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(71) Applicant: **Giesecke+Devrient ePayments GmbH**
81677 München (DE)

(72) Inventor: **Jamdar, Yogesh**
122002 Gurgaon (IN)

(74) Representative: **Giesecke + Devrient IP**
Prinzregentenstraße 161
81677 München (DE)

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(54) **ESIM-BASED SECURE SMART HELMET**

(57) The present invention relates to an eSIM-based secure smart helmet (100). The helmet (100) includes sensors attached to the helmet (100), which are configured to monitor vibration and impact on the helmet (100). Further, an eSIM (102) is configured with the helmet (100) and connected to the sensors. The eSIM (102) stores a profile of the user (300), comprising a record of name and address of the user, nearest police station, nearest hospital, and emergency contact numbers. The eSIM (102) generates alert signals in form of an SMS indicative of the occurrence and location of an accident when the monitored vibration and impact exceed a predefined value. The eSIM (102) transmits the alert signals/SMS to mobile devices (104) associated with any or a combination of the last dialed mobile number of the user (300), the nearest police station, nearest hospitals, and the emergency contact numbers.

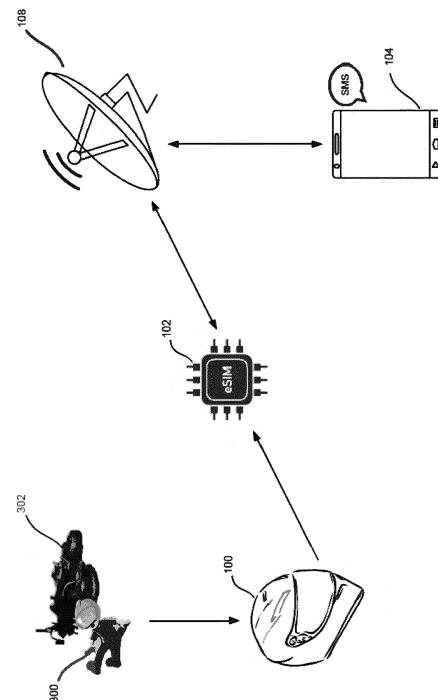


Fig. 3

Description

TECHNICAL FIELD

[0001] The present disclosure relates generally to the field of smart helmets. In particular, the present disclosure relates to an eSIM-based secure smart helmet that automatically sends an alert SMS having details and location of the user to a last dialed number, nearest police station, and emergency contact numbers in case of occurrence of an accident.

BACKGROUND

[0002] Background description includes information that may be useful in understanding the present invention. It is not an admission that any of the information provided herein is prior art or relevant to the presently claimed invention, or that any publication specifically or implicitly referenced is prior art.

[0003] Road accidents are one of the major causes of fatality in the world. Two-wheelers (or bikes) have the maximum involvement in fatal road accidents compared to four-wheelers as four-wheeler provides better stability. Even a minor imbalance of the bike may lead to the rider falling from the bike, resulting in serious injury. Further, direct impact or collision is much more serious. In worst cases, the rider of the bike may sustain an injury to vital organs such as the head while falling, resulting in loss of blood, paralysis, and fatality. A helmet plays a very important role in saving the life of bike riders by saving their head from any serious impact and injury. Still, the existing helmets are just capable of lowering the impact on the head, however, the rider might get hit at any other vital parts as well, which may lead to loss of blood, long-term disability, or fatality, if remains untreated instantly.

[0004] First-aid plays a very important role in saving the lives of the bike riders as the initial hour after the accident is the most critical time to save a life. Reduction in response time with respect to emergency responders increases the chances of saving lives during an accident. However, it has been observed that most of the time people at the accident site try to avoid helping the injured person, which decreases the chances of saving the injured person's life. Besides, the bike accident may also take place in a remote area or at night time where the chances of people noticing the injured person or accident are very low. This leaves the injured person untreated or unaided for a reasonable time and the chances of saving the injured person from permanent disability or fatality are significantly reduced in such cases.

[0005] Helmets are nowadays capable of detecting if the rider has worn the helmet or not, which alerts the rider to wear the helmet. Further, some of the helmets also come with accident and health detection systems that monitor the vital signs of the rider to determine the health of the rider and the occurrence of an accident. Further, these helmets are equipped with a physical sim or WiFi

technology to alert the user about wearing the helmet and also alert the user and others about health risks of the user or signs of the user involved in an accident. For instance, Patent document number ES2610034A1 discloses a Helmet for detection and notification of motorcycle accidents with biosignal monitoring. The disclosed helmet includes biosignal sensors for cardiac monitoring and heart rate estimation, electroencephalogram detection, flicker detection, humidity detection, and/or body temperature detection. These biosignals are processed to determine if the rider has met with an accident and also help determine if the user is at a health risk. However, the use of biosignal sensors makes such helmets costly, heavy, and bulky, making it uncomfortable to use.

[0006] Another patent document number CN104000340A discloses a multifunctional safety helmet with a physical sim card, particularly for underground workers. However, the safety helmet is not capable of determining the occurrence of an accident. Besides, the physical SIM card used in such a helmet requires the manufacturing of a SIM slot in the helmet, which adds cost and complexity.

[0007] Another patent document number CN112971254A discloses a motorcycle helmet with a physical SIM card to detect whether the rider has worn a helmet or not. Again, the disclosed helmet is not capable of determining the occurrence of an accident and the physical SIM card used in such a helmet requires the manufacturing of a SIM slot in the helmet, which adds cost and complexity.

[0008] The helmets disclosed in the above-cited patent documents involve a physical SIM card that requires the manufacturer of the helmets to provide an additional SIM slot for accommodating the physical SIM and other associated circuitry. This adds cost to the manufacturing of the helmet. Moreover, the physical SIM in general and used in such helmets is functionally limited to allow the use of only one profile with the helmet at a time. As a result, when the same helmet is used by another user, the SIM is required to be replaced with a new SIM having the profile of the new user. Besides, these helmets fail to automatically send an alert SMS having details and the location of the rider's emergency contact numbers in case of the rider meets an accident.

[0009] There is, therefore, a requirement in the art for a means to overcome the above drawbacks, shortcomings, and limitations associated with existing physical SIM-based helmets, and provide an improved and secured eSIM-based secure smart helmet that automatically sends an alert SMS having details and location of the user to a last dialed number, nearest police station, and emergency contact numbers in case of occurrence of an accident.

OBJECTS OF THE PRESENT DISCLOSURE

[0010] Some of the objects of the present disclosure, which at least one embodiment herein satisfy are as listed

herein below.

[0011] It is an object of the present disclosure to lower the number of fatalities from bike accidents by decreasing the response time with respect to emergency response and service provided to the injured person.

[0012] It is an object of the present disclosure to overcome the above-mentioned drawbacks, shortcomings, and limitations associated with existing physical SIM-based smart helmets.

[0013] It is an object of the present disclosure to eliminate the requirement of a physical SIM and an additional SIM slot in the existing smart helmet in order to reduce the helmet manufacturing cost and complexity.

[0014] It is an object of the present disclosure to provide an eSIM-based smart helmet that automatically sends an alert SMS having details and location of the user to a last dialed number, nearest police station, and emergency contact numbers in case of occurrence of an accident.

[0015] It is an object of the present disclosure to provide an eSIM-based smart helmet that allows downloading multiple profiles in the eSIM, unlike a physical SIM-based helmet.

[0016] It is an object of the present disclosure to provide a simple and reliable accident detection system that can be implemented in a helmet.

SUMMARY

[0017] The present disclosure relates to an improved and secured eSIM-based secure smart helmet that automatically sends an alert SMS having details and location of the user to any or a combination of a last dialed number, nearest police station, and emergency contact numbers in case of occurrence of an accident.

[0018] An aspect of the present disclosure pertains to an eSIM-based secure smart helmet. The helmet may comprise a shell adapted to be worn on the head of a user (or rider). The shell may extend circumferentially and vertically over the head of the user and may be fitted with cushioning and support pads along an inner surface of the shell and may be made of strong and lightweight material to provide comfort to the user and mainly lower the impact of any force or accident on the head of the user. The helmet may be further provided with straps to secure the helmet on the head and a chin guard (or face-guard) may be provided to protect the chin or face of the user. Further, a transparent visor may also be provided on the front of the helmet to protect the user from sunlight, wind, and dust, thereby providing better visibility to the user.

[0019] The smart helmet may comprise a set of sensors selected from a vibration sensor and pressure sensor being configured at predefined positions on the shell. The sensors may be configured to sense and monitor the vibrations and impact on the helmet. The smart helmet may further comprise an embedded-subscriber identity module (eSIM) configured or attached or embedded

in the shell, without requiring any additional SIM slot. The eSIM may be configured to receive and store/download profiles of one or more users in the eSIM. The profile may comprise the record of any or a combination of the name and address of the corresponding user, nearest police station, nearest hospital, and one or more emergency contact numbers of the users.

[0020] The eSIM may be operatively coupled to the sensors and configured to receive data corresponding to the vibration and impact on the helmet being monitored by the sensors. The eSIM may correspondingly generate a set of alert signals indicative of the occurrence and location of an accident when the monitored vibration and impact on the helmet exceeds a predefined value. The eSIM may send the alert signals in form of an SMS or voice SMS to one or more mobile devices associated with any or a combination of the nearest police station, nearest hospitals, and the one or more emergency contact numbers, and a last dialed mobile number of the user.

[0021] The helmet additionally comprises a GPS module embedded in the shell and operatively coupled to the eSIM to monitor the real-time and precise location of the helmet and the respective user. The GPS module correspondingly enables the eSIM to send the accident site of the user and/or the real-time location of user to the one or more mobile devices upon the occurrence of the accident.

[0022] Accordingly, upon the occurrence of the accident, the eSIM may transmit the alert SMS to the mobile device of the last dialed mobile number of the user. Further, when the last dialed mobile number is not in a network range, the eSIM may transmit the alert SMS comprising the name, address, and real-time location of the user to the mobile device associated with the nearest police station, and the nearest hospital. Furthermore, when the last dialed mobile number by the user returns in the network range, the eSIM may transmit the set of alert signals to the mobile device of the last dialed mobile number, and the one or more emergency contact numbers. This helps lower the number of fatalities from bike accidents by decreasing the response time with respect to emergency response and service provided to the injured user.

[0023] Thus, the present disclosure provides an improved and secured smart helmet that detects the occurrence of an accident and automatically sends an alert SMS having details and location of the user to any or a combination of a last dialed number, nearest police station, and emergency contact numbers in case of occurrence of an accident. Besides, the use of eSIM eliminates the requirement of an additional SIM slot in the helmet, which reduces the helmet manufacturing cost and complexity. Further, the eSIM also allows downloading multiple profiles in the eSIM, unlike a physical SIM-based helmet.

[0024] In another aspect, the mobile devices are configured to process the set of alert signals and maintain the records of the name, address, and real-time location

of the users in the corresponding mobile device using a mobile app.

[0025] Various objects, features, aspects, and advantages of the present disclosure will become more apparent from the following detailed description of preferred embodiments, along with the accompanying drawing figures in which like numerals represent like features.

[0026] Within the scope of this application, it is expressly envisaged that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, in the claims and/or in the following description and drawings, and in particular the individual features thereof, may be taken independently or in any combination. Features described in connection with one embodiment are applicable to all embodiments, unless such features are incompatible

BRIEF DESCRIPTION OF DRAWINGS

[0027] The accompanying drawings are included to provide a further understanding of the present invention and are incorporated in and constitute a part of this specification. The drawings illustrate exemplary embodiments of the present invention and, together with the description,

FIG. 1 illustrates an exemplary network architecture for implementing the accident alert SMS generation operation by the proposed eSIM-based smart helmet, in accordance with an embodiment of the present disclosure.

FIG. 2 illustrates an exemplary architecture of the proposed eSIM-based smart helmet, in accordance with an embodiment of the present disclosure.

FIG. 3 illustrates an exemplary diagram depicting the communication between the eSIM-based smart helmet and the mobile devices of emergency numbers through the network operator, upon the occurrence of an accident, in accordance with an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0028] The following is a detailed description of embodiments of the disclosure depicted in the accompanying drawings. The embodiments are in such detail as to clearly communicate the disclosure. However, the amount of detail offered is not intended to limit the anticipated variations of embodiments; on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the present disclosure as defined by the appended claims.

[0029] In the following description, numerous specific details are set forth in order to provide a thorough understanding of embodiments of the present invention. It will be apparent to one skilled in the art that embodiments of the present invention may be practiced without some of these specific details.

[0030] Embodiments of the present invention include various steps, which will be described below. The steps may be performed by hardware components or may be embodied in machine-executable instructions, which may be used to cause a general-purpose or special-purpose processor programmed with the instructions to perform the steps. Alternatively, steps may be performed by a combination of hardware, software, and firmware and/or by human operators.

[0031] Existing helmets are capable of lowering the impact on the head using the cushions provided within the shell of the helmet. Still, the rider might get hit at any other vital parts as well, which may lead to loss of blood, long-term disability, or fatality, if remains unattended for long. Herein, first-aid provided to the user in the initial hours plays a very important role in saving the lives of the bike riders as the initial few hours after the accident is a very critical time for saving an injured person's life. Thus, there is a requirement of reducing the response time of providing emergency medical assistance to the injured person to increase the chances of saving lives his/her life. But it has been observed that most of the time, people at the accident site try to avoid helping the injured person, wasting the initial valuable time, thereby decreasing the chances of saving the injured person's life. Besides, the bike accident can also take place in a remote area or at night time when the chances of people noticing the injured person or accident are very low. This leaves the injured person untreated or unaided for a reasonable time and the chances of saving the injured person from permanent disability or fatality are significantly reduced in such cases.

[0032] The physical SIM-based helmets available in the art are capable of alerting the rider to wear the helmet. One such existing helmet is capable of diagnosing early health risks to users and the occurrence of an accident using costly and bulky biosignal sensors for cardiac monitoring and heart rate estimation, electroencephalogram detection, flicker detection, humidity detection, and/or body temperature detection. This makes the overall helmet costly, bulky, complex, and inconvenient to the user. Besides, the existing helmet includes a physical SIM card that requires the manufacturer of the helmets to provide an additional SIM slot for accommodating the physical SIM and other associated circuitry. This adds cost to the manufacturing of the helmet. Moreover, the physical SIM in general and used in such helmets is functionally limited to allow the use of only one profile with the helmet at a time. As a result, when the same helmet is used by another user, the SIM is required to be replaced with a new SIM having the profile of the new user. Besides, these helmets fail to automatically send an alert SMS having details and the location of the rider's emergency contact numbers in case of the rider meets an accident

[0033] The present disclosure overcomes the above drawbacks, shortcomings, and limitations associated with existing physical SIM-based smart helmets, and provides an improved and secured smart helmet that detects

the occurrence of an accident and automatically sends an alert SMS having details and location of the user to any or a combination of a last dialed number, nearest police station, and emergency contact numbers in case of occurrence of an accident. Besides, the use of eSIM eliminates the requirement of an additional SIM slot in the helmet, which reduces the helmet manufacturing cost and complexity.

[0034] An eSIM (embedded-SIM) is a form of programmable SIM card that is embedded directly into the helmet. Instead of an integrated circuit located on a removable universal integrated circuit card (UICC), typically made of PVC, an eSIM consists of software installed onto an eUICC chip. Once an eSIM carrier profile has been downloaded and installed on an eUICC, it operates the same as a physical SIM, complete with a unique ICCID and network authentication key generated by the carrier. An eSIM improves reliability and network security, while also reducing space requirements, since a relatively bulky connector is not needed, thereby increasing design flexibility. Further, the eSIM also allows downloading multiple profiles in the eSIM, unlike a physical SIM-based helmet.

[0035] According to an aspect, the present disclosure elaborates upon an eSIM-based secure smart helmet including a shell adapted to be worn on the head of a user, and a set of sensors configured at predefined positions on the shell. The set of sensors can be configured to monitor vibration and impact on the helmet. Further, an eSIM can be configured with the shell and operatively coupled to the set of sensors. The eSIM includes a processor coupled to a memory storing instructions executable by the processor. The eSIM can be configured to receive and store a first of data packets corresponding to the profile of the user. The profile can include the record of any or a combination of the name and address of the corresponding user, nearest police station, nearest hospital, and one or more emergency contact numbers of the user. The eSIM can be further configured to receive a second set of data packets corresponding to the vibration and impact on the helmet being monitored by the sensors and can generate and transmit, when the monitored vibration and impact exceeds a predefined value, a set of alert signals indicative of occurrence and location of an accident, to one or more mobile devices associated with any or a combination of the nearest police station, nearest hospitals, and the one or more emergency contact numbers, and a last dialed mobile number of the user.

[0036] In an embodiment, the helmet can include a GPS module embedded in the shell and operatively coupled to the eSIM. The GPS module can be configured to monitor the real-time location of the helmet and the respective user, and can correspondingly enable the eSIM to send the real-time location of the user to one or more mobile devices upon the occurrence of the accident.

[0037] In an embodiment, upon the occurrence of the accident, the eSIM can be configured to transmit the set of alert signals to the mobile device of the last dialed mobile number of the user. Further, when the last dialed

mobile number is not in a network range, the eSIM can be configured to transmit the set of alert signals comprising the name, address, and real-time location of the user to the mobile device associated with the nearest police station, and the nearest hospital.

[0038] In an embodiment, when the last dialed mobile number by the user returns in the network range, the eSIM can be configured to transmit the set of alert signals to the mobile device of the last dialed mobile number, and the one or more emergency contact numbers.

[0039] In an embodiment, the set of alert signals, and the name, address, and real-time location of the user can be transmitted to the mobile devices in form of an SMS.

[0040] In another embodiment, the set of alert signals, and the name, address, and real-time location of the user can be transmitted to the mobile devices in form of a voice SMS or eCall.

[0041] In an embodiment, the set of sensors can include any or a combination of a vibration sensor, and pressure sensor.

[0042] In an embodiment, the helmet can be in communication with the mobile devices through a telecommunication network provided by one or more telecom operators.

[0043] In an embodiment, the eSIM can be configured to receive and store one or more profiles associated with one or more users, which can allow the users to use and register with the helmet. Further, the eSIM can allow the selection of one of the profiles at a time.

[0044] In an embodiment, the one or more mobile devices can be configured to process the set of alert signals and maintain the records of the name, address, and real-time location of the one or more users in the corresponding mobile device.

[0045] Referring to FIGs. 1 and 3, the exemplary network architecture for implementing the accident alert and SMS generation operation by the proposed eSIM-based smart helmet is disclosed. The network architecture can be in form of a system involving the eSIM-based helmet 100, a telecom service provider 108 (also referred to as service provider or network operator 108, herein), and one or more mobile devices 104-1 to 104-N (collectively referred to as mobile device 104, herein) associated with one or more entities 106-1 to 106-N (collectively referred to as entities 106, herein) comprising emergency contacts of the user 300, the nearest police station, and nearest hospitals, but not limited to the like. The proposed system can include the helmet 100 fitted with the eSIM 102, which can be in communication with the mobile devices 104 and the telecom provider 108 through a network 110. The mobile devices 104 of entities 106 can be pre-registered with and pre-authenticated by the telecom service provider 108 using the identity (factors) and credentials provided by the entities 106 associated with the mobile devices 104. The profile for a given user 300 of the helmet 100 can be downloaded and installed in the eSIM 102 of the helmet 100 using a mobile computing device of the user 300. In an exemplary embodiment, the

profile can include a record of the name and address of the user 300, and details of the entities 106 including the nearest police station, nearest hospital, and contact numbers and names of the entities. The telecom service provider 108 can allow the eSIM 102 to communicate with the mobile devices 104 of the entities 106 and exchange data therebetween via the network 110.

[0046] Mobile devices 104 of entities 106 can be any or a combination of a smartphone, tablet, computer, wearable devices, and the like, which can include a processing unit operatively coupled to a database and a memory. The mobile devices 104 can include a communication module that communicatively couples the processing unit or mobile device with the eSIM 102 and the telecom service provider 108, through the network 110. Further, the telecom service provider 108 can also include a server, and a database that can store a mapping of multiple eSIMs 102 associated with multiple helmets 100 and multiple users 300, and contact numbers and details of multiple entities 106. The telecom service provider 108 can store the identity (factors) and credentials of each entity 106, which can be provided by corresponding entities, using their mobile device 106, while registering for the first time with the telecom service provider 108. The telecom service provider 108 can use the stored mappings to later send the alert SMS from the eSIM 102 to the mobile devices 104 of the entities 106 as required, through the network 110.

[0047] In an implementation, the system can be accessed by an application installed on the mobile device of the user 300 100 and the mobile devices 104 of the entities 106, which can be configured with any operating system, comprising but not limited to, Android™, iOS™, Windows, and the like.

[0048] Further, network 110 is a wireless network, a wired network, or a combination thereof that is implemented as one of the different types of networks, such as a Mobile GSM network, Intranet, Local Area Network (LAN), Wide Area Network (WAN), Internet, and the like as the case may be. Further, the network 110 is either a dedicated network or a shared network. The shared network represents an association of the different types of networks that uses a variety of protocols, for example, Hypertext Transfer Protocol (HTTP), Transmission Control Protocol/Internet Protocol (TCP/IP), Wireless Application Protocol (WAP), and the like.

[0049] The communication module of the mobile device 104 and the helmet 100 can be of any type. For example, the communication interface can be a GSM (global system for mobile communication)-interface, a UMTS (universal mobile telecommunication system 100)-interface, a WLAN (wireless local area network)-interface, and the like.

[0050] The eSIM 102 is able to exchange data with the mobile devices 104 and telecom service providers 108, through a number of communication networks each of them being under the control of a specific network provider or operator. In FIG. 1, only one communication net-

work of all possible accessible networks is illustrated by way of example. It is to be noted that the communication technology of the network is not relevant for the invention. The network operator also represents an entity that is responsible for granting access to the network.

[0051] Referring to FIG. 2, an exemplary architecture of the proposed eSIM-based smart helmet 100 is disclosed. In an embodiment, the helmet 100 can include a shell defining the shape of the helmet and which can be worn on the head of the user 300 (or rider). The shell can extend circumferentially and vertically over the head of the user 300 and can be fitted with cushioning and support pads along the inner surface of the shell to provide comfort to the user 300. The shell can be made of strong and lightweight material to lower the impact of any force or accident on the head of the user 300, thereby saving the head of the user 300 from any injury. The helmet 100 can be further provided with a set of straps for securing the helmet on the head while driving. Further, a chin guard (or faceguard) can also be provided to protect the chin or face of the user 300. Further, a transparent visor can also be movably attached to the front of the helmet to protect the user 300 from sunlight, wind, and dust when required, thereby providing better visibility to the user 300, and also allowing the user 300 to open the front of the helmet 100 for better cooling.

[0052] In an embodiment, the helmet 100 can include a set of sensors 202 selected from a vibration sensor, pressure sensor, but not limited to the like, being configured at predefined positions on the shell of the helmet 100. The sensors 202 can be configured to sense and monitor the vibrations and impact on the helmet 100. The helmet 100 can further include a GPS module 204 (or GPS unit) embedded in the shell to monitor the real-time and precise location of the helmet 100 and the respective user 300.

[0053] The smart helmet 100 can include the embedded-subscriber identity module (eSIM) 102 configured or attached or embedded in the shell, without requiring any additional SIM slot. The eSIM 102 can be configured to receive and store/download profiles of one or more users 300 in the eSIM 102. The profile can include the record of any or a combination of the name and address of the corresponding user 300, and entities 106 including the nearest police station, nearest hospital, and one or more emergency contact numbers of the user 300s.

[0054] The eSIM 102 can be operatively coupled to the sensors 202 and the GPS unit 204. The eSIM 102 can be configured to receive data or signals corresponding to the vibration and impact on the helmet being monitored by the sensors 202. The eSIM 102 can correspondingly generate a set of alert signals indicative of the occurrence and location of an accident when the monitored vibration and impact on the helmet 100 exceeds a predefined value. The eSIM 102 can then send the set of alert signals in form of an SMS or voice SMS to the mobile devices 104 associated with entities 106 comprising any or a combination of the nearest police station, nearest hospitals,

and the one or more emergency contact numbers, and a last dialed mobile number of the user 300. The GPS unit 204 can enable the eSIM 102 to send the accurate accident site of the user 300 and/or the real-time location of the user 300 to the mobile devices upon the occurrence of the accident.

[0055] Accordingly, in an implementation, as shown in FIG. 3, upon detection of the occurrence of the accident of the user 300 or bike 302 by the sensors 202 of the helmet 100, the telecom service provider 108 can enable the eSIM 102 to transmit the alert SMS comprising the name, address, and real-time location of the user 300 to the mobile device 104 of the last dialed mobile number of the user 300. Further, when the last dialed mobile number of the user 300 is not within a network range of the telecom service provider 108, the eSIM 102 can transmit the alert SMS to the mobile device 104 associated with the nearest police station, and the nearest hospital. Furthermore, when the last dialed mobile number by the user 300 returns in the network range of the telecom service provider 108, the service provider 108 can enable the eSIM 102 to transmit the alert SMS to the mobile device 104 of the last dialed mobile number, and the one or more emergency contact numbers. As a result, this automated and spontaneous sending of alert SMSs by the helmet 100 upon the occurrence of an accident of the user 300, allows the emergency and medical services to quickly provide medical assistance to the injured user 300, which may help lower any medical complications and permanent disability and help save the life of the user 300.

[0056] Thus, the present disclosure provides an improved and secured smart helmet 100 that detects the occurrence of an accident and automatically sends an alert SMS having details and location of the user 300 to any or a combination of a last dialed number, nearest police station, and emergency contact numbers in case of occurrence of an accident. Besides, the use of eSIM 102 in the proposed helmet 100 eliminates the requirement of an additional SIM slot in the helmet 100, which reduces the helmet manufacturing cost and complexity. Further, the eSIM 102 also allows downloading multiple profiles in the eSIM 102, unlike a physical SIM-based helmet that is limited to one profile only.

[0057] In an aspect, eSIM 102 may comprise one or more processor(s) 206. The one or more processor(s) 206 may be implemented as one or more microprocessors, microcomputers, microcontrollers, digital signal processors, central processing units, logic circuitries, and/or any devices that manipulate data based on operational instructions. Among other capabilities, one or more processor(s) 206 are configured to fetch and execute computer-readable instructions stored in a memory 208 of the eSIM 102. The memory 208 may store one or more computer-readable instructions or routines, which may be fetched and executed to create or share the data units over a network service. The memory 208 may comprise any non-transitory storage device including, for example, volatile memory such as RAM, or non-volatile

memory such as EPROM, flash memory, and the like.

[0058] The eSIM 102 may also comprise an interface(s). The interface(s) may comprise a variety of interfaces, for example, interfaces for data input and output devices, referred to as I/O devices, storage devices, and the like. The interface(s) may facilitate communication of eSIM 102 with the GPS unit 204, the sensors 202, and a mobile device of the user 300. The interface allows the user 300 to download and install multiple profiles in the eSIM 102 using his/her mobile device. The interface(s) may also provide a communication pathway for one or more components of the eSIM 102. Examples of such components include, but are not limited to, processing engine(s) 210 and database 220.

[0059] The processing engine(s) 210 may be implemented as a combination of hardware and programming (for example, programmable instructions) to implement one or more functionalities of the processing engine(s). In examples described herein, such combinations of hardware and programming may be implemented in several different ways. For example, the programming for the processing engine(s) 210 may be processor-executable instructions stored on a non-transitory machine-readable storage medium and the hardware for the processing engine(s) 210 may comprise a processing resource (for example, one or more processors), to execute such instructions. In the present examples, the machine-readable storage medium may store instructions that, when executed by the processing resource, implement the processing engine(s). In such examples, eSIM 102 may comprise the machine-readable storage medium storing the instructions and the processing resource to execute the instructions, or the machine-readable storage medium may be separate but accessible to eSIM 102 and the processing resource. In other examples, the processing engine(s) 210 of eSIM 102 may be implemented by electronic circuitry.

[0060] The database 220 may comprise data that is either stored or generated as a result of functionalities implemented by any of the components of the processing engine(s) 210 or eSIM 102. The profiles downloaded by the user 300 may be stored in the database 220.

[0061] In an exemplary embodiment, the processing engine(s) 210 may include a profile unit 212, accident detection unit 214, SMS/Alert unit 216, and other unit(s) 218. Other unit(s) 218 can supplement the functionalities of the processing engine 210 or the eSIM 102.

[0062] In an embodiment, the profile unit 212 can enable the processor 206 of the eSIM 102 to connect with the mobile device of the user 300 as well as the telecom service provider 108 to download one or more profiles in the eSIM 102 using the mobile device. The profile may include records of the user details such as name address, nearest police station number, emergency contact numbers, and the like. Once a profile is installed, the eSIM 102 functionally operates as a physical SIM by creating a communication channel between the eSIM 102 and the telecom service provider 108.

[0063] In an embodiment, the accident detection unit 214 can enable the processor 206 of the eSIM 102 to enable the sensors 202 to sense and monitor vibrations and impacts on the shell of the helmet 100. The eSIM 102 can receive the monitored vibrations and impact on the helmet 100 as a set of data packets from the sensors 202, which can be further processed by the processor 206 for determining the occurrence of an accident. The processor 204 can compare the vibrations and impact on the helmet 100 with a set of predefined values. The accident detection unit 214 can detect an accident when the monitored vibrations and impact on the helmet 100 exceed the predefined values.

[0064] In an embodiment, the SMS/alert unit 216 can enable the processor 204 to generate a set of alert signals upon the occurrence of an accident by the accident detection unit 214. In an implementation, the SMS/alert unit 216 can enable the processor 204 to transmit the set of alert signals, and the name, address, and real-time location of the user 300 to the mobile devices 104 of entities 106 in form of an SMS. In another implementation, the SMS/alert unit 216 can enable the processor 204 to transmit the set of alert signals, and the name, address, and real-time location of the user 300 to the mobile devices 104 of the entities in form of a voice SMS or eCall.

[0065] In another embodiment, a second set of sensors can also be positioned at predefined positions on the bike 302 of the user 300 (in addition to the sensors of the proposed helmet. The second set of sensors on the bike 302 can include pressure sensors that can monitor the impact on the bike 302 from multiple locations and a gyroscope and accelerometer that can monitor the orientation and inclination of the bike 302. The impact on the bike 302 or the orientation and inclination of the bike 302 with respect to the road can enable the eSIM 102 to detect the occurrence of an accident. The second set of sensors can be in communication with the eSIM 102 through an additional communication module either provided on the bike 302 or on the helmet 100, which allows the second sensors to transmit the monitored impact and orientation of the bike 302 to the eSIM 102 for further processing and accident detection. This enhances the flexibility and reliability of the eSIM 102 and the proposed helmet 100 to detect accidents of the bike or user 300, in case there is no direct impact on the helmet 100 during an actual accident.

[0066] It is to be appreciated by a person skilled in the art that while various embodiments and drawings of the present disclosure elaborate upon a single proposed smart helmet connected to the entities and telecom service provider through the network, however, multiple proposed smart helmets can be in communication through the network, and all such embodiments are well within the scope of the present disclosure, without any limitations.

[0067] If the specification states a component or feature "may", "can", "could", or "might" be included or have a characteristic, that particular component or feature is

not required to be included or have the characteristic.

[0068] As used in the description herein and throughout the claims that follow, the meaning of "a," "an," and "the" includes plural reference unless the context clearly dictates otherwise. Also, as used in the description herein, the meaning of "in" includes "in" and "on" unless the context clearly dictates otherwise.

[0069] Moreover, in interpreting the specification, all terms should be interpreted in the broadest possible manner consistent with the context. In particular, the terms "comprises" and "comprising" should be interpreted as referring to elements, components, or steps in a non-exclusive manner, indicating that the referenced elements, components, or steps may be present, or utilized, or combined with other elements, components, or steps that are not expressly referenced. Where the specification claims refer to at least one of something selected from the group consisting of A, B, Cand N, the text should be interpreted as requiring only one element from the group, not A plus N, or B plus N, etc.

[0070] While the foregoing describes various embodiments of the invention, other and further embodiments of the invention may be devised without departing from the basic scope thereof. The scope of the invention is determined by the claims that follow. The invention is not limited to the described embodiments, versions or examples, which are comprised to enable a person having ordinary skill in the art to make and use the invention when combined with information and knowledge available to the person having ordinary skill in the art.

ADVANTAGES OF THE INVENTION

[0071] The proposed invention lowers the number of fatalities from bike accidents by decreasing the response time with respect to emergency response and service provided to the injured person.

[0072] The proposed invention overcomes the above-mentioned drawbacks, shortcomings, and limitations associated with existing physical SIM-based smart helmets.

[0073] The proposed invention eliminates the requirement of a physical SIM and an additional SIM slot in the existing smart helmet in order to reduce the helmet manufacturing cost and complexity.

[0074] The proposed invention provides an eSIM-based smart helmet that automatically sends an alert SMS having details and location of the user to a last dialed number, nearest police station, and emergency contact numbers in case of occurrence of an accident.

[0075] The proposed invention provides an eSIM-based smart helmet that allows downloading multiple profiles in the eSIM, unlike a physical SIM-based helmet.

[0076] The proposed invention provides a simple and reliable accident detection system that can be implemented in a helmet

Claims**1.** A secure smart helmet (100) comprising:

a shell adapted to be worn on a head of a user (300);
 a set of sensors (202) configured at predefined positions on the shell, the set of sensors (202) configured to monitor vibration and impact on the helmet (100); and
 an eSIM (102) configured with the shell and operatively coupled to the set of sensors (202), the eSIM (102) comprising a processor (206) coupled to a memory (204) storing instructions executable by the processor (206), the eSIM (102) configured to:

receive and store a first of data packets corresponding to a profile of the user (300), the profile comprising a record of any or a combination of name and address of the corresponding user (300), nearest police station, nearest hospital, and one or more emergency contact numbers of the user (300);
 receive a second set of data packets corresponding to the vibration and impact on the helmet (100) being monitored by the sensors (202); and
 generate and transmit, when the monitored vibration and impact exceeds a predefined value, a set of alert signals indicative of the occurrence and location of an accident, to one or more mobile devices (106) associated with any or a combination of the nearest police station, nearest hospitals, and the one or more emergency contact numbers, and a last dialed mobile number of the user (300).

2. The smart helmet (100) as claimed in claim 1, wherein the helmet (100) comprises a GPS module (204) embedded in the shell and operatively coupled to the eSIM (102), the GPS module (204) is configured to monitor a real-time location of the helmet (100) and the respective user (300), and correspondingly enable the eSIM (102) to send the real-time location of the user (300) to the one or more mobile devices (106) upon the occurrence of the accident.

3. The smart helmet (100) as claimed in claim 1, wherein upon the occurrence of the accident, the eSIM (102) is configured to transmit the set of alert signals to the mobile device of the last dialed mobile number of the user (300), and wherein when the last dialed mobile number is not in a network range, the eSIM (102) is configured to transmit the set of alert signals comprising the name, address, and real-time location of the user (300) to the mobile device associated

with the nearest police station, and the nearest hospital.

4. The smart helmet (100) as claimed in claim 3, wherein when the last dialed mobile number by the user (300) returns in the network range, the eSIM (102) is configured to transmit the set of alert signals to the mobile device of the last dialed mobile number, and the one or more emergency contact numbers.

5. The smart helmet (100) as claimed in claim 1, wherein the set of alert signals, and the name, address, and real-time location of the user (300) are transmitted to the one or more mobile devices (106) in form of an SMS.

6. The smart helmet (100) as claimed in claim 1, wherein the set of alert signals, and the name, address, and real-time location of the user (300) are transmitted to the one or more mobile devices (106) in form of a voice SMS or eCall.

7. The smart helmet (100) as claimed in claim 1, wherein the set of sensors (202) comprises any or a combination of a vibration sensor, and pressure sensor.

8. The smart helmet (100) as claimed in claim 1, wherein the helmet (100) is in communication with the one or more mobile devices (106) through a telecommunication network (110) provided by one or more telecom service operators (108).

9. The smart helmet (100) as claimed in claim 1, wherein the eSIM (102) is configured to receive and store one or more profiles associated with one or more users (300), which allows the one or more users (300) to use and register with the helmet (100), wherein the eSIM (102) allows selection of one of the profiles at a time.

10. The smart helmet (100) as claimed in claim 9, wherein the one or more mobile devices (106) are configured to process the set of alert signals and maintain the records of the name, address, and real-time location of the one or more users (300) in the corresponding mobile device (106).

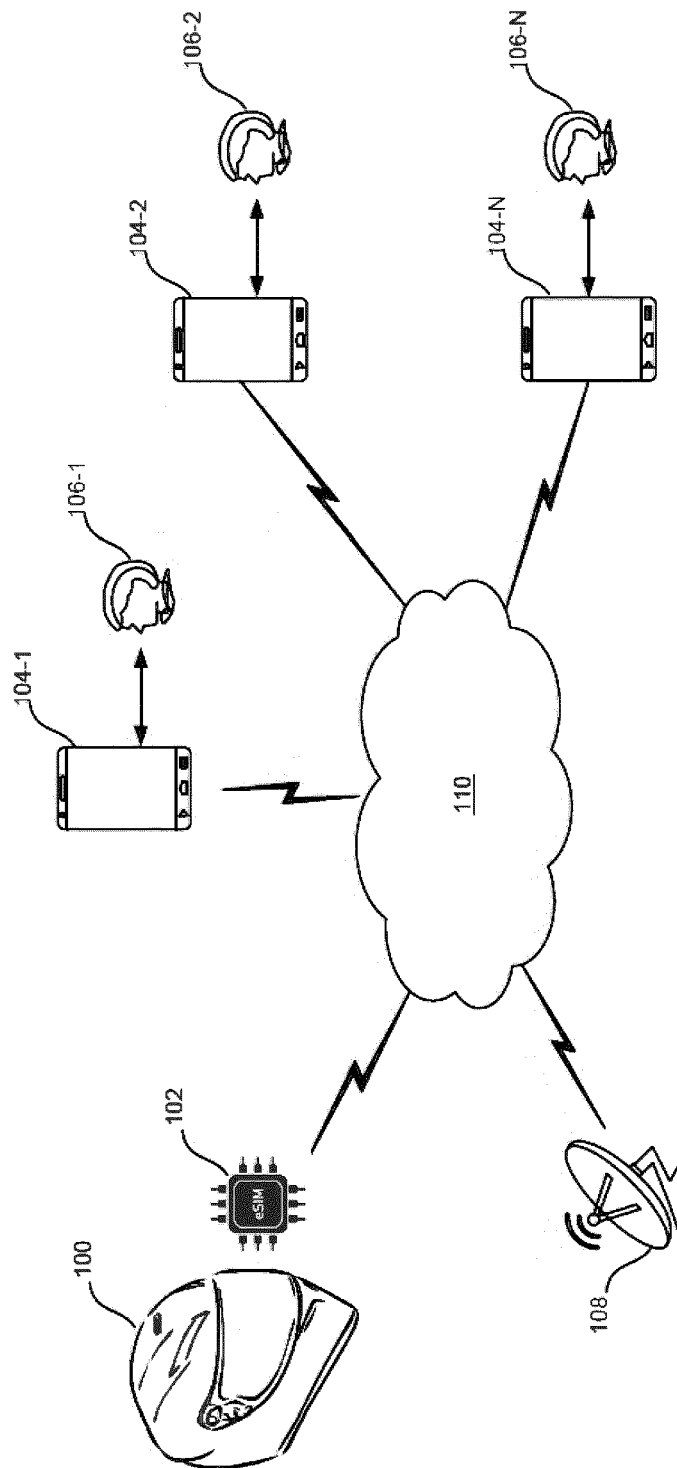


FIG. 1

Fig. 1

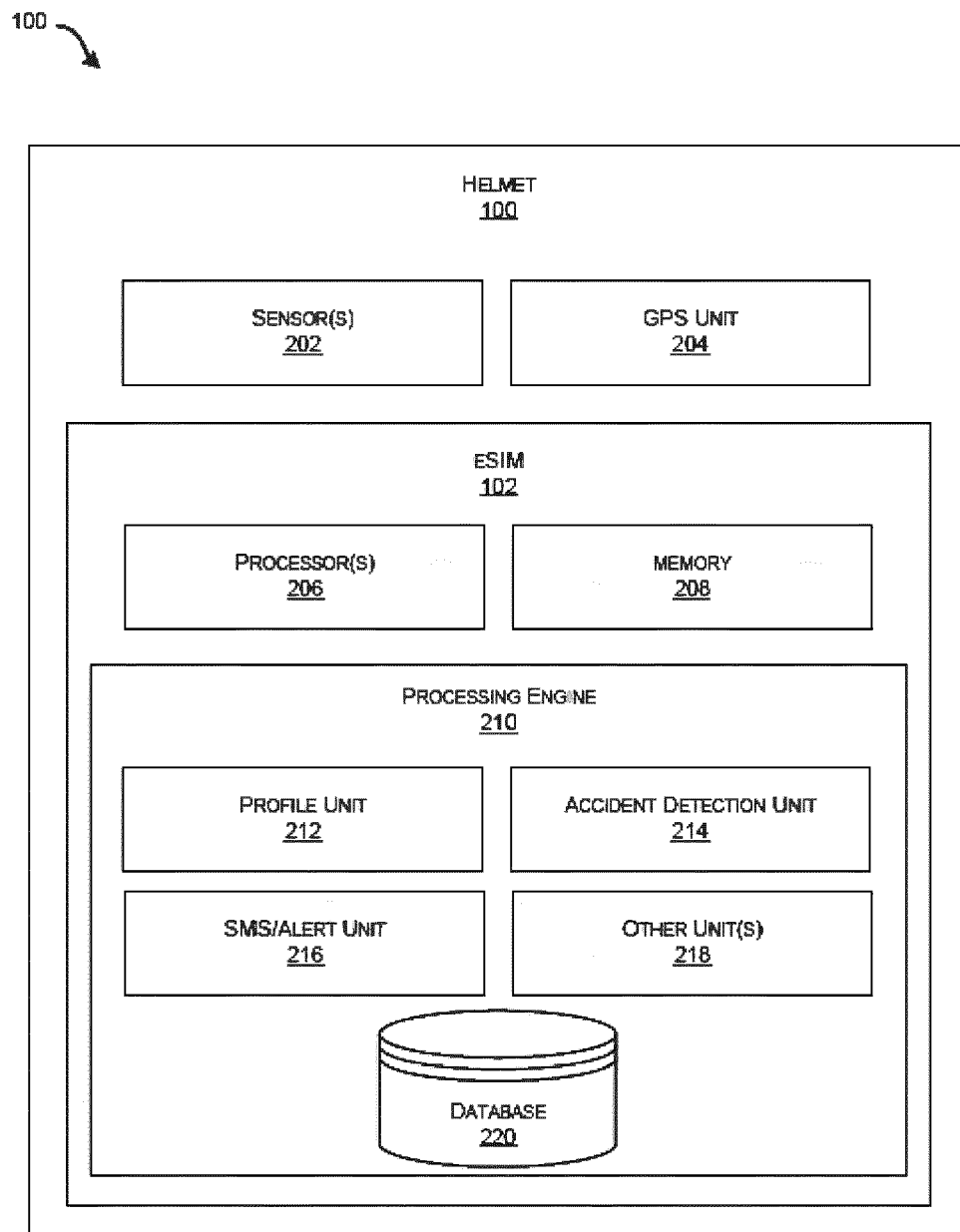


Fig. 2

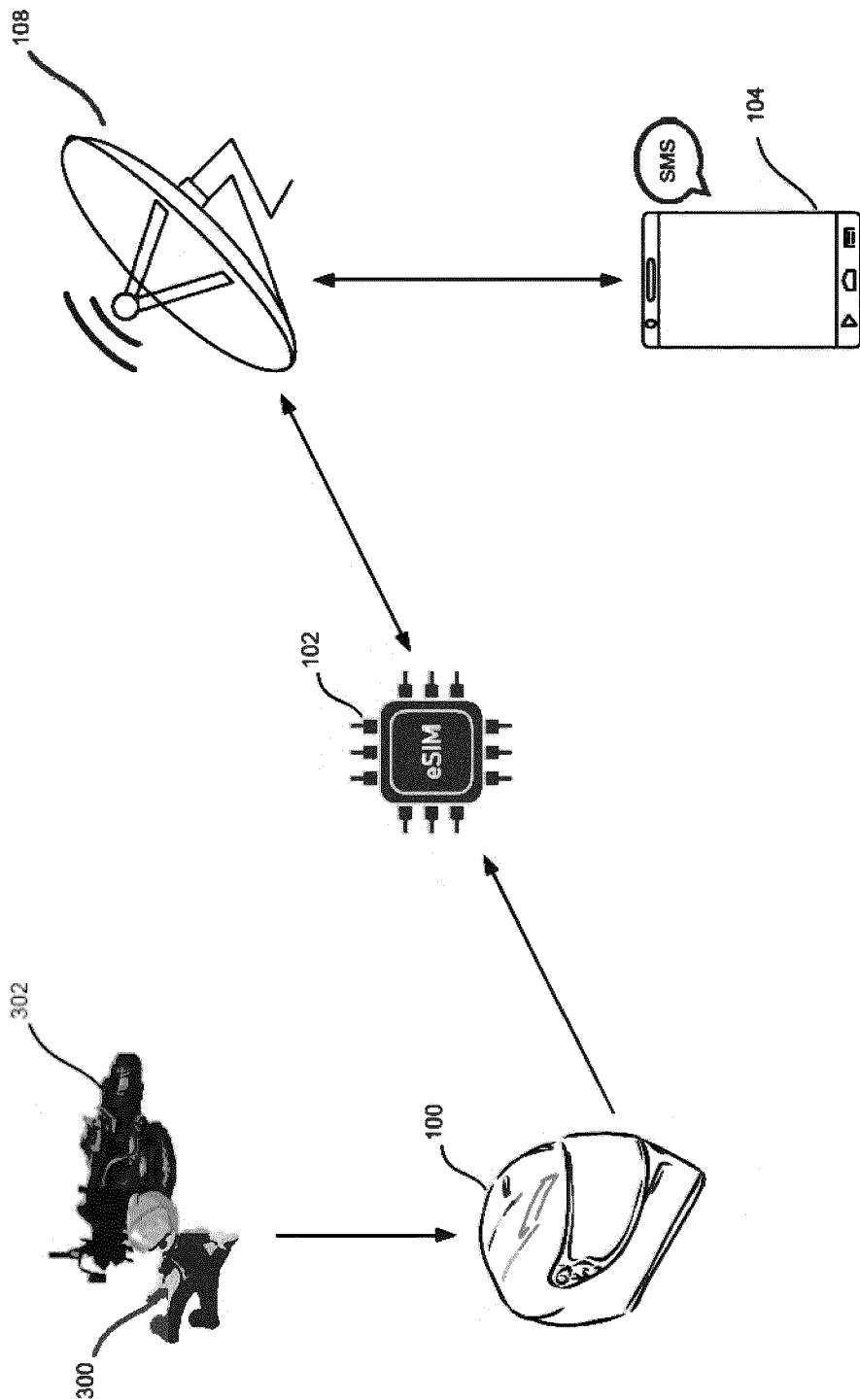


FIG. 3

Fig. 3



EUROPEAN SEARCH REPORT

Application Number

EP 23 02 0226

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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EPO FORM 1503 03:82 (P04C01)

Place of search

The Hague

Date of completion of the search

3 October 2023

Examiner

Thielgen, Robert

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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