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ENHANCED TELEPHONY USING HUMAN INAUDIBLE DATA OVER VOICE CHANNEL

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ABSTRACT

A telephone, such as a mobile phone, places a telephone call to another telephone by transmitting a signal (e.g., digital or analog) indicative of a sound wave. The signal indicative of the sound wave encodes sound data over a voice channel. The sound data includes human audible data, such as data indicative of sounds (e.g., voice) captured by a microphone. That is, the frequency of the sound wave that encodes the human audible data is within a frequency range audible by humans. The sound data also includes human inaudible data, such as a telephone number of the calling device, an image of the caller, a location of the calling device, associated with the calling telephone or a user of the calling telephone. That is, the frequency of the sound wave that encodes the human inaudible data is above the frequency range audible by humans. When the recipient telephone receives the signal indicative of the sound data, the recipient telephone converts the signal to a human audible sound wave that encodes the human audible data. The recipient telephone may utilize the human inaudible data to enhance the functionality of the call. For example, the recipient telephone may display the human inaudible data (e.g., a phone number of the calling device and/or an image of the caller) or connect a video call via URL encoded in the human inaudible data.

DESCRIPTION

Techniques are described that enable a telephone to transmit human audible data and human inaudible data to another telephone over a voice channel. In the example of FIG. 1, system 2 includes telephone 4 and telephone 6 communicating over a network 8. In one example, network 8 includes a public switched telephone network (PSTN), which may include a

cellular network (e.g., GSM, CDMA, LTE, etc.), plain old telephone service (POTS) network, or a combination of networks configured to transmit voice calls between different devices.

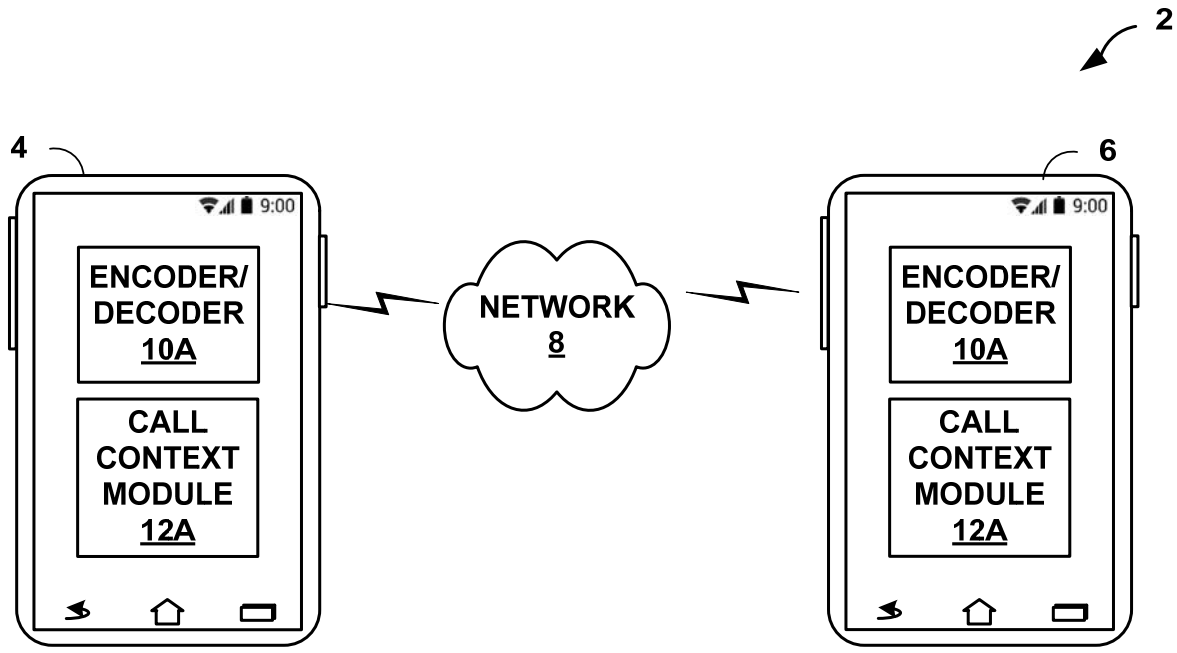

FIG. 1

In the example of FIG. 1, telephones 4, 6 are illustrated as mobile phones (e.g., smartphones). In some examples, telephones 4, 6 may include any type of device capable of communicating with another device via network 8, such as a desktop computer, a laptop computer, a tablet computer, a smart watch, or a smart speaker, among others. Telephones 4, 6 each include one or more processors. Examples of processors include, but are not limited to, digital signal processors (DSPs), general purpose microprocessors, application specific integrated circuits (ASICs), field programmable logic arrays (FPGAs), or other equivalent integrated or discrete logic circuitry. In the example of FIG. 1, one or more processors execute the functionality of encoder/decoders 10A and 10B (collectively, encoder/decoders 10) and call context modules 12A and 12B (collectively, call context modules 12).

In the example of FIG. 1, telephone 4 calls telephone 6 via network 8. For example, a user of telephone 4 may dial a phone number or select a contact from a contact list. Once the call is connected (e.g., when a user of telephone 6 answers the phone call), telephones 4 and 6 transmit signals indicative of sound waves to one another. The sound waves encode sound data, such as human audible data, that is within a human audible frequency range (e.g., approximately 20 Hz to approximately 20 kHz). For example, a microphone of telephone 4 may detect a sound wave (e.g., the voice of the user of telephone 4) and encoder/decoder 10A may generate a digital or analog signal indicative of the sound wave.

Throughout the disclosure, examples are described where telephone 4 and/or telephone 6 analyzes data associated with a telephone and a user of a telephone, only if the telephone receives permission from the user of the telephone to analyze the information. For example, in situations discussed below, before a telephone can collect or may make use of information associated with a user, the user may be provided with an opportunity to provide input to control whether programs or features of the telephone can collect and make use of user information (e.g., information about a user's current location, current speed, etc.), or to dictate whether and/or how to the telephone may receive content that may be relevant to the user.

In addition, certain information may be treated in one or more ways before it is stored or used by the telephone, so that personally-identifiable information is removed. For example, a user's identity may be treated so that no personally identifiable information can be determined about the user, or a user's geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over how information is collected about the user and used by the telephone.

According to techniques of this disclosure, the sound data encoded within the signal includes human inaudible data. That is, the portion of the sound wave that encodes the human inaudible data has a frequency above one human audible threshold (e.g., approximately 20 kHz) or below another human audible threshold (e.g., approximately 20 Hz). In one example, call context module 12A outputs the human inaudible data to encoder/decoder 10A which encodes the human inaudible data into the signal indicative of the sound wave. In some examples, human inaudible data includes information associated with telephone 4 or a user of telephone 4, such as a name of the user of telephone 4, an image of the user of telephone 4, the phone number associated with telephone 4, a charge level of a battery of telephone 4, a strength of a cellular signal of telephone 4, among others. Additionally or alternatively, the human inaudible data may include information indicative of a banking transaction or a cryptocurrency transaction, such as an account number and dollar amount. In one example, the human inaudible data may also include anti-spam information, such as information indicating whether the phone number associated with telephone 4 is authentic. In yet another example, the human inaudible data may include supplemental communication information, such as a URL for a video chat or an internet-based game.

Encoder/decoder 10A encodes the human inaudible data within the signal indicative of the sound wave by assigning an ultrasonic or human inaudible frequency (e.g., a frequency above a human audible threshold) to the human inaudible data. Responsive to encoding the human inaudible data and the human audible data in the signal indicative of the sound wave, telephone 4 transmits the signal to telephone 6 via network 8.

Responsive to receiving the signal from telephone 4, encoder/decoder 10B of telephone 6 decodes the signal into the human audible data and the human inaudible data. For instance,

encoder/decoder 10B may determine the frequencies of the signal to separate the human audible data from the human inaudible data. In one instance, encoder/decoder 10B identifies the human audible data by determining the portions of the signal that include frequencies that are within the human audible frequency range and identifies the human inaudible data by determining the portions of the signal that include frequencies above the human audible frequency range.

In one example, encoder/decoder 10B outputs the human audible data to a speaker of telephone 6. In such examples, the speaker emits a sound wave that encodes the human audible data with a frequency in the human audible frequency range. In this way, the users of telephone 4 and 6 may speak to one another via telephones 4 and 6.

Call context module 12B receives the human inaudible data and outputs all or a portion of the human inaudible data via an output device of telephone 6 (e.g., a display device). In one example, call context module 12B determines that phone number for telephone 4 is not associated with a contact for telephone 6. In such examples, call context module 12B may determine the human inaudible data includes an image of the user of telephone 4 and/or the phone number associated with telephone 4, and may output the image and/or phone number via a display device. In this way, call context module 12B may enable the user of telephone 6 to identify the caller when the caller is not in the recipient's contact list.

Additionally or alternatively, call context module 12B may determine the human inaudible data includes information indicating a charge level of a battery of telephone 4, a location of telephone 4, a strength of a cellular signal of telephone 4, etc. In such examples, call context module 12B may output a graphical user interface indicating the charge level, location, and/or strength of the cellular signal of telephone 4 via a display device of telephone 6. Outputting the human inaudible data to the user of telephone 6 may enable the user of telephone

6 to predict whether a call is likely to drop (e.g., telephone 4 has a poor signal and/or low battery) or determine how far away the user of telephone 4 is (e.g., to predict when the user will be home), among other advantages.

In one scenario, the human inaudible data includes a URL for a video chat. In such scenarios, call context module 12B may output a graphical button indicative of the URL. In one example, responsive to receiving data indicating that the user of telephone 6 selected the graphical button, call context module 12B may execute an application and join the video chat (e.g., via a WiFi® connection or cellular data connection). Similarly, the human inaudible data may include a URL for an internet game and call context module 12B may output a graphical button that, when selected by the user of telephone 6, executes an application to enable the user of telephone 6 to join the game. By encoding a URL in the signal indicative of the sound wave, telephone 4 may enable the user of telephone 4 to send an invite to a user of telephone 6 via a low-bandwidth voice channel (e.g., a telephone call) and establish a connection via a higher bandwidth communication protocol, such as WiFi® or cellular data channel.

It is noted that the techniques of this disclosure may be combined with any other suitable technique or combination of techniques. As one example, the techniques of this disclosure may be combined with the techniques described in U.S. Patent No. 9,020,121 entitled “Method and apparatus for sharing data between devices” to Dhanda. As another example, the techniques of this disclosure may be combined with the techniques described by U.S. Patent Publication No. 2013/035,079 entitled “Method and system for establishing data commuication [sic] channels” by O’Doherty.