured to transmit the sensed motion.
19. The client according to claim 16 or 17, further comprising a motion sensor  
20 (314) configured to sense a motion of the animal, wherein the processor (116)  
is further configured to determine whether the movement of the animal is  
above a predetermined threshold, and wherein the communication  
module (118) is further configured to, in response to detecting that the sound  
comprises the specific sound characteristic and that the movement is  
25 determined to be above the predetermined threshold, transmit the recorded  
sound.
20. The client according to any one of claims 16-19, further comprising a  
location sensor (316) configured to sense a location of the animal, wherein  
30 the communication module (118) is further configured to transmit the location  
of the animal.

21. The client according to any one of claims 16-19, further comprising a location sensor (316) configured to sense a location of the animal, wherein the processor (116) is further configured to determine whether the location of the animal is within a predetermined area, and wherein the communication
- 5 module (118) is further configured to, in response to detecting that the sound comprises the specific sound characteristic and that the location of the animal is determined to be within the predetermined area, transmit the recorded sound.
- 10 22. The client according to any one of claims 16-21, wherein the communication module (118) is further configured to be activated in response to the processor (116) detecting that the sound comprises the specific sound characteristic.
- 15 23. A server comprising:
- a communication module (128) configured to receive data pertaining to a recorded sound; and
- a processor (124) configured to:
- classify the recorded sound by comparing one or more sound
- 20 characteristics of the recorded sound with the historic sound data comprised in a database (106) comprising historic sound data pertaining to one or more animals, the database (106) being accessible by the client; and
- generate a status output based on the classification of the
- 25 recorded sound.
24. The server according to claim 23, wherein the communication module (128) is further configured to receive data pertaining to a location, and wherein the processor (124) is further configured to generate the status
- 30 output based on the classification of the recorded sound and the location.

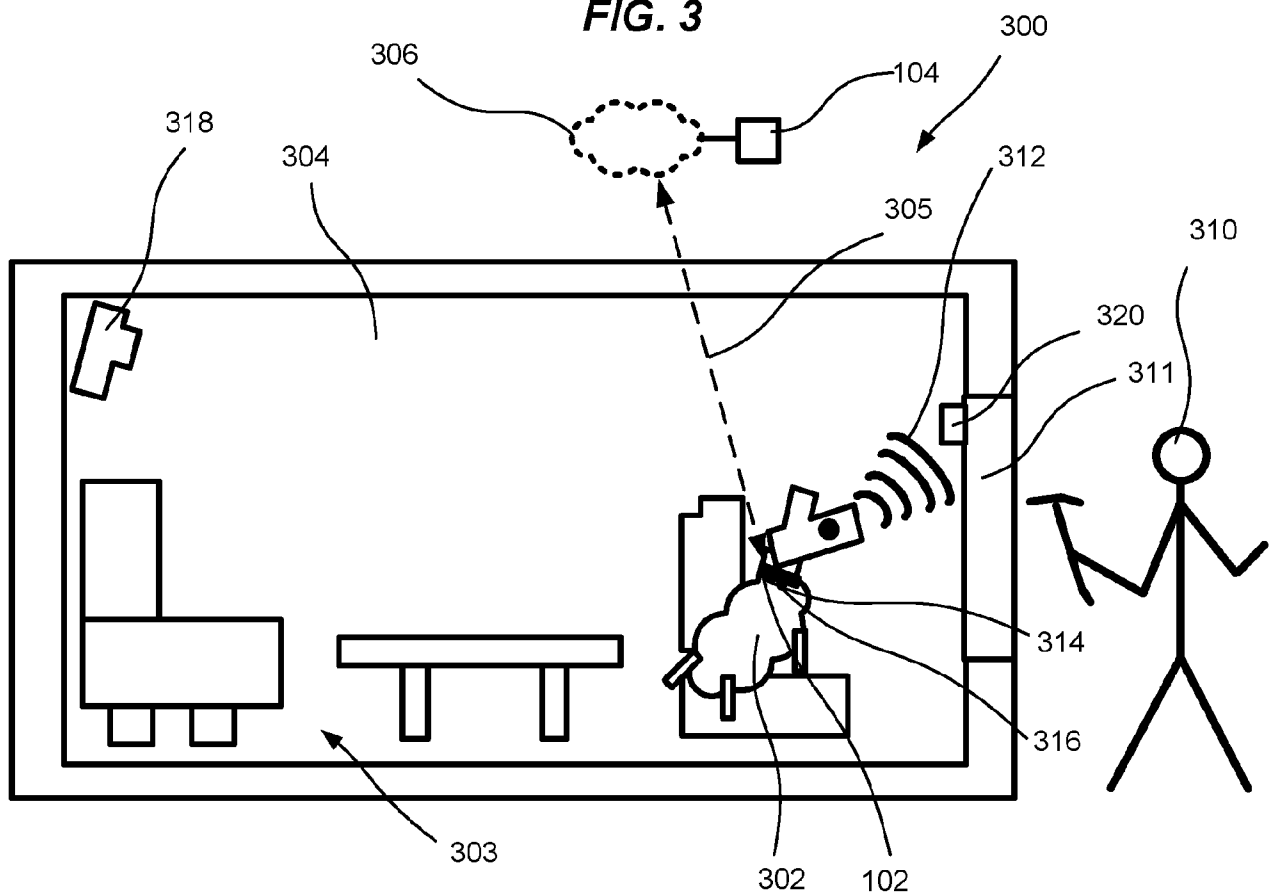
25. The server according to claim 23 Or 24, wherein the communication module (128) is further configured to retrieve images captured by a camera (318), and wherein the processor (124) is further configured to
- analyze the images captured by the camera (318) for identifying action
- 5 behavior of an animal; and
- generate the status output based on the classification of the recorded sound and the identified action behavior of the animal.

**FIG. 1**

**FIG. 2**



**FIG. 3**



**FIG. 4**

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/IB2017/054724

## A. CLASSIFICATION OF SUBJECT MATTER

INV. G08B25/00 G08B25/08 G08B21/04 G08B13/16  
ADD. H04W12/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G08B H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                | Relevant to claim No.       |
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| Y         | page 1, line 6 - line 10<br>page 5, line 2 - line 5<br>page 6, line 1 - page 7, line 21<br>page 8, line 8 - line 12<br>page 11, line 15 - line 21 | 5-10,12,<br>20-22,<br>24,25 |
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| Y         | page 9, paragraph 1 - page 14, paragraph 3                                                                                                        | 5-10,12,<br>20-22,<br>24,25 |
|           | -----<br>-/--                                                                                                                                     |                             |



Further documents are listed in the continuation of Box C.



See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

16 November 2017

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27/11/2017

Name and mailing address of the ISA/

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Authorized officer

Dascaiu, Aurel

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/IB2017/054724

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                 | Relevant to claim No. |
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Information on patent family members

International application No

PCT/IB2017/054724

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)                                                                                                                         | Publication<br>date                                                                                          |
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