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Emergency Behavior for a Connected Smartphone

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Abstract:

Smartphones today are capable of being connected to one or more devices via wireless communication technologies, such as Bluetooth®. While a smartphone is connected (or "paired") with a device, an audio-distribution profile of the smartphone governs routing of audio to and from mechanisms (*e.g.*, speakers, microphones) of either the smartphone or a device to which the smartphone is paired. A protocol that routes audio, based on an input telephone number being an emergency telephone number, is described.

Keywords:

Smartphone, audio-distribution profile, Bluetooth®, emergency, directory

Background:

While a smartphone is paired with another device, there may be emergencies where it is desirable to route audio of a telephone call to the other device. For example, if a user is in an automobile accident, it may be beneficial for audio of an emergency telephone call to be automatically routed through speakers and microphones of the smartphone as opposed to those of a hands-free system of the automobile, which may be damaged and non-functional. As another example, a user communicating through a headset that is paired with a smartphone may come across an accident and offer his smartphone to a victim of the accident so that the victim is able to call a hospital. The accident victim may make the telephone call without realizing that the audio-distribution profile is set up to route audio through mechanisms of the headset, which could cause

confusion and a delay until an audio-distribution profile is reconfigured so that the victim might use the smartphone.

Fig. 1 below illustrates a scenario in which a user is placing a telephone call during an emergency. Due to the nature of the emergency, the user may be distracted and focused on an immediate task at hand and not on audio-distribution profile settings. As a result, when the user makes a call, he may be surprised as to where audio is routed.

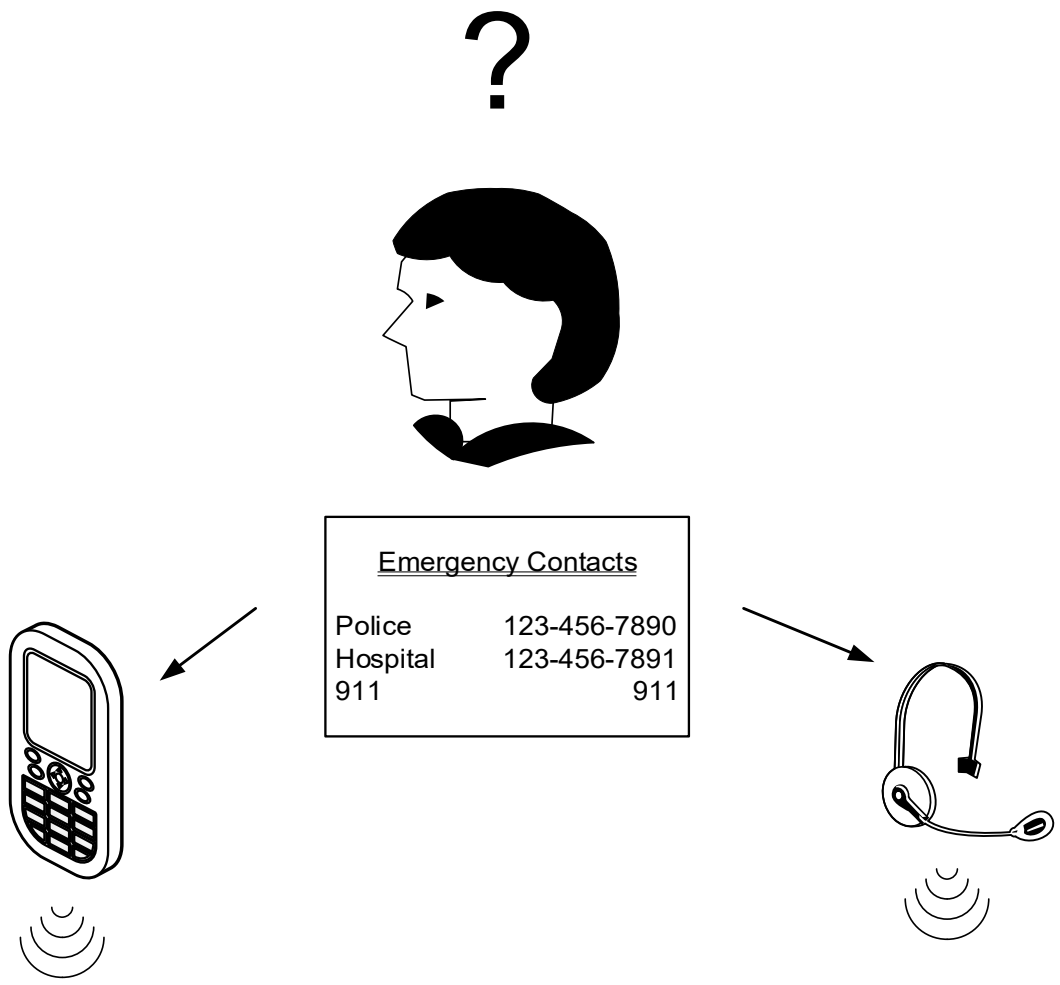

Fig. 1

Techniques are needed to address routing of call audio during emergencies. In particular, a technique that manages audio-distribution profile settings of a smartphone during emergency

calls is required to not only improve reliability and speed of communication during an emergency, but also meets a user's expectations during the emergency.

Detailed Description:

In general, when a smartphone is paired with another device via a wireless connection such as Bluetooth®, the smartphone manages wireless communication with the other device, in a master/slave relationship, via one or more profiles. A profile may specify details needed for successfully communicating data of a type, and can include formats and protocols necessary for successful communication. Furthermore, a smartphone may manage one or more profiles across multiple devices.

A particular profile is an audio-distribution profile. The audio-distribution profile, which a user can configure via Bluetooth® settings menus available on his smartphone, governs how audio streams that originate from the smartphone are audibly played or received. For example, a user in an automobile may have his smartphone actively paired to both a hands-free system of the automobile and a headset. In this example, the user chooses an audio-distribution profile that routes media audio (*e.g.*, a MP3 media file being played by a media player on the smartphone) to speakers of the hands-free system of the automobile and routes call audio (*e.g.*, a telephone call) to the headset. An illustration of menus, configuring settings in accordance with this example, is depicted in Fig. 2 below:

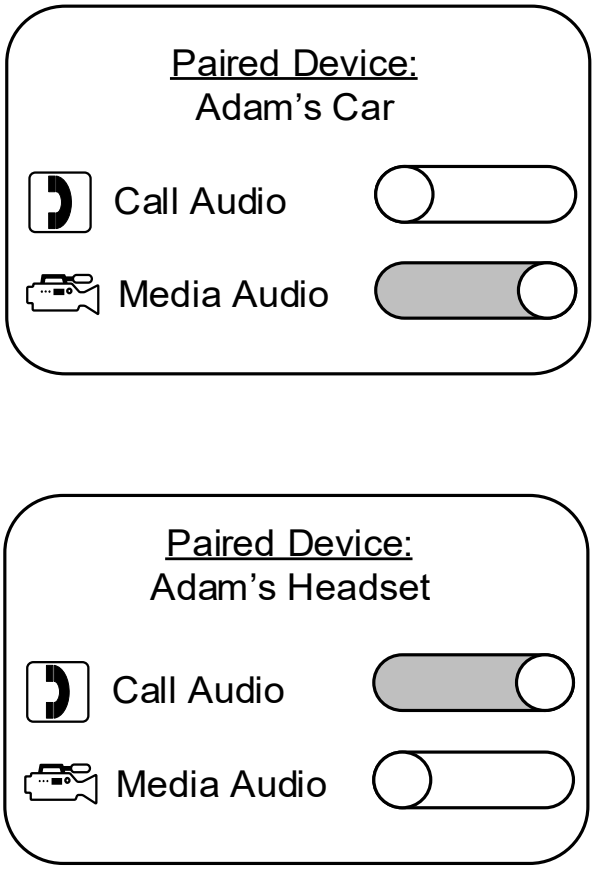

Fig. 2

Implementing a protocol that manages the audio-distribution profile of a smartphone, based on a dialed telephone number and not on a chosen setting, can change the behavior of a smartphone to act in accordance with expectations during an emergency.

For example, a set of telephone numbers typically used to manage an emergency may be flagged to cause, when dialed, the smartphone to invoke an emergency audio-distribution profile that is directed to effective management of audio routing during an emergency. Such a telephone number may be a telephone number of a hospital, a fire department, a police station, an emergency service (*e.g.*, 911), or the like. An example flowchart of such a protocol is illustrated in Fig. 3 below:

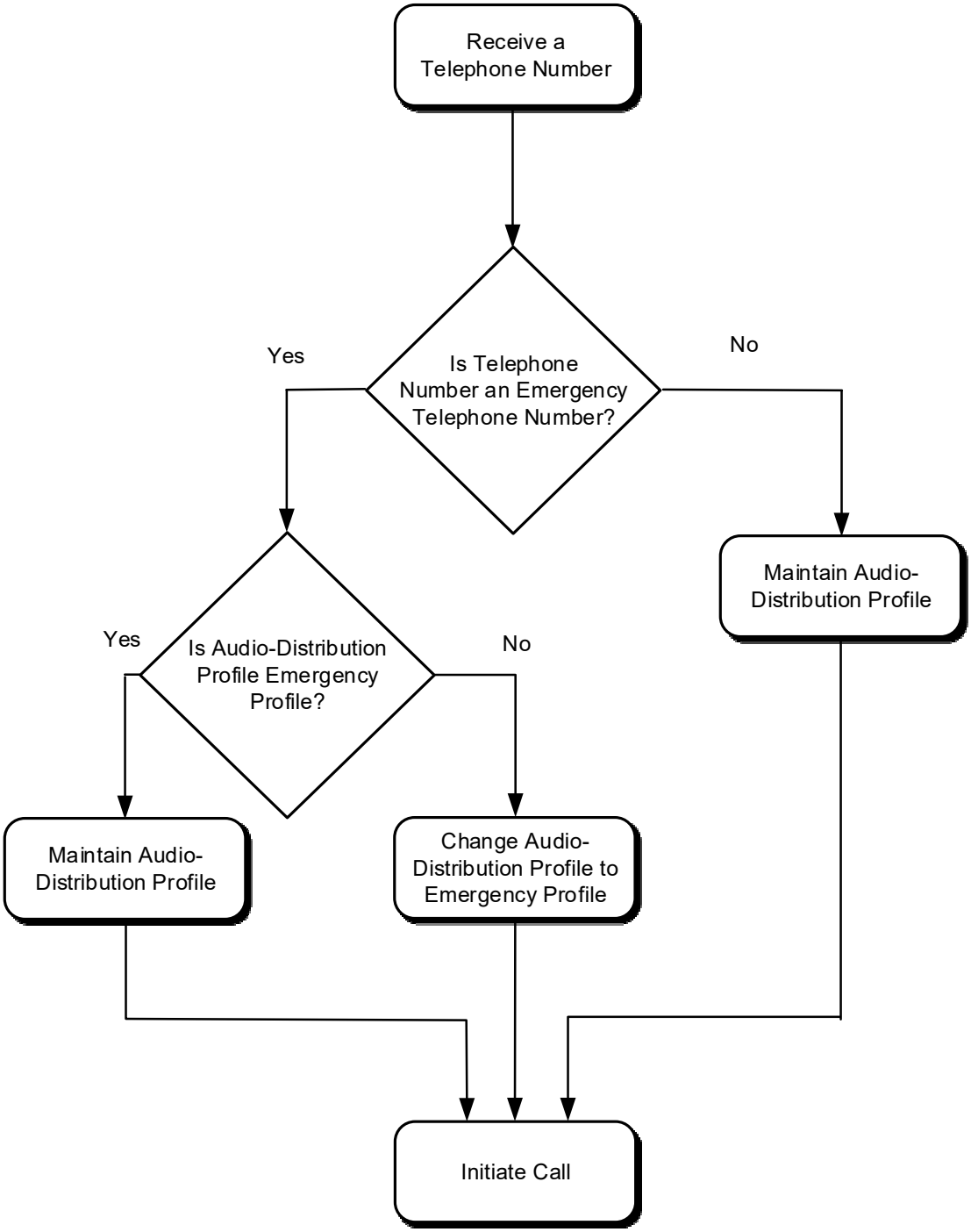

Fig. 3

As illustrated in Fig. 3, the smartphone executes a protocol that manages an audio-distribution profile of the smartphone based on a telephone number that is received via an input by

a user of the smartphone. After receiving the input telephone number, the smartphone determines if the telephone number is an emergency telephone number. If the telephone number is an emergency telephone number, the smartphone then determines if the audio-distribution profile of the smartphone (as set) is an emergency distribution profile. If not, the smartphone alters the audio-distribution profile to the emergency profile prior to initiating the call.

The protocol may also incorporate a notification/prompt from the smartphone indicating the state of the audio-distribution profile prior to changing the audio-distribution profile. For example, upon receiving an input of a telephone number associated with an emergency service and determining that the audio routing is not correct, the smartphone could notify a user with a prompt prior to invoking a change to its audio-distribution profile. The prompt could be, for example, an warning audio presented by the telephone itself, such as "The audio-distribution profile of your smartphone is currently routing audio through the headset. Would you like to change?", after which a user could confirm the change (with an audible command, keyed input, or the like) or physically change to the headset if response time is critical. Alternatively, a display of the smartphone could present the notification along with haptic signaling to the user, also apprising the user of the audio-distribution profile and giving him an opportunity to change the audio-distribution profile.

The protocol may be implemented into the smartphone with embedded firmware or an Application Programmable Interface (API), such that upon powering up, the smartphone is caused to search (via a cloud-based directory, service, or the like) for a listing of emergency telephone numbers local to geolocation where the smartphone may be operating. The smartphone may then create a directory of emergency telephone numbers for use (*e.g.*, the smartphone may use the directory to determine if an input telephone number is an emergency telephone number when

following the protocol of Fig. 2). Furthermore, the directory of emergency telephone numbers may always be enabled by a communication service and, in such instances, be accessible to a user of the smartphone, regardless of a limitation that might be placed on the smartphone by a subscriber identity module (SIM) card balance or the like.

The directory may be a dynamic directory, where emergency telephone numbers are searched for and replaced as the smartphone changes its geolocation. Alternatively, the directory may also be a static directory, where emergency telephone numbers are input by the user or "tagged" from a listing of numbers. In this instance, the user would have control over what telephone numbers are used by the protocol when determining emergency telephone numbers.

Furthermore, the directory may be local to the smartphone and stored in a cache memory of the smartphone. This permits a user to allocate a part of the cache memory to store emergency telephone numbers. If the allocated part is exceeded, the smartphone can notify the user so that emergency telephone numbers may be deleted or so that an allocation may change. The cache memory may be nonvolatile in nature, such a memory based in NAND, NOR, or SRAM semiconductor technology.

If storage capacity of a memory of the smartphone is critical, the directory may be remote from the smartphone. In such an instance, the directory may be stored via a cloud-based service, such as a service dedicated to providing emergency services during an emergency.

Sensor data available to the smartphone may also be used to help determine if an emergency has occurred and an intended device for audio routing. For example, accelerometers or GPS sensors in a smartphone may detect a sudden deceleration in motion of the smartphone, indicating that the smartphone has been in a vehicle in which an accident has occurred. As another

example, a sensor, such as a proximity sensor, may detect that the smartphone is being held near a person's head, and that the person intends to route audio through the smartphone.

The protocol that manages the audio-distribution profile may rely on a combination of input methods, telephone numbers, and sensor data when determining routing of audio. For example, the protocol may route audio to speakers of a smartphone based on a combination of the emergency telephone number being received through an input of the smartphone *and* a proximity sensor detecting that the smartphone is placed to a user's ear. If, however, the emergency telephone number is received through an input of a paired device (and a proximity sensor of a smartphone does not detect that the smartphone is near the user's ear), the protocol may route audio to the paired device.

Although techniques have been described in the context of a smartphone paired with one or more devices via Bluetooth® wireless communication technology, the techniques are applicable to other communication environments. For example, the techniques may be applied to a system within a wi-fi environment, such as smart-speakers, laptops, or any other device directly or indirectly supporting a Voice Over Internet Protocol (VoIP) communication environment.

Furthermore, the techniques are not restricted to emergencies and outgoing calls only. For example, a user may have a group of contacts (*e.g.*, telephone numbers), with which he wishes to have private conversations and, by default, associated telephone calls are not to be audibly routed to a device that others can hear. For example, the user's group of contacts may include an attorney, a personal physician, and an investment broker with whom he would like to keep his conversations private. Thus, it may be desirable for a telephone call with any individual from the group of contacts to not be heard over a speaker of a hands-free system of an automobile. To avoid such a situation, a directory of private telephone numbers may be created by a user that, when dialed by

the user (as an outgoing call) or recognized by the smartphone (as an incoming call), is subject to the described protocol managing the audio-distribution profile of the smartphone.