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U.S. Patent 9,807,564

U.S. Patent 9,807,564 ("*Context Directions*" or the "patent-at-issue") was filed on December 13, 2016. According to the paragraph in the specification entitled "Cross-Reference to Related Applications", the patent-at-issue is a continuation of U.S. patent application Ser. No. 14/745,433, filed on June 21, 2015, which is also a continuation of U.S. patent application Ser. No. 14/346,985, filed on March 25, 2014, and now U.S. Patent No. 9,107,093, which is a national stage entry of PCT Patent Application Serial No. PCT/EP2013/052187, filed February 5, 2013, which claims priority to Polish Patent Application No. P.398132, filed on February 17, 2012. Claim 23 of the patent-at-issue describes a method of detecting the context of a mobile device with multiple sensors by organizing them into sensor groups arranged hierarchically. The classification by a classifier in a lower-level sensor group triggers the activation of a classifier in a higher-level sensor group. Additionally, the configuration of the classifier in the lower-level group is adjusted based on the result of the classification by the higher-level group's classifier.

The primary reference, U.S. Patent 10,145,707 ("*CSR Technology*"), was filed on May 25, 2011 and claims priority on the same date. The patent is directed to a method of locating a navigation device using sensor data analysis. The navigation device's precise location, including its relationship to a person's body, is determined by a series of decisions made using a hierarchical algorithm. Each decision corresponds to a class related to the device's potential motion modes and/or precise location. The hierarchical algorithm helps to improve situational awareness by precisely locating the device and supplying pertinent contextual information.

The secondary reference, U.S. Patent 8,472,986 ("*Buckyball*"), was filed on July 16, 2010 and claims an earliest priority date on September 21, 2005. The patent is directed to a method of improving mobile device context-data acquisition. A message generated by the mobile device is identified and at least one mobile device sensor is added to a list. Based on a certain metric, the list is arranged and one of the first specified sensors on the mobile device measures a physical quantity of an environmental feature. Data about the context is created from the measurement.

A sample claim chart comparing claim 23 of *Context Directions* to *CSR Technology* and *Buckyball* is provided below.

US9807564 ("*Context Directions*")	**A. US10145707** (*"CSR Technology"*) **B. US8472986** (*"Buckyball"*)
23.pre. A method for **detecting a context of a mobile device** **equipped with a plurality of sensors**, comprising:	**A. US10145707** "1. A method for using position information about a mobile device to enhance user experience, the method comprising: **detecting, by a processor, a motion mode of the mobile device** **based on data collected from one or more sensors coupled to the mobile device**; . . . ." *CSR Technology* at claim 1 "In other words, **the hierarchical algorithm in some embodiments described herein creates** **a predefined contextual classification framework in which collected sensor data can be fed (automatically or semi-automatically) and analyzed**, **such that the output of the algorithm is indicative of the location of the navigation device** with a certain confidence level." *CSR Technology* at col. 5:9-15 **B. US8472986** "A system, method, and article of manufacture for **optimization of context-data acquisition by a mobile device** are disclosed." *Buckyball* at col. 2:53-55 "In yet another aspect, a system that includes a text-messaging component is operative to generate, send and receive a text message. A text-message enriching component is operative to associate a sensor data with a text data. **A sensor manager component is operative to select a sensor component according to a selection metric**. **A sensor component is operative to acquire the context data**." *Buckyball* at col. 3:1-7
23.a. **assigning the plurality of sensors to a plurality of sensor groups**, wherein **each sensor group is assigned at least one sensor**;	**A. US10145707** "2. The method of claim 1, wherein detecting the location of the mobile device on the user's body comprises performing one or both of time-domain analysis and frequency-domain **analysis of the data collected from the one or more sensors**." *CSR Technology* at claim 2 "6. The method of claim 5, wherein **comparing the spectral information in the collected sensor data to spectral**

(cont.) 23.a. **assigning the plurality of sensors to a plurality of sensor groups**, wherein **each sensor group is assigned at least one sensor**;	**information in two or more sets of training data** further comprises: . . . .” *CSR Technology* at claim 6 “One of the features of the present invention is the ability to recognize the **natural segmentation of the collected sensor data**, and **associate a proper classifier to each segment of data**, as will be elaborated further with illustrative examples” *CSR Technology* at col. 5:22-26 **B. US8472986** “**Context-enriched messaging application** 108 **can also be arranged to manage the sensors** 130 **A-N and** 132 **according to the various system attributes of the mobile device such as power availability, sensor power use, mobile device context, sensor availability** and the like. In some embodiments, **sensor availability can include** a granular resolution of different states of availability such as mode operation (e.g. awake, asleep), **integration into mobile device (e.g. remote sensor, add-on sensor, and/or integrated sensor)**, attributes of the type of coupling between mobile device and sensor (e.g. Bluetooth™ protocol, communication via a LAN, WAN and/or PAN), and/or any combination thereof.” *Buckyball* at col. 6:17-28 “In one example embodiment, a word, phrase or word structure pattern of the short message can be pre-associated with a set of sensors. The **set of sensors can be listed according to how each currently rates according a given set of metrics**. The **top-listed sensor can then be chosen to provide the context data** to be associated with the word, phrase or word structure pattern.” *Buckyball* at col. 6:39-45 “Mobile device 100 can be arranged to communicate with one or more remote sensors 132. For example, **a set of remote sensors** 132 **can be arranged as a wireless sensor network (WSN) and/or a virtual sensor network (VSN)**. For example, **a WSN can be implemented as a network of distributed autonomous sensors that cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants**. In another example, **a VSN can involve dynamically varying subset of remote sensors**. In such a case, **remote sensors can detect how a phenomenon changes with time as the phenomenon migrates**. Sensor drivers 120 can differentiate between active and inactive sensors and interact with the active sensors to

	conserve the processing and power resources of mobile computing device 100." *Buckyball* at col. 8:3-17
23.b. **arranging the sensor groups according to a hierarchy**;	**A. US10145707** "A **hierarchical algorithm uses the sensor data for making a series of decisions regarding the location of the navigation device, with each decision corresponding to a class among a plurality of classes related to the possible motion modes and/or precise location of the device**, including the location of the device with respect to a person's body. By accurately identifying the device location, **the hierarchical algorithm facilitates in providing relevant contextual information**, thereby enhancing situational awareness for the user." *CSR Technology* at col. 2:36-45 **B. US8472986** "**Context analyzer** 202 **can then generate a list of available sensors that provide the relevant context data types**. **Context analyzer** 202 **can order the list of sensors according certain metrics**. Example metrics include sensor power usage, signal availability, sensor availability, processor availability (e.g. CPU, GPU), power source level, relevance between sensor's context data and associated term, user settings, and so forth. **Context analyzer** 202 **can then acquire context data from the first listed sensor**. **Context analyzer** 202 **can acquire context data from such sources as the sensor manager** 204, a database of recent context data 136, operating system 104, and memory 150. Context analyzer 202 can generate a list of possible context data sources (e.g. sensors). The **list can then be prioritized according to one or more metrics such as recency of context data acquisition by a sensor, quality of the context data, integrity of context data, type of message, size constraints of the messaging protocol and/or availability of context data**, for example. For example, if the short message is an SMS message, context analyzer 202 may prioritize a context data type that can be expressed within the 140 octet size constraint (e.g. GPS coordinates as text, temperature as text). In one example, **context analyzer** 202 **can use a ranking algorithm to perform a multi-dimensional fit across a broad set of parameters**. This parameter can include any metric including those listed herein." *Buckyball* at col. 10:48-67 through col. 11:1-5

(cont.) 23.b. **arranging the sensor groups according to a hierarchy**;	"In the operations of blocks 706-710, values can be given to each sensor based on a magnitude of the condition evaluated. For example, **a sensor functioning at near maximum sensitivity can receive a higher value than a sensor functioning at a lower sensitivity**. Block 712 illustrates **applying a ranking algorithm to the list of sensors and ranking the list according one or more metrics**. For example, **a sensor ranking utility can rank sensor according to such metrics as ranking sensors based on relevance to short message content, sensor power usage (e.g. if mobile device power supply is a concern) user settings, and the like**." *Buckyball* at col. 17:41-51
23.c. **activating a classification by a classifier assigned to a second sensor group after a result of a classification by a classifier assigned to a first sensor group**, wherein **the second sensor group is at a higher level in the hierarchy than the first sensor group**; and	**A. US10145707** "As described before, the present invention uses **a hierarchical algorithm to broadly detect a motion mode of a navigation device (e.g., whether a person carrying the device is walking, is in a vehicle, is jogging, or is stationary, etc.), and additional finer-level of information regarding the physical location of a navigation device (e.g., on the person's body, within/coupled to an item of clothing, or within/coupled to a carrier, such as a bag, etc.)**. Inherently, the nature of the locational data associated with the PND is hierarchical, therefore the collected sensor data, e.g. data collected from one or more IMUs coupled to the PND, is also hierarchical. The locational information is gleaned efficiently by exploiting existing hierarchy in collected sensor data. In other words, **the hierarchical algorithm in some embodiments described herein creates a predefined contextual classification framework in which collected sensor data can be fed (automatically or semi-automatically) and analyzed, such that the output of the algorithm is indicative of the location of the navigation device** with a certain confidence level." *CSR Technology* at col. 4:63-67 through col. 5:1-15 "3. The method of claim 1, wherein detecting the location of the mobile device on the user's body comprises **performing a time-domain classification using classifiers of data collected from the one or more sensors**." *CSR Technology* at claim 3 "According to an aspect of this invention, a method for determining position information about a device is disclosed, the method comprising: **performing a first level of classification to detect a motion mode of the device by**

(cont.) 23.c. **activating a classification by a classifier assigned to a second sensor group after a result of a classification by a classifier assigned to a first sensor group**, wherein **the second sensor group is at a higher level in the hierarchy than the first sensor group**; and	**distilling data collected from one or more sensors coupled to the device**; and, **performing a second level of classification to detect a location of the device on a user's body by further distilling data collected from the one or more sensors**." *CSR Technology* at col. 3:4-11 "An example hierarchical context detection algorithm to determine the location of the module on the body of person is described in FIGS. 4 and 5. In FIGS. 4 and 5, **classification of the user mode of motion (context detection) is conducted first, and, next, for each mode, further classification of the module's location or position on the person's body is performed**. It should be noted that **the order in which the classification hierarchy is chosen determines the nature of the algorithm**. Also, although in FIGS. 4 and 5, only two levels of classifications are discussed (motion mode detection and position detection on a person's body), the classification can potentially have more than two levels. For example, an additional level of classification may determine if the PND is outdoors, indoors, underground etc." *CSR Technology* at col. 11:5-18 **B. US8472986** "In the operations of blocks 706-710, values can be given to each sensor based on a magnitude of the condition evaluated. For example, **a sensor functioning at near maximum sensitivity can receive a higher value than a sensor functioning at a lower sensitivity**. Block 712 illustrates **applying a ranking algorithm to the list of sensors and ranking the list according one or more metrics**. For example, **a sensor ranking utility can rank sensor according to such metrics as ranking sensors based on relevance to short message content, sensor power usage (e.g. if mobile device power supply is a concern) user settings, and the like**." *Buckyball* at col. 17:41-51 "Another example **metric can include security levels associated with the various sensors**. For example, **a particular sensor may be more susceptible in a particular location**. In some embodiments, **sensors with lower security levels can be weighted lower (e.g. allocated a lower metric value) on the list of context data sources generated by the context analyzer** 202. For example, **if the location has been associated with a security concern, a camera/image recognition application that is native to mobile device** 100 (such as Google Goggles™) **can receive a more favorable**

(cont.) 23.c. **activating a classification by a classifier assigned to a second sensor group after a result of a classification by a classifier assigned to a first sensor group**, wherein **the second sensor group is at a higher level in the hierarchy than the first sensor group**; and	**metric value than a non-native sensor that transmits information via a radio signal** (e.g. Bluetooth™ or NFC). The embodiments are not limited in this context. In some embodiments, the security level metric can be user-defined." *Buckyball* at col. 11:6-19
23.d. **adapting a configuration of the classifier assigned to the first sensor group based**, at least in part, **on a result of the classification by the classifier assigned to the second sensor group**.	**A. US10145707** "3. The method of claim 1, wherein detecting the location of the mobile device on the user's body comprises performing **a time-domain classification using classifiers of data collected from the one or more sensors**." *CSR Technology* at claim 3 "An algorithmic flowchart for an example embodiment of detecting PND location on the body of the user is shown in FIG. 5. **The user mode (walking, fast walking, jogging, or stationary) is the first decision** (block 502) **in this hierarchical context determination logic**. **If the user mode is walking or fast walking (FW), the orientation of device is used in next classification** (block 504). **When the device is oriented such that the direction perpendicular to plane of the device is parallel to walking direction of motion, then it is classified as orientation 0**. This orientation is most commonly found when device is carried in shirt pocket, at the waist, or trouser pocket, or in hand, or in a bag (block 506). **Orientation 1 is the case when the plane of the device is perpendicular to the walking direction of motion (most commonly found when the device is located close to head, but other possibilities include device in hand, or in trouser pocket, or in hand, or in a bag**, as shown in block 510). **Various time domain classifiers, such as, amplitude of pitch angle variation, number of zero crossings in norm of acceleration, number of peaks in acceleration data, and amplitude of yaw angle variation are utilized to determine the location of module on the body**. However, these classifiers are all non-limiting examples, and can be replaced by other types of classifiers, because the algorithm's basic nature is independent of the classifiers. Similarly, more than just two orientations can be accommodated in the algorithm." *CSR Technology* at col. 11:40-65

(cont.) 23.d. **adapting a configuration of the classifier assigned to the first sensor group based**, at least in part, **on a result of the classification by the classifier assigned to the second sensor group**.	**B. US8472986** "Context-enriched messaging application 108 can include sensor manager 204. **Sensor manager** 204 **can be arranged to manage sensor driver(s)** 120 **to control the operation of the sensors** 130 A-N and 132. Sensor manager 204 can modulate power allocation to sensors 130 A-N. **Sensor manager** 204 **can also provide sensor metrics (e.g. signal reception quality, sensor availability and the like) to context analyzer** 202. **If more than one utility is using a sensor, sensor manager** 204 **can modulate utility sensor usage**. For example, **sensor manager** 204 **can prioritize sensor usage for acquisition of context data for the context analyzer** 202 over an operation of another utility or application. **Sensor manager** 204 **can provide a register of stored context-data and metadata about the context-data (e.g. time stamp data, location of acquisition and the like)**. Sensor manager 204 can acquire certain pre-defined types of context data on a periodic basis and store the context data in context-data memory store 136." *Buckyball* at col. 11:41-57