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Electronic device and method for providing personalized user context aware service

Abstract

An electronic device includes a display and a processor configured to identify whether an application installed and mapped to a predefined user context predefined in the electronic device is being executed in the electronic device, based on the application being executed in the electronic device, recognize the predefined user context by using information on mapping between the application and the predefined user context, collect a usage log of the electronic device and store the usage logs, identify a usage pattern according to a user characteristic by analyzing the stored usage logs, generate a personalized user context corresponding to an undefined situation not predefined in the electronic device based on the usage pattern and control the display to output a recommendation function related to the recognized predefined user context or the personalized user context in the display in response to recognizing the predefined user context or the personalized user context.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application is a bypass continuation of International Application No. PCT/KR2022/011645, filed on Aug. 5, 2022, which is based on and claims priority to Korean Patent Application No. 10-2021-0111072, filed on Aug. 23, 2021, in the Korean Intellectual Property Office, the disclosures of which are incorporated by reference herein in their entireties.

BACKGROUND
1. Field
(1) Various embodiments relate to an electronic device and a method for providing a personalized user context-aware service.
2. Description of the Related Art
(2) Electronic devices recognize the peripheral situation of users and provide services appropriate for users (e.g., context aware service (CAS)). For example, an electronic device may recognize or determine a situation where the user is using the electronic device, or the user context that may characterize the user's behavior by using information collected through the electronic device, and

may provide the user with a service or function suitable for the situation based thereon.

(3) In this disclosure, context may refer to information that characterizes the situation or information that serves as a reference for determining a meaningful service behavior. Recognizing user context may be one of important functions of the CAS.

(4) In the case of the CAS, context to be used in a specific service is predefined or prestored in an electronic device, and the context is recognized in a predetermined scheme.

(5) For example, an electronic device predefines a running-related application in an "exercise" situation and, if the user executes the running-related application, recognizes "currently exercising" context.

(6) Such a manner of predefining context has a problem in that a relation regarding connection with situation recognition needs to be predefined and configured for each application. In addition, the electronic device determines whether the predefined context is appropriate through app execution information, thereby recognizing the situation, but may be unable to recognize the situation regarding an undefined situation or application.

(7) As a result, there is a problem in that the electronic device can only recognize a predefined situation and unilaterally provides the same CAS, but cannot provide a user-tailored CAS.

SUMMARY

(8) Various embodiments may provide a CAS optimized to an individual user by recognizing contexts that have not been predefined by reflecting not only context predefined by an electronic device, but also user characteristics, in connection with a CAS.

(9) According to an aspect of the disclosure, there is provided an electronic device that may include a display, a processor and a memory storing instructions executable by the processor where the processor may be connected to the memory and configured to collect a usage log of the electronic device, identify a usage pattern according to a user characteristic by analyzing the usage log, generate a personalized user context corresponding to an undefined situation that is not predefined in the electronic device based on the usage pattern, and output a recommendation service to the display in response to recognizing the personalized user context.

(10) According to an aspect of the disclosure, there is provided a method for providing a situation-aware service of an electronic device that may include collecting a usage log of the electronic device, identifying a usage pattern according to a user characteristic by analyzing the usage log, generating a personalized user context corresponding to an undefined situation that is not predefined in the electronic device based on the usage pattern, and outputting a recommendation service to the display in response to recognizing the personalized user context.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The above and other aspects, features, and advantages of certain embodiments of the present disclosure will be more apparent from the following description taken in conjunction with the accompanying drawings, in which:

(2) FIG. **1** is a block diagram illustrating an electronic device in a network environment according to various embodiments;

(3) FIG. **2** illustrates a network environment configured to support a personalized context-aware service according to various embodiments;

(4) FIG. **3** illustrates a configuration of a processor of an electronic device according to various embodiments;

(5) FIG. **4** illustrates an example of comparing context-aware situations according to various embodiments;

(6) FIG. **5** illustrates a personalized context recognition service method of an electronic device

(7) FIG. **6** is a diagram illustrating a personalized context recognition service method of an electronic device according to various embodiments;

(8) FIG. **7** illustrates an example describing log analysis data according to various embodiments;

(9) FIG. **8** illustrates an example describing a context recognition model according to various embodiments;

(10) FIG. **9** illustrates a configuration of a server supporting a context-aware service according to various embodiments;

(11) FIG. **10** illustrates an example of a context combination according to various embodiments;

(12) FIG. **11** illustrates an example of providing a context-based recommendation service according to various embodiments; and

(13) FIGS. **12** and **13** illustrate a situation in which a personalized context recognition service is provided according to various embodiments.

DETAILED DESCRIPTION

(14) The electronic device according to various embodiments may be one of various types of electronic devices. The electronic devices may include, for example, a portable communication device (e.g., a smartphone), a computer device, a portable multimedia device, a portable medical device, a camera, a wearable device, or a home appliance. According to an embodiment of the disclosure, the electronic devices are not limited to those described above.

(15) FIG. **1** is a block diagram illustrating an electronic device in a network environment according to an embodiment of the disclosure.

(16) Referring to FIG. **1**, the electronic device **101** in the network environment **100** may communicate with an electronic device **102** via a first network **198** (e.g., a short-range wireless communication network), or at least one of an electronic device **104** or a server **108** via a second network **199** (e.g., a long-range wireless communication network). According to an embodiment, the electronic device **101** may communicate with the electronic device **104** via the server **108**. According to an embodiment, the electronic device **101** may include a processor **120**, memory **130**, an input module **150**, a sound output module **155**, a display module **160**, an audio module **170**, a sensor module **176**, an interface **177**, a connection terminal **178**, a haptic module **179**, a camera module **180**, a power management module **188**, a battery **189**, a communication module **190**, a subscriber identification module (SIM) **196**, or an antenna module **197**. In an embodiment, at least one of the components (e.g., the connection terminal **178**) may be omitted from the electronic device **101**, or one or more other components may be added in the electronic device **101**. In an embodiment, some of the components (e.g., the sensor module **176**, the camera module **180**, or the antenna module **197**) may be implemented as a single component (e.g., the display module **160**).

(17) The processor **120** may execute, for example, software (e.g., a program **140**) to control at least one other component (e.g., a hardware or software component) of the electronic device **101** coupled with the processor **120**, and may perform various data processing or computation. According to an embodiment, as at least part of the data processing or computation, the processor **120** may store a command or data received from another component (e.g., the sensor module **176** or the communication module **190**) in volatile memory **132**, process the command or the data stored in the volatile memory **132**, and store resulting data in non-volatile memory **134**. According to an embodiment, the processor **120** may include a main processor **121** (e.g., a central processing unit (CPU) or an application processor (AP)), or an auxiliary processor **123** (e.g., a graphics processing unit (GPU), a neural processing unit (NPU), an image signal processor (ISP), a sensor hub processor, or a communication processor (CP)) that is operable independently from, or in conjunction with, the main processor **121**. For example, when the electronic device **101** includes the main processor **121** and the auxiliary processor **123**, the auxiliary processor **123** may be adapted to consume less power than the main processor **121**, or to be specific to a specified function. The auxiliary processor **123** may be implemented as separate from, or as part of the main

processor **121**.

(18) The auxiliary processor **123** may control at least some of functions or states related to at least one component (e.g., the display module **160**, the sensor module **176**, or the communication module **190**) among the components of the electronic device **101**, instead of the main processor **121** while the main processor **121** is in an inactive (e.g., sleep) state, or together with the main processor **121** while the main processor **121** is in an active state (e.g., executing an application). According to an embodiment, the auxiliary processor **123** (e.g., an image signal processor or a communication processor) may be implemented as part of another component (e.g., the camera module **180** or the communication module **190**) functionally related to the auxiliary processor **123**. According to an embodiment, the auxiliary processor **123** (e.g., the neural processing unit) may include a hardware structure specified for artificial intelligence model processing. An artificial intelligence model may be generated by machine learning. Such learning may be performed, e.g., by the electronic device **101** where the artificial intelligence is performed or via a separate server (e.g., the server **108**). Learning algorithms may include, but are not limited to, e.g., supervised learning, unsupervised learning, semi-supervised learning, or reinforcement learning. The artificial intelligence model may include a plurality of artificial neural network layers. The artificial neural network may be a deep neural network (DNN), a convolutional neural network (CNN), a recurrent neural network (RNN), a restricted boltzmann machine (RBM), a deep belief network (DBN), a bidirectional recurrent deep neural network (BRDNN), deep Q-network or a combination of two or more thereof but is not limited thereto. The artificial intelligence model may, additionally or alternatively, include a software structure other than the hardware structure.

(19) The memory **130** may store various data used by at least one component (e.g., the processor **120** or the sensor module **176**) of the electronic device **101**. The various data may include, for example, software (e.g., the program **140**) and input data or output data for a command related thererto. The memory **130** may include the volatile memory **132** or the non-volatile memory **134**.

(20) The program **140** may be stored in the memory **130** as software, and may include, for example, an operating system (OS) **142**, middleware **144**, or applications **146**.

(21) The input module **150** may receive a command or data to be used by another component (e.g., the processor **120**) of the electronic device **101**, from the outside (e.g., a user) of the electronic device **101**. The input module **150** may include, for example, a microphone, a mouse, a keyboard, a key (e.g., a button), or a digital pen (e.g., a stylus pen.

(22) The sound output module **155** may output sound signals to the outside of the electronic device **101**. The sound output module **155** may include, for example, a speaker or a receiver. The speaker may be used for general purposes, such as playing multimedia or playing record. The receiver may be used for receiving incoming calls. According to an embodiment, the receiver may be implemented as separate from the speaker, or as part of the speaker.

(23) The display module **160** may visually provide information to the outside (e.g., a user) of the electronic device **101**. The display module **160** may include, for example, a display, a hologram device, or a projector and control circuitry to control a corresponding one of the display, the hologram device, and the projector. According to an embodiment, the display module **160** may include a touch sensor adapted to detect a touch, or a pressure sensor adapted to measure the intensity of force incurred by the touch.

(24) The audio module **170** may convert a sound into an electrical signal and vice versa. According to an embodiment, the audio module **170** may obtain the sound via the input module **150**, or output the sound via the sound output module **155** or a headphone of an external electronic device (e.g., an electronic device **102**) directly (e.g., wiredly) or wirelessly coupled with the electronic device **101**.

(25) The sensor module **176** may detect an operational state (e.g., power or temperature) of the electronic device **101** or an environmental state (e.g., a state of a user) external to the electronic device **101**, and then generate an electrical signal or data value corresponding to the detected state. According to an embodiment, the sensor module **176** may include, for example, a gesture sensor, a

gyro sensor, an atmospheric pressure sensor, a magnetic sensor, an acceleration sensor, a grip sensor, a proximity sensor, a color sensor, an infrared (IR) sensor, a biometric sensor, a temperature sensor, a humidity sensor, or an illuminance sensor.

(26) The interface **177** may support one or more specified protocols to be used for the electronic device **101** to be coupled with the external electronic device (e.g., the electronic device **102**) directly (e.g., wiredly) or wirelessly. According to an embodiment, the interface **177** may include, for example, a high definition multimedia interface (HDMI), a universal serial bus (USB) interface, a secure digital (SD) card interface, or an audio interface.

(27) The connection terminal **178** may include a connector via which the electronic device **101** may be physically connected with the external electronic device (e.g., the electronic device **102**). According to an embodiment, the connection terminal **178** may include, for example, a HDMI connector, a USB connector, a SD card connector, or an audio connector (e.g., a headphone connector).

(28) The haptic module **179** may convert an electrical signal into a mechanical stimulus (e.g., a vibration or a movement) or electrical stimulus which may be recognized by a user via his tactile sensation or kinesthetic sensation. According to an embodiment, the haptic module **179** may include, for example, a motor, a piezoelectric element, or an electric stimulator.

(29) The camera module **180** may capture a still image or moving images. According to an embodiment, the camera module **180** may include one or more lenses, image sensors, image signal processors, or flashes.

(30) The power management module **188** may manage power supplied to the electronic device **101**. According to an embodiment, the power management module **188** may be implemented as at least part of, for example, a power management integrated circuit (PMIC).

(31) The battery **189** may supply power to at least one component of the electronic device **101**. According to an embodiment, the battery **189** may include, for example, a primary cell which is not rechargeable, a secondary cell which is rechargeable, or a fuel cell.

(32) The communication module **190** may support establishing a direct (e.g., wired) communication channel or a wireless communication channel between the electronic device **101** and the external electronic device (e.g., the electronic device **102**, the electronic device **104**, or the server **108**) and performing communication via the established communication channel. The communication module **190** may include one or more communication processors that are operable independently from the processor **120** (e.g., the application processor (AP)) and support a direct (e.g., wired) communication or a wireless communication. According to an embodiment, the communication module **190** may include a wireless communication module **192** (e.g., a cellular communication module, a short-range wireless communication module, or a global navigation satellite system (GNSS) communication module) or a wired communication module **194** (e.g., a local area network (LAN) communication module or a power line communication (PLC) module). A corresponding one of these communication modules may communicate with the external electronic device via the first network **198** (e.g., a short-range communication network, such as Bluetooth™, wireless-fidelity (Wi-Fi) direct, or infrared data association (IrDA)) or the second network **199** (e.g., a long-range communication network, such as a legacy cellular network, a 5G network, a next-generation communication network, the Internet, or a computer network (e.g., LAN or wide area network (WAN)). These various types of communication modules may be implemented as a single component (e.g., a single chip), or may be implemented as multi components (e.g., multi chips) separate from each other. The wireless communication module **192** may identify and authenticate the electronic device **101** in a communication network, such as the first network **198** or the second network **199**, using subscriber information (e.g., international mobile subscriber identity (IMSI)) stored in the subscriber identification module **196**.

(33) The wireless communication module **192** may support a 5G network, and next-generation communication technology, e.g., new radio (NR) access technology. The NR access technology

may support enhanced mobile broadband (eMBB), massive machine type communications (mMTC), or ultra-reliable and low-latency communications (URLLC). The wireless communication module **192** may support a high-frequency band (e.g., the mmWave band) to achieve, e.g., a high data transmission rate. The wireless communication module **192** may support various technologies for securing performance on a high-frequency band, e.g., beamforming, massive multiple-input and multiple-output (massive MIMO), full dimensional MIMO (FD-MIMO), array antenna, analog beam-forming, or large scale antenna. The wireless communication module **192** may support various requirements specified in the electronic device **101**, an external electronic device (e.g., the electronic device **104**), or a network system (e.g., the second network **199**). According to an embodiment, the wireless communication module **192** may support a peak data rate (e.g., 20 Gbps or more) for implementing eMBB, loss coverage (e.g., 164 dB or less) for implementing mMTC, or U-plane latency (e.g., 0.5 ms or less for each of downlink (DL) and uplink (UL), or a round trip of 1 ms or less) for implementing URLLC.

(34) The antenna module **197** may transmit or receive a signal or power to or from the outside (e.g., the external electronic device) of the electronic device **101**. According to an embodiment, the antenna module **197** may include an antenna including a radiating element composed of a conductive material or a conductive pattern formed in or on a substrate (e.g., a printed circuit board (PCB)). According to an embodiment, the antenna module **197** may include a plurality of antennas (e.g., array antennas). In such a case, at least one antenna appropriate for a communication scheme used in the communication network, such as the first network **198** or the second network **199**, may be selected, for example, by the communication module **190** (e.g., the wireless communication module **192**) from the plurality of antennas. The signal or the power may then be transmitted or received between the communication module **190** and the external electronic device via the selected at least one antenna. According to an embodiment, another component (e.g., a radio frequency integrated circuit (RFIC)) other than the radiating element may be additionally formed as part of the antenna module **197**.

(35) According to various embodiments, the antenna module **197** may form a mmWave antenna module. According to an embodiment, the mmWave antenna module may include a printed circuit board, a RFIC disposed on a first surface (e.g., the bottom surface) of the printed circuit board, or adjacent to the first surface and capable of supporting a designated high-frequency band (e.g., the mmWave band), and a plurality of antennas (e.g., array antennas) disposed on a second surface (e.g., the top or a side surface) of the printed circuit board, or adjacent to the second surface and capable of transmitting or receiving signals of the designated high-frequency band.

(36) At least some of the above-described components may be coupled mutually and communicate signals (e.g., commands or data) therebetween via an inter-peripheral communication scheme (e.g., a bus, general purpose input and output (GPIO), serial peripheral interface (SPI), or mobile industry processor interface (MIPI)).

(37) According to an embodiment, commands or data may be transmitted or received between the electronic device **101** and the external electronic device **104** via the server **108** coupled with the second network **199**. Each of the electronic devices **102** or **104** may be a device of a same type as the electronic device **101**, or a different type from the electronic device **101**. According to an embodiment, all or some of operations to be executed at the electronic device **101** may be executed at one or more of the external electronic devices **102**, **104**, or **108**. For example, if the electronic device **101** should perform a function or a service automatically, or in response to a request from a user or another device, the electronic device **101**, instead of, or in addition to, executing the function or the service, may request the one or more external electronic devices to perform at least part of the function or the service. The one or more external electronic devices receiving the request may perform the at least part of the function or the service requested, or an additional function or an additional service related to the request, and transfer an outcome of the performing to the electronic device **101**. The electronic device **101** may provide the outcome, with or without

further processing of the outcome, as at least part of a reply to the request. To that end, a cloud computing, distributed computing, mobile edge computing (MEC), or client-server computing technology may be used, for example. The electronic device **101** may provide ultra low-latency services using, e.g., distributed computing or mobile edge computing. In another embodiment, the external electronic device **104** may include an internet-of-things (IoT) device. The server **108** may be an intelligent server using machine learning and/or a neural network. According to an embodiment, the external electronic device **104** or the server **108** may be included in the second network **199**. The electronic device **101** may be applied to intelligent services (e.g., smart home, smart city, smart car, or healthcare) based on 5G communication technology or IoT-related technology.

(38) FIG. **2** illustrates a network environment configured to support a personalized context-aware service according to various embodiments.

(39) Referring to FIG. **2**, according to various embodiments, an electronic device (e.g., the electronic device **101** of FIG. **1**) may communicate with a server **201** (e.g., the server **108** of FIG. **1**) in a network **209** environment. The electronic device **101** may include at least some of the components of the electronic device of FIG. **1**.

(40) The server **201** may be a server supporting a context-aware service. Although not shown, the server **201** may also communicate with one or more other user electronic devices.

(41) The electronic device **101** and the server **201** may recognize a user context (hereinafter, the user context may be referred to as context or context information) corresponding to a user situation by interworking with each other, and may recommend or guide a personalized service or function corresponding to a personalized user context to the user.

(42) According to an embodiment, the electronic device **101** may include a usage log collection module **210**. The server **201** may include a context analysis module **220**. The usage log collection module **210** and the context analysis module **220** may provide a context-aware service to the user in the electronic device by interworking or collaborating with each other, and some of the components of the context analysis module **220** may be implemented to be performed by the electronic device **101**.

(43) According to an embodiment, the electronic device **101** may collect usage logs generated while the user uses the electronic device **101**. The electronic device **101** may transmit the usage logs to the server **201** and may receive result information obtained by analyzing the usage logs by the context analysis module **220** of the server **201**.

(44) The electronic device **101** may recognize the user context based on the result analyzed based on the usage logs.

(45) Here, the user context may refer to information defining a characteristic of the electronic device **101** or the user situation, or information that is a basis for determining a meaningful service action.

(46) The user context may include a first type of context and a second type of context. The first type of context may refer to a defined context that is predefined in the electronic device **101**, and the second type of context may refer to an undefined or personalized context or customized context in which a user's personal characteristic is reflected.

(47) In relation to the first type of context, when an application (hereinafter, referred to as "app") to which a specific context is mapped is executed, the electronic device **101** may recognize a predefined specific context.

(48) For example, when an exercise-related app is executed, the electronic device **101** may recognize a user context that the user is "in exercise" based on the execution of the exercise-related app.

(49) In relation to the second type of context, the electronic device **101** may analyze the usage log through the context analysis module **220** in conjunction with the server **201** to check a usage pattern corresponding to the user's personal characteristic, and may predict and generate a user

context personalized according to the usage pattern. The electronic device **101** may recognize the personalized user context through the context analysis module **220**.

(50) For example, when the user frequently acts to exceed a predetermined level for executing a music app while the user is located at a company, the server **201** may analyze the usage log of the electronic device **101** to check the user's usage pattern, may predict and generate a personalized user context "listening to music while working at the company", and may transmit a result obtained by recognizing the personalized user context to the electronic device **101**. The electronic device **101** may receive context recognition information transmitted from the server **201**, and may recognize the personalized user context "listening to music while working at the company" based on the received context recognition information.

(51) According to an embodiment, the electronic device **101** may analyze the usage log to predict and generate a context according to the user's usage pattern. When the predicted context cannot be defined as meaningful information (e.g., when the predicted context cannot be defined as a text such as "listening to music while watching a movie at the company"), the electronic device **101** may recognize the predicted context as an arbitrary name such as context **1** or context **2**.

(52) According to an embodiment, when the predicted context is recognized as the arbitrary name such as context **1** or context **2**, the electronic device **101** may provide the recognized arbitrary context information to the user and may display a user interface on a display so that the user can directly configure a context name.

(53) Although the embodiment of FIG. **2** is described as analyzing the usage log of the electronic device **101** by the server **201**, in the following drawings, an example in which the electronic device **101** analyzes the usage log to recognize the user context will be described.

(54) FIG. **3** illustrates a configuration of a processor of an electronic device according to various embodiments, and FIG. **4** illustrates an example of comparing context-aware situations according to various embodiments.

(55) Functions or operations described in FIG. **3** may be understood as functions performed by a processor (the processor **120** of FIG. **1**) of an electronic device (e.g., the electronic device **101** of FIG. **1**). The processor **120** may execute instructions stored in a memory (e.g., the memory **130** of FIG. **1**) to implement a software module, and may control hardware (e.g., the communication module **180** of FIG. **1**) associated with the function. According to an embodiment, some of modules included in FIG. **3** may be implemented in a server (e.g., **201** in FIG. **2**), and may operate in conjunction with the server **201** and the electronic device **101**.

(56) Referring to FIGS. **3** and **4**, according to an embodiment, a processor (e.g., the processor **120** of FIG. **1**) of the electronic device **101** may include at least one of a usage log collection module **310**, a context analysis module **320**, and a graphic user interface (GUI) support module **330**, and a memory (e.g., the memory **130** of FIG. **1**) may include a personalized context recognition model **340**. According to an embodiment, the usage log collection module **310** may collect usage logs generated while the user uses the electronic device **101**

(57) The usage logs may include hardware log information or physical information and software log information or logical information.

(58) The hardware log information or physical information may include at least one of location information, time information, and sensor information. The location information may include, for example, at least one of GPS coordinate information of the electronic device **101**, network cell information obtained from a network through the communication module, and access point (AP) information connected to the electronic device **101**, but the disclosure is not limited thereto. The time information may refer to a specific time when an event occurs from a timer of the electronic device **101** and may include one or more pieces of information of month, day, hour, day, minute, and second. The sensor information may include, for example, one or more pieces of sensor information obtained from various sensors (e.g., an acceleration sensor, a proximity sensor) mounted on the electronic device **101**.

(59) The software log information or logical information may include application execution information collected when the user uses an application. The app execution information may include, for example, at least one of an app identifier (e.g., app name), time information when the app is executed, time information while the app is operating, and content information executed through the app.

(60) According to an embodiment, when the electronic device **101** is used by a plurality of users, the usage log collection module **310** may collect the usage log for each user account.

(61) According to an embodiment, the usage log collection module **310** may transmit the collected usage logs to a server (e.g., the server **201** of FIG. **2**).

(62) The usage log collection module **310** may transmit the collected usage logs to the context analysis module **320**.

(63) The context analysis module **320** may include a first type of context recognition module **3200** and a second type of context recognition module **3210**.

(64) The first type of context recognition module **3200** may identify whether the electronic device **101** is in a predefined situation, and may recognize a first type of context (e.g., a predefine context) designated as a predefined situation.

(65) The first type of context may include a predefined context or predetermined context defined by the electronic device **101** or the server **201** and a general or common context. The first type of context may be a context stored in the electronic device **101**.

(66) According to an embodiment, the first type of context recognition module **3200** may identify whether an application mapped with a user context is being used, and may recognize the first type of context based on the fact that the application mapped with the context is being executed. The first type of context recognition module **3200** may recognize the first type of context using app mapping information (e.g., an application—context mapping model).

(67) For example, as illustrated in FIG. **4**, when designated music apps **410**a, **410**b, **410**c, and **410**d (that is, information on apps classified as music apps are stored in advance) are executed, mapping may be performed in a manner that the electronic device **101** recognizes a context of "listening to music". When it is detected that one of the designated music apps is executed and in use, the first type of context recognition module **3200** may recognize or estimate a situation in which the user is listening to music and may recognize a first type of context (e.g., a predefined context) of "listening to music".

(68) The second type of context recognition module **3210** may recognize a second type of context according to a result analyzed based on the usage log.

(69) The second type of context may include an undefined context that is not predefined by the electronic device **101** or the server **201**, an unknown context or undiscovered context, an individual context, or a personalized context or customized context. The second type of context may be a context generated by the electronic device **101** or the server **201** in response to a user's personal characteristic.

(70) The second type of context recognition module **3210** may predict the second type of context according to a usage pattern corresponding to the user's personal characteristics based on the usage log and store the second type of context, and may recognize the second type of context based thereon.

(71) According to an embodiment, the second type of context recognition module **3210** may analyze a usage log and may predict a context that is not previously defined according to a user's usage pattern. When the predicted context cannot be defined as meaningful information (e.g., when the predicted context cannot be defined as a text such as "listening to music while watching a movie at a company"), the second type of context recognition module **3210** may recognize the predicted context as an arbitrary name such as context **1** or context **2**.

(72) According to an embodiment, when the predicted context is recognized as the arbitrary name such as context **1** or context **2**, the electronic device **101** may provide the recognized arbitrary

context information to the user and may display a user interface on a display so that the user can directly configure the context name.

(73) According to an embodiment, the second type of context recognition module **3210** may include an input vector conversion module **3211**, a log analysis module **3212**, and a personalized context generation module **3213**.

(74) The input vector conversion module **3211** may convert frequently occurring logs among the collected usage logs or usage logs collected over a configured reference value into an embedding input vector. The embedding input vector may be used as an input value of a neural network model or a clustering model.

(75) The log analysis module **3212** may derive or acquire the usage pattern corresponding to the user's personal characteristic by analyzing user's propensity or interest using the converted input vector. For example, the log analysis module **3212** may derive the usage pattern by grouping the collected usage logs into clusters according to similar items. The log analysis module **3212** may derive the usage pattern based on the neural network model or the clustering model.

(76) The personalized context generation module **3213** may generate the second type of context suitable for the user's personal characteristic based on the derived usage pattern and store the second type of content. For example, the personalized context generation module **3213** may generate the second type of context for usage patterns that frequently appear above a threshold value.

(77) For example, as illustrated in FIG. **4**, the electronic device **101** may cluster the usage logs to derive the usage pattern suitable for the user's propensity or interest. When a navigation app **430** is executed through the usage log in the electronic device **101**, a music app (e.g., **410***a*) is executed, and a usage pattern of transmitting music to an external device through a Bluetooth **435** is analyzed, the electronic device **101** may newly generate a personalized user context (in other words, the second type of context) of "listening to music while driving" **470**. Alternatively, when a music app (e.g., **410***a*) is executed and a usage pattern in which the user does not move for a predetermined time after being located at the company is analyzed, the electronic device **101** may newly generate a personalized context of "listening to music while working at the company **472**". In addition, as illustrated in FIG. **4**, when usage patterns of various conditions are analyzed in the electronic device **101**, a personalized context according to the personal characteristic such as "listening to music while exercising **471**" or "listening to music while resting at home **473**" may be generated in response to the analyzed usage patterns.

(78) The personalized context generation module **3213** may store the second type of context generated according to the usage pattern in the memory **130**.

(79) According to an embodiment, the personalized context generation module **3213** may control a context recognition model stored in the memory **130** to be updated to the personalized context recognition model **340** based on the personalized user context.

(80) The second type of context recognition module **3310** may recognize the second type of context by determining a similarity with currently generated usage logs.

(81) For example, the second type of context recognition module **3310** may compare the similarity of the usage logs with context feature elements defined as "listening to music while driving", and may recognize the personalized user context of "listening to music while driving" when it is determined that a situation where a music app, a navigation app, and a Bluetooth function are executed in the electronic device **101**.

(82) The input vector conversion module **3211**, the log analysis module **3212**, and the personalized context generation module **3213** may perform an operation by the electronic device **101** alone, or may be connected to the server (e.g., the server **201** of FIG. **2**) and a network to perform complementary operations.

(83) According to an embodiment, the electronic device **101** may provide unrecognized data that is not recognized as a personalized user context through a usage log analysis, to the server **201**

through the network. The electronic device **101** may receive a result obtained by recognizing the unrecognized data as a new context from the server through integrated analysis with contexts of other electronic devices.

(84) The GUI support module **330** may output a recommendation service for guiding a user based on a recognized context (e.g., the first type of context and the second type of context) on the display. The recommendation service may include at least one piece of recommendation information. For example, the recommendation information may be provided in the form of a list, but is not limited thereto.

(85) The GUI support module **330** may output information on at least one of a function or an application registered in advance in relation to the recognized context.

(86) According to an embodiment, the GUI support module **330** may output information about a usage pattern that is not recognized as a context or a context that cannot be defined as meaningful information or an arbitrary context to the display, and may provide the user with a guide on whether to store the unrecognized usage pattern as the personalized user context. The GUI support module **330** may output information on the usage pattern that is not recognized as a context as a pop-up window or through a notification bar.

(87) For example, the GUI support module **330** may output a guidance message inquiring whether to store the unrecognized data or unrecognized usage pattern as the context on the display. The GUI support module **330** may output a user interface (UI) capable of recording a context name for the unrecognized data in response to a request for permission to store the context. The electronic device **101** may store a context name named by the user, and may store context information named by the user in the memory **130** or may update the context information to the personalized context recognition model **340** so that the context name can be used later as a context defined by the user.

(88) The electronic device **101** according to various embodiments may include a display (e.g., the display module **160** of FIG. **1**), a memory (e.g., the memory **130** of FIG. **1** or the memory **130** of FIG. **3**) configured to store a usage log of the electronic device, and a processor (e.g., the processor **120** of FIG. **1** or the processor **120** of FIG. **3**) configured to be connected to the memory, wherein the processor may be configured to collect the usage logs of the electronic device, to identify a usage pattern according to a user characteristic by analyzing the usage logs, to generate and store a personalized user context corresponding to an undefined situation that is not predefined in the electronic device based on the usage pattern, and to display a recommendation service to the display in response to recognizing the personalized user context.

(89) According to various embodiments, the usage log may include sensor information and app execution information.

(90) According to various embodiments, the processor may be configured to convert the usage log into an embedding input vector and to obtain an output value corresponding to the personalized user context by using the converted input vector as an input value of a clustering model.

(91) According to various embodiments, the processor may be further configured to recognize a user context that is predefined in the electronic device in relation to the executed application based on information on the execution of the application, and the predefined user context may be a first type of context and the personalized user context may be a second type of context.

(92) According to various embodiments, the processor may be configured to store the personalized user context in a public context recognition model stored in the memory and to update a personalized context recognition model.

(93) According to various embodiments, the electronic device may further include a communication module configured to communicate with a server, wherein the processor may be configured to classify recognized data designated as the personalized user context as meaningful information and unrecognized data not designated as the user context among the analyzed usage patterns, and to transmit at least one of the collected usage logs, the recognized data, and the unrecognized data to the server.

(94) According to various embodiments, the processor may be configured to display a user interface (UI) that guides the user on whether to store the usage pattern classified into the unrecognized data as the personalized user context, on the display.

(95) According to various embodiments, the processor may be configured to name a context name for the unrecognized data, and to store information named to correspond to the unrecognized data by the user in the memory in response to a user input to be stored as the personalized user context or to transmit the named information to the server through the communication module.

(96) According to various embodiments, the processor may be configured to receive result information in which data analyzed as noise in the electronic device is recognized as a new context by performing integrated analysis with contexts of the other electronic devices from the server, through the communication module.

(97) According to various embodiments, when the server analyzes that context data of another electronic device having a similar value equal to or greater than a predetermined reference value to at least one of the usage pattern of the electronic device or the personalized user context exists, the processor may be configured to receive a context recognition service from the server based on the context data of the other electronic device and to display the received recommendation service on the display.

(98) FIG. **5** illustrates a personalized context recognition service method of an electronic device according to various embodiments of the disclosure.

(99) Referring to FIG. **5**, according to an embodiment, in operation **510**, a processor (e.g., the processor **120** of FIG. **3**) of the electronic device **101** may collect usage logs generated while the user uses the electronic device **101**.

(100) For example, the processor **120** may collect hardware log information such as sensor information and may collect software log information such as app execution information.

(101) According to an embodiment, the processor **120** may store the collected usage logs in a memory (e.g., the memory **130** of FIG. **3**).

(102) In operation **520**, the processor **120** may analyze the usage logs. In operation **530**, the processor **120** may derive a usage pattern corresponding to a user's personal characteristic.

(103) According to an embodiment, the processor **120** may convert the collected usage logs into an embedding input vector, and may derive a usage pattern that is frequently used by equal to or greater than a predetermined reference value by using the embedding input vector as an input value of a clustering model to group the usage logs into clusters according to similar items.

(104) In operation **530**, the processor **120** may predict and generate personalized user contexts suitable for the user's personal characteristic according to the usage pattern.

(105) In operation **540**, the processor **120** may store the personalized user context.

(106) According to an embodiment, the processor **120** may update a context recognition model based on the personalized user context.

(107) The processor **120** may recognize a second type of context (e.g., undefined context or personalized context) based on the personalized user context. For example, the electronic device **101** may determine whether a situation condition corresponding to the personalized user context occurs by comparing similarity between the currently collected usage logs and the characteristics of the context, thereby recognizing the second type of context.

(108) According to an embodiment, the processor **120** may recognize the second type of context (e.g., undefined context or personalized context,) based on the app execution information.

(109) FIG. **6** is a diagram illustrating a personalized context recognition service method of an electronic device according to various embodiments of the disclosure, and FIG. **7** illustrates an example describing log analysis data according to various embodiments.

(110) Referring to FIGS. **6** and **7**, according to an embodiment, in operation **610**, a processor (e.g., the processor **120** of FIG. **3**) of the electronic device **101** may collect usage logs generated while the user uses the electronic device **101**.

(111) For example, the processor **120** may collect hardware log information such as sensor information and collect software log information such as app execution information.

(112) According to an embodiment, the processor **120** may store the collected usage logs in a memory (e.g., the memory **130** of FIG. **3**).

(113) According to an embodiment, the processor **120** may transmit the collected usage logs to a server (e.g., the server **201** in FIG. **2**) supporting a context recognition system through a network, and operations **630** to **650** may be performed in the server.

(114) The processor **120** may branch to operation **620** to recognize a first type of context, and may branch to operation **630** to recognize a second type of context.

(115) Operations **620** and **630** are only separated for convenience of explanation, and depending on situations, the processor **120** may proceed from operation **620** to operation **680** and operation **690** to support a context-aware service, or may proceed from operation **620** to operation **630** to **670** or to operation **680** and **690** to support the context-aware service.

(116) For example, in order to recognize the first type of context, in operation **620**, the processor **120** may identify whether an app mapped to a predefined context is being used.

(117) As an example, the processor **120** may identify whether an app included in an application-context mapping model operates.

(118) In operation **680**, in response to the execution of the app included in the application-context mapping model, the processor **120** may recognize a context corresponding to the executed app.

(119) As another example, in order to recognize the second type of context, in operation **630**, the processor **120** may analyze the usage logs. In operation **640**, the processor **120** may derive a usage pattern corresponding to a user's personal characteristic based on the usage logs.

(120) According to an embodiment, the processor **120** may convert the collected usage logs into an embedding input vector, and may derive a usage pattern that is frequently used by equal to or greater than a predetermined reference value by using the embedding input vector as an input value of a clustering model to group the usage logs into clusters according to similar items.

(121) In operation **650**, the processor **120** may generate a personalized user context suitable for the user's personal characteristics by analyzing the usage pattern.

(122) The processor **120** may store the personalized user context or may update the context recognition model based on the personalized user context.

(123) In operation **660**, the processor **120** may identify whether to transmit analysis data to the server **201** by identifying whether the context recognition system interworks with the server **201**.

(124) For example, the processor **120** may proceed to operation **665** when the context recognition system is configured to interwork with the server **201**, and may proceed to operation **680** when the context recognition system is configured not to interwork with the server or a network connection is not smoothly performed.

(125) In operation **665**, the processor **120** may determine whether to transmit all analysis data to the server **201**. When all the analysis data is configured to be transmitted to the server, the processor **120** may proceed to operation **670** to transmit data recognized as the personalized user context and unrecognized data to the server **201**. The processor **120** may transmit data related to the usage pattern to the server **201**.

(126) In this case, the server **201** may compare and integrally analyze usage pattern data of the user with usage pattern data collected from other electronic devices or user devices of other accounts, thereby deriving a result in which data that is not analyzed or unrecognized by the electronic device **101** is recognized as a new context.

(127) For example, the server **201** may derive a result in which the usage log classified as noise by the electronic device **101** is recognized as the new context through integrated data analysis of the electronic device **101** and the other electronic devices.

(128) Referring to (a) of FIG. **7**, when the usage logs are clustered by the electronic device **101**, data within a predetermined range may be recognized as a context (e.g., recognized data), but as

illustrated in (a) of FIG. **7**, logs that do not frequently appear or exceed the predetermined range may be analyzed as noise **710** and classified as unrecognized data. However, referring to (b) of FIG. **7**, the server **201** may integrally analyze the unrecognized data classified as noise **710** by the electronic device **101** with data of the other electronic devices to identify whether the unrecognized data is noise or new data. When a portion of the noise **710-1** is recognized as a context **720** of the other electronic devices, the server **201** may classify the noise **710-1** as a meaningful context, and may provide result information in which the noise **710-1** is recognized as the context **720** to the electronic device **101**.

(129) When only the unrecognized data is configured to be transmitted to the server **201**, the processor **120** may proceed to operation **675** to transmit only the unrecognized data to the server. In this case, since the server **201** analyzes only the unrecognized data, data transmission traffic between the electronic device **101** and the server **201** can be reduced.

(130) In operation **677**, the processor **120** may receive analysis information on the unrecognized data from the server **201**.

(131) In operation **680**, the processor **120** may recognize a first type of context (e.g., a predefined context) based on whether the app is used, and may recognize a second type of context (e.g., undefined context or personalized context) based on the personalized user context.

(132) For example, when a music app and a context of "listening to music" are predefined, the processor **120** may detect that the music app is in operation and may recognize a context for situation-aware of "listening to music" based on the detected information.

(133) For another example, the processor **120** may compare the similarity of the currently collected usage logs to identify whether a situation condition (e.g., execution of a music app or indoor location) corresponding to the personalized user context occurs, thereby recognizing a user context (or a personalized user context) to which a personal situation of "listening to music while resting at home" is reflected.

(134) In operation **690**, the processor **120** may output recommendation information (e.g., a recommendation function or a recommendation service) through the display in response to the recognized context.

(135) FIG. **8** illustrates an example describing a context recognition model according to various embodiments.

(136) Referring to FIG. **8**, according to an embodiment, the electronic device **101** may support a function of updating a common context recognition model to a customized context recognition model **830** based on at least one of a user context (in other words, a personalized user context) generated by analyzing a usage log of the electronic device **101** or a new context that is not analyzed by the electronic device **101** from the server **201**.

(137) The customized context recognition model **830** may include data (e.g., predefined data) **810** for recognizing a first type of context and data (e.g., undefined data) **820** for recognizing a second type of context. The predefined data **810** may be data included in a common context recognition model. For example, the predefined data **810** may be data for recognizing a general or common context, such as "while exercising", "while working", "while driving", or "while shopping".

(138) The undefined data **820** may be data stored to recognize a personalized user context generated according to a user's personal characteristic by analyzing the usage log by the electronic device **101**. The undefined data **820** may include data (e.g., labeled data) **821** that is recognized as a context through log analysis (e.g., clustering) and data (e.g., unlabeled data) **822** that is analyzed as noise by the electronic device **101** and requires integrated analysis by the server.

(139) The electronic device **101** may transmit in operation **825** data (e.g., unlabeled data) in which the usage pattern analyzed by log analysis is not recognized as a context or classified as noise, to the server **201**. The server **201** may integrally analyze data transmitted from the electronic device **101** with data of other electronic devices to classify the analyzed data as noise or recognize the analyzed data as a new meaningful context, and may transmit the classified and recognized

information to the electronic device **101**.

(140) The electronic device **101** may receive in operation **827** result data (e.g., result transmission) recognized from the unlabeled data through integrated analysis with other electronic devices from the server **201**, and may update the received result data to the customized context recognition model **830**. The electronic device **101** may update the customized context recognition model **830**.

(141) The electronic device **101** may recognize a context by performing context-aware based on the updated customized context recognition model **830**.

(142) The electronic device **101** may recognize a personalized user context analyzed through the usage logs and newly generated, that is, a second type of context **850** (e.g., a personalized context **1 851** or a personalized context **2 853**) as well as a context predefined in the electronic device **101**, that is, a first type of context **840** (e.g., a predefined context), thereby providing a personalized context-aware service optimized for the user to the user. Here, the personalized context **1 851** may be a personalized user context predicted based on the data (e.g., labeled data) recognized as the context through log analysis (e.g., clustering). The personalized context **2 853** may be a personalized user context predicted through information obtained through integrated analysis of data (e.g., unlabeled data) not analyzed by the electronic device **101** with other electronic devices in the server.

(143) The electronic device **101** may recommend different context-aware services for each user even if the same application is used by recognizing the personalized user context reflecting user characteristics.

(144) FIG. **9** illustrates a configuration of a server supporting a context-aware service according to various embodiments of the disclosure.

(145) Referring to FIG. **9**, a server **901** according to an embodiment may collect user contexts of an electronic device (e.g., the electronic device **101** of FIG. **1**), and may support a function of performing integrated analysis of contexts and a function of recommending and guiding a service suitable for a situation of the electronic device **101** by determining similarity for each context. The electronic device **101** may interwork with the server **901** to guide the user to a recommendation service or function corresponding to the user context.

(146) According to an embodiment, the server **901** may include a context mapping module **910** (e.g., context mapper) and a context analysis module **920** (e.g., context analyzer).

(147) The context mapping module **910** may collect context data or usage log information transmitted from the electronic device **101** for each electronic device or for each user account.

(148) For example, the context mapping module **910** may acquire at least one of a first type of context **911** (e.g., a common context) from the electronic device **101**, a second type of context **912** (e.g., a personalized context, a customized context, or a labeled context) that is recognized by log analysis (e.g., clustering) of the electronic device **101**, a third type context **913** (e.g., unlabeled context) that is analyzed as noise by the electronic device **101** and requires integrated analysis of the server.

(149) The context mapping module **910** may map data **915** (e.g., metadata) stored in the server and feature elements of the context transmitted from the electronic device, and may transmit the mapped result information (e.g., input data) to the context analysis module **920**. The data (e.g., metadata) stored in the server may include app-related information (e.g., category information or app detailed information), but the disclosure is not limited thereto. Various types of information necessary for context analysis, such as location information of the electronic device **101** may be stored as metadata. For example, the data (e.g., metadata) stored in the server may be stored based on usage log information of the electronic device **101**.

(150) In FIG. **9**, the corresponding context is classified into the second type of context **912** and the third type context **913**, but this is for illustrative purposes only, and according to an embodiment, the third type context **913** may be integrally classified into the second type of context **912**.

(151) The context analysis module **920** may include a context classifier **930** and a context scorer

940.

(152) The context classifier **930** may classify and manage contexts based on the result information (e.g., input data) transmitted from the context mapping module **910**. The context classifier **930** may perform a function of integrating and analyzing data transmitted from the electronic device **101** with data of other electronic devices to classify the analyzed data as noise or to determine the analyzed data as a new meaningful context. The context scorer **940** may comparatively evaluate (e.g., score) the collected contexts, and may transmit the result to the electronic device **101**.

(153) For example, the context scorer **940** may gather or group contexts associated with a specific context recognized by the electronic device **101**. The context scorer **940** may use an association score to extract groups. The association score may increase along with an increase in the number of feature elements associated with feature elements included in each context.

(154) The context scorer **940** may select a function or service having the association score (e.g., an accuracy score) higher than a reference threshold value based on the specific context recognized by the electronic device **101**, and may transmit information on the selected function and service to the electronic device **101** as recommendation service information. The context scorer **940** may select a predetermined number of recommended functions in descending order from the highest association score (e.g., the accuracy score).

(155) FIG. **10** illustrates an example of a context combination according to various embodiments.

(156) Referring to FIG. **10**, according to an embodiment, the electronic device **101** may combine user contexts generated by analyzing usage logs to generate a higher-level user context and may support a function of recognizing the generated user context.

(157) For example, the electronic device **101** may support to generate user contexts **1** to **7** (that is, context **1**, context **2**, context **3**, context **4**, context **5**, context **6**, and context **7**) as personalized user contexts and to recognize the personalized user contexts by analyzing the usage logs.

(158) The electronic device **101** may generate a new level of context by combining contexts having the same feature according to a configuration. For example, when it is analyzed that the user frequently uses a specific place (e.g., location **1**) other than a designated place (e.g., home or company) (e.g., located in the specific place more than a predetermined number of times), the electronic device **101** may newly combine context **1** and context **4** including the feature of location **1** to generate a new level of context **8** for a situation related to location **1**, and may recognize the generated new level of context **8**. As another example, the electronic device **101** may generate a new level of context **9** by combining context **2**, context **3** and context **4** including features related to a specific app (e.g., app **0**), and may generate a new level of context **10** by combining context **2**, context **4** and context **5** including features related to a specific time (e.g., time **2** or **5**).

(159) FIG. **11** illustrates an example of providing a context-based recommendation service according to various embodiments.

(160) Referring to FIG. **11**, according to an embodiment, an electronic device (e.g., the electronic device **101** of FIG. **1**) may interwork with a server (e.g., the server **201** of FIG. **2**) to recommend a user context suitable for a situation of the electronic device **101** based on similarity between the user contexts.

(161) For example, when context **1** has feature elements of location **2**, time **2**, app**2**, and URL **0**, and context **2** has feature elements of time **4**, app **6**, and URL **4**, the electronic device **101** (or the server **201**) may determine that context **1** and context **2** are not similar to each other. On the other hand, when context **3** and context **4** have feature elements of time **3**, app **6**, and URL **4**, the electronic device **101** or the server **201** may determine that context **3** and context **4** are similar contexts, and may provide a context recognition or recommendation service based on the determination information.

(162) For example, context **3** having the feature elements of time **3**, app **6**, and URL **4** may be generated as a personalized user context by user device **1**, and recommendation service **1** corresponding to context **3** may be guided. The server **201** may recommend recommendation

service **1** to user device **2** as the recommendation information for context **3** by identifying the similarity between context **4** and context **3** generated in user device **2**.

(163) FIGS. **12** and **13** illustrate a situation in which a personalized context recognition service is provided according to various embodiments of the disclosure.

(164) Referring to FIGS. **12** and **13**, an electronic device (e.g., the electronic device **101** of FIG. **1**) according to an embodiment may support a function of recommending and proposing a name of a context that is not designated in advance and a function of comparing a corresponding context with that of another electronic device and providing a recommendation service, in conjunction with the server (e.g., the server **201** of FIG. **2**).

(165) According to an embodiment, user device **1** may transmit a usage log or a context analyzed based on the usage log to the server, and the electronic device **101** of user device **2** may also transmit the usage log or the context to the server **201**.

(166) The server **201** may compare and analyze the usage log or context of user device **1** and user device **2**.

(167) For example, as illustrated in FIG. **12**, the server **201** may identify the contexts (e.g., anonymous context **1**, anonymous context **2**, driving, or shopping) collected from user device **1**. In this case, there may be anonymous context **1** and anonymous context **2** of which name cannot be specified although they are recognized as the context by user device **1**. User device **1** may provide information about anonymous context **1** and anonymous context **2** to the user and may guide the user to request a name.

(168) When user **1** names a situation for anonymous context **2** as "meeting in conference room", user device **1** may update the name of anonymous context **2** to "meeting in conference room".

(169) On the other hand, the server **201** may identify contexts (anonymous context **3**, anonymous context **4**, listen to music, and shopping) collected from user device **2**, and may recommend and provide information of anonymous context **2** (e.g., "meeting in conference room") named by user device **1** when it is determined that the feature element of anonymous context **3** among the identified contexts is similar to anonymous context **2** of user device **1**. User device **2** may recognize the context of "meeting in conference room", and may provide a recommendation service based on the recognized context to user **2**.

(170) For example, as illustrated in FIG. **13**, the server **201** may compare and analyze the contexts (e.g., anonymous context **1**, anonymous context **2**, driving, shopping) collected from user device **1** with the contexts (anonymous context **3**, anonymous context **4**, listen to music, shopping) collected from user device **2**. The server may analyze that anonymous context **1** of user device **1** and anonymous context **4** of user device **2** have a predetermined level of similarity or more. The server **201** may identify a configuration value of a function or service provided when anonymous context **4** is recognized by user device **1**, and may provide a configuration value of the identified user device **1** to user device **2** as recommendation information when anonymous context **4** is recognized by user device **2**.

(171) According to various embodiments, a situation-aware service method of an electronic device may include collecting usage logs of the electronic device, identifying a usage pattern according to a user characteristic by analyzing the usage log, generating and storing a personalized user context corresponding to an un-defined situation that is not predefined in the electronic device based on the usage pattern, and displaying a recommendation service to the display in response to recognizing the personalized user context.

(172) According to various embodiments, the usage log may include sensor information and app execution information.

(173) According to various embodiments, the generating and storing of the personalized user context may include converting the usage log into an embedding input vector and obtaining an output value corresponding to the personalized user context by using the converted input vector as an input value of a clustering model.

(174) According to various embodiments, the situation-aware service method may further include detecting execution of an application, and recognizing a user context that is predefined in the electronic device in relation to the executed application based on the execution of the application, wherein the predefined user context may be a first type of context and the personalized user context may be a second type of context.

(175) According to various embodiments, the generating and storing of the personalized user context may further include storing the personalized user context in a public context recognition model stored in the electronic device and updating a personalized context recognition model.

(176) According to various embodiments, the identifying of the usage pattern according to the user's characteristic by analyzing the usage log may further include classifying recognized data designated as the personalized user context as meaningful information and unrecognized data not designated as the user context among the analyzed usage patterns, and transmitting at least one of the collected usage logs, the recognized data, and the unrecognized data through a communication module to the server according to a configuration of the electronic device.

(177) According to various embodiments, the situation-aware service method may further include, after the classifying of the unrecognized data, displaying a user interface (UI) that guides the user on whether to store the usage pattern classified into the unrecognized data as the personalized user context, on the display.

(178) According to various embodiments, the situation-aware service method may further include, after the displaying of the UI on the display, naming a context name for the unrecognized data; and storing information named to correspond to the unrecognized data by the user in the memory in response to a user input to be stored as the personalized user context or transmitting the named information to the server through the communication module.

(179) According to various embodiments, the situation-aware service method may further include, after the transmitting of the at least one of the usage log, the recognized data, and the unrecognized data to the server, receiving result information in which the unrecognized data is recognized as a new context by performing integrated analysis with contexts of the other electronic devices from the server, through the communication module.

(180) According to various embodiments, the outputting of the recommendation service to the display may further include, when the server analyzes that context data of another electronic device having a similar value equal to or greater than a predetermined reference value to at least one of the usage pattern of the electronic device or the personalized user context exists, receiving a recommendation service corresponding to a situation recognized based on the context data of the other electronic device from the server, and outputting the received recommendation service to the display.

(181) According to various embodiments, personalized user context conforming to the user's individual preferences may be recognized, thereby recommending a different service to each user even in the case of the same application.

(182) According to various embodiments, personalized user contexts generated by an electronic device different from a personalized user context generated by the electronic device may be integrated/analyzed, thereby recommending a CAS tailored to individual users.

(183) As used in connection with various embodiments of the disclosure, the term "module" may include a unit implemented in hardware, software, or firmware, and may interchangeably be used with other terms, for example, "logic," "logic block," "part," or "circuitry". A module may be a single integral component, or a minimum unit or part thereof, adapted to perform one or more functions. For example, according to an embodiment, the module may be implemented in a form of an application-specific integrated circuit (ASIC).

(184) Various embodiments as set forth herein may be implemented as software (e.g., the program **140**) including one or more instructions that are stored in a recording medium or a storage medium (e.g., internal memory **136** or external memory **138**) that is readable by a machine (e.g., the

electronic device **101**). For example, a processor (e.g., the processor **120**) of the machine (e.g., the electronic device (**101**) may invoke at least one of the one or more instructions stored in the storage medium, and execute it, with or without using one or more other components under the control of the processor. This allows the machine to be operated to perform at least one function according to the at least one instruction invoked. The one or more instructions may include a code generated by a complier or a code executable by an interpreter. The machine-readable storage medium may be provided in the form of a non-transitory storage medium. Wherein, the term "non-transitory" simply means that the storage medium is a tangible device, and does not include a signal (e.g., an electromagnetic wave), but this term does not differentiate between where data is semi-permanently stored in the storage medium and where the data is temporarily stored in the storage medium.

(185) According to an embodiment, a method according to various embodiments of the disclosure may be included and provided in a computer program product. The computer program product may be traded as a product between a seller and a buyer. The computer program product may be distributed in the form of a machine-readable storage medium (e.g., compact disc read only memory (CD-ROM)), or be distributed (e.g., downloaded or uploaded) online via an application store (e.g., PlayStore™), or between two user devices (e.g., smart phones) directly. If distributed online, at least part of the computer program product may be temporarily generated or at least temporarily stored in the machine-readable storage medium, such as memory of the manufacturer's server, a server of the application store, or a relay server.

(186) According to various embodiments, each component (e.g., a module or a program) of the above-described components may include a single entity or multiple entities, and some of the multiple entities may be separately disposed in different components. According to various embodiments, one or more of the above-described components may be omitted, or one or more other components may be added. Alternatively or additionally, a plurality of components (e.g., modules or programs) may be integrated into a single component. In such a case, according to various embodiments, the integrated component may still perform one or more functions of each of the plurality of components in the same or similar manner as they are performed by a corresponding one of the plurality of components before the integration. According to various embodiments, operations performed by the module, the program, or another component may be carried out sequentially, in parallel, repeatedly, or heuristically, or one or more of the operations may be executed in a different order or omitted, or one or more other operations may be added.

Claims

1. An electronic device comprising: a display; a processor; and a memory storing instructions executable by the processor, wherein the processor is connected to the memory and configured to execute the instructions to: identify whether an application installed in the electronic device and mapped to a predefined user context predefined in the electronic device is being executed in the electronic device, based on the application being executed in the electronic device, recognize the predefined user context by using information on mapping between the application and the predefined user context, collect usage logs of the electronic device and store the collected usage logs in the memory, identify a usage pattern according to a user characteristic by analyzing the stored usage logs, generate a personalized user context of a first level corresponding to feature elements related to an undefined situation that is not predefined in the electronic device based on the usage pattern, and control the display to output a recommendation function related to the recognized predefined user context or the personalized user context in the display in response to recognizing the predefined user context or the personalized user context, wherein the processor is further configured to execute the instructions to identify the usage pattern by grouping the collected usage logs into clusters according to similar items of the collected usage logs based on a clustering

model, wherein the feature elements comprise at least one of location information, application information, time information, uniform resource locator (URL) information, and device information, and wherein the processor is further configured to generate a personalized user context of a second level by combining personalized user contexts of the first level having a same feature element related to the undefined situation.

2. The electronic device of claim 1, wherein the usage logs comprise sensor information and app execution information.

3. The electronic device of claim 1, wherein the processor is further configured to: as an operation of grouping the collected usage logs, convert the usage logs into an embedding input vector, and obtain an output value corresponding to the personalized user context by using the converted input vector as an input value of the clustering model.

4. The electronic device of claim 1, wherein the processor is further configured to execute the instructions to: store the personalized user context in a public context recognition model stored in the memory, and update a personalized context recognition model.

5. The electronic device of claim 1, further comprising a communication module configured to communicate with a server, wherein the communication module comprises one or more communication processors, wherein the processor is further configured to execute the instructions and control the communication module to: classify recognized data designated as the personalized user context as meaningful information and unrecognized data not designated as the user context among analyzed usage patterns, and transmit at least one of the collected usage logs, the recognized data, and the unrecognized data to a server.

6. The electronic device of claim 5, wherein the processor is further configured to execute the instructions to display a user interface (UI) that provides the user with a guide on whether to store the usage pattern classified into the unrecognized data as the personalized user context, on the display.

7. The electronic device of claim 6, wherein the processor is further configured to execute the instructions to: name a context name for the unrecognized data, and store information named to correspond to the unrecognized data by the user in the memory in response to a user input to be stored as the personalized user context or transmit the named information to the server.

8. The electronic device of claim 5, wherein the processor is configured to execute the instructions to receive result information in which data analyzed as noise in the electronic device is recognized as a new context by performing integrated analysis with contexts of other electronic devices from the server.

9. The electronic device of claim 5, wherein, when the server analyzes that context data of another electronic device having a similar value equal to or greater than a predetermined reference value to at least one of the usage pattern of the electronic device or the personalized user context exists, the processor is further configured to execute the instructions to: receive a recommendation service corresponding to a situation recognized based on the context data of the another electronic device from the server, and display the received recommendation service on the display.

10. A method for providing a situation-aware service of an electronic device, the method comprising: identifying whether an application installed in the electronic device and mapped to a predefined user context predefined in the electronic device is being executed in the electronic device, based on the application being executed in the electronic device, recognizing the predefined user context by using information on mapping between the application and the predefined user context, collecting usage logs of the electronic device and storing the collected usage logs in a memory; identifying a usage pattern according to a user characteristic by analyzing the stored usage logs; generating a personalized user context of a first level corresponding to feature elements related to an undefined situation that is not predefined in the electronic device based on the usage pattern; and displaying a recommendation function related to the recognized predefined user context or the personalized user context in a display in response to recognizing the predefined user

context or the personalized user context, wherein the identifying of the usage pattern comprises identifying the usage pattern by grouping the collected usage logs into clusters according to similar items of the collected usage logs based on a clustering model, wherein the feature elements comprise at least one of location information, application information, time information, uniform resource locator (URL) information, and device information, and wherein the method further comprises generating a personalized user context of a second level by combining personalized user contexts of the first level having a same feature element related to the undefined situation.

11. The method of claim 10, wherein the grouping of the collected usage logs comprises: converting the usage logs into an embedding input vector; and obtaining an output value corresponding to the personalized user context by using the converted input vector as an input value of the clustering model.

12. The method of claim 10, wherein the identifying of the usage pattern according to the user characteristic by analyzing the usage logs further comprises: classifying recognized data designated as the personalized user context as meaningful information and unrecognized data not designated as the user context among analyzed usage patterns; and transmitting at least one of the collected usage logs, the recognized data, and the unrecognized data to a server according to a configuration of the electronic device.

13. The method of claim 12, after the classifying of the unrecognized data, further comprising: displaying a user interface (UI) that provides a user with a guide on whether to store the usage pattern classified into the unrecognized data as the personalized user context, on the display, receiving a user input for naming a context name for the unrecognized data and storing the named context name as the personalized user context; and storing information named to correspond to the unrecognized data by the user in a memory in response to a user input to be stored as the personalized user context or transmitting the named information to the server.

14. The method of claim 12, after the transmitting of the at least one of the usage logs, the recognized data, and the unrecognized data to the server, further comprising: receiving result information in which the unrecognized data is recognized as a new context by performing integrated analysis with contexts of other electronic devices from the server, and wherein the outputting of the recommendation service to the display further comprises: when the server analyzes that context data of another electronic device having a similar value equal to or greater than a predetermined reference value to at least one of the usage pattern of the electronic device or the personalized user context exists, receiving a recommendation service corresponding to a situation recognized based on the context data of the another electronic device from the server, and outputting the received recommendation service to the display.