

METHOD, SYSTEM AND DEVICE FOR PROCESSING ONE OR MORE SENSOR VALUES FROM A SET OF ONE OR MORE DISTRIBUTED SENSORS

FIELD OF THE INVENTION

[0001] The present invention relates generally to receiving activity data from plurality of smart wearable devices and more particularly, a method, system and device for processing one or more sensor values from a set of one or more distributed sensors.

RELATED ART

[0002] Wearables or wearable technology generally smart wearable devices are electronic devices which are worn by the people close to surface of their skin. These devices are activity trackers which monitor user's health, detect activity by means of one or more sensors, analyze and share activity data with the connected mobile device of the user. The smart wearable device collects user's health data or user activity data but not limited to step count, heart rate. The smart wearable device also monitors and identifies change in mood, fatigue, BP, athletic performance, sleep, location, direction etc. The smart wearable device employs one or more sensors to monitor user activities and health. However, activity data collected by sensors of the smart wearable device is not accurate due to inaccurate determination and computation of data. Sometimes, the user may receive inappropriate or redundant data while not even performing any activity and may receive an inaccurate notification regarding health status. Hence there is need to provide an accurate data to the user and may be achieved through the configuration of at least two smart wearable devices to monitor and collect the activity data.

[0003] From the point of accuracy of data, there is a need and requirement to effectively determine and compute the activity data of the user, for example, step count, health data, sleep data, heart rate etc. The following paragraphs provide a novel method, system and device for processing and determining the activity data from plurality of sensors configured in one or more smart wearable devices.

SUMMARY

[0004] In one aspect of the present invention, one or more plurality of smart wearable devices, sensor clusters are configured to monitor at least one activity related to the user. The activity may be at least one of walking, heart rate of user, etc. The activity data from one or more smart wearables are collected and a final step count data is determined based on minimum activity data, mean value of activity data and final step count data is displayed to the user. In another aspect of the present invention, In one aspect of the present invention, a method for processing activity data and determining step count data, by a mobile device comprising, receiving at least one activity data from the at least two of the smart wearable devices connected, analyzing and

checking activity data, finding a minimum activity data amongst the at least two of the smart wearable devices, by comparing the at least two activity data with one another, when the received activity data is not equal in at least two of the smart wearable devices and displaying the final activity data to the user on the display. In an embodiment, the at least two of the smart wearable devices are worn by the user, in left and right hand respectively. In another embodiment, the final activity data is one of user's final step count, stroke count, skipping count, and direction route information from start to destination location.

BRIEF DESCRIPTION OF DRAWINGS

[0005] FIG.1A illustrates the first example system 100 of distributed smart wearable devices.

[0006] FIG. 1B illustrates the second example system 140 comprising a plurality of one or more sensor clusters, having distributed sensors configured therein.

[0007] FIG. 2 illustrates the example components of a smart wearable device 200.

[0008] FIG. 3 is a flowchart 300 illustrating the example configuration of smart wearable devices or sensor cluster distributed in an embodiment of the present invention.

[0009] FIG. 4 is a flowchart 400 illustrating an example processing of activity data and determination step count data.

[0010] FIG. 5 is a flowchart 500 illustrating a second example processing of activity data and determination step count data.

[0011] FIG. 6 is a flowchart 600 illustrating example method of determining the activity data and to find most used hand of the user.

[0012] FIG. 7 is a flowchart 700 illustrating a third example processing of activity data and determination step count data.

DETAILED DESCRIPTION

[0013] FIG.1A illustrates the first example system 100 of distributed smart wearable devices. The system 100 comprising a plurality of smart wearable devices (for example, first smart wearable device 105 and second smart wearable device 110), a mobile device 115, an application server 120 and a database 125. The first and second smart wearable devices (105 and 110) are worn by (in the arms of) the user, and connected and paired with the user's mobile device 115, through a BLE or Bluetooth connection or any short-range communications (not shown). The mobile device 115 is configured with an application which is capable of performing one or more actions but not limited to, connection establishment, transfer of data from smart wearable devices (105 and 110), sharing the activity data to the application server 120, display of data from the one or more smart wearable devices (105 and 110) etc. The mobile device 115 is connected to the application server 120 by means of long-range communications.

The application server 120 may process user data, user activity data, and stores them in the database 125, connected therein. Each smart wearable device includes at least have one sensor, but not limited to accelerometer, gyroscope, magnetometer, position sensor, inertial navigation sensors, Heart rate monitoring (HRM), blood pressure sensors, blood sugar sensors or glucometer, ECG sensor, Oximeters, EMG sensor, pressure sensors, body temperature sensor, pedometer sensor, camera (to capture gestures), light sensors, pedometer a GPS module, or combination of one or more sensors thereof.

[0014] The user wears two smart wearable devices (105 and 110), a first smart wearable device 105 on left hand and second smart wearable device 110 on right hand, respectively. Plurality of smart wearable devices ('n') may be used by the user and configured with the user's mobile device 115 and mobile application. A single mobile application is capable of receiving all data from all smart wearable devices configured therein. Here, an example is shown with two smart wearable devices (105 and 110) to describe the operation, and operation is applicable for 'n' number of smart wearable devices (105 and 110) connected and distributed in the system. In another embodiment, the smart wearable devices are configured with at least one sensor, specifically capable of monitoring at least one user activity (for example, walking, jogging or running). The smart wearable devices (105 and 110) are connected and paired with the mobile device 120 of the user, and may be capable of directly transmitting data to the application server 120, without a mobile device 115, where the smart wearable devices (105 and 110) are configured with communication modules and support long range communications. The settings/configurations of sensors employed in the smart wearable devices (105 and 110) may be configured and monitored through the mobile application of the subject user's mobile device 115. The configuration of sensors may include one step of, adjusting or modification of all sensor device parameters and sending sensor device configuration details to respective sensors of the at least one of subject smart wearable devices. Each sensor may provide a raw data, and may have name, threshold value, and energy value. The application server 120 may send actual sensor setting/configuration information to be configured in smart wearable devices, time to time, to the mobile application, whenever updated. In an embodiment, the application server 120 is a standalone server or a network server or plurality of connected and networked servers which are capable, and effectively communicating (receiving and transmitting data) to the large set of mobile devices and smart wearable devices of the users.

[0015] In another embodiment, the application server process, analyze, sort, group, compare, and transmit the processed activity data to one or more smart wearable devices and a mobile device, when smart wearable devices are directly connected with the application server. Each

smart wearable device is configured with one or more algorithms to effectively process, extract and filter the sensor data, which is further converted to a format of activity data, depending on their sensor's nature and capabilities. The application server 120 is connected with a database 125, which may suitably store the processed sensor data/value/information, by means of indexing. Additionally, the database 125 stores the details user such as profile data, device configuration data (mobile application configuration data and one or more smart wearable device configuration data, device parameters), etc.

[0016] The two of smart wearable devices are configured with at least one sensor, capable of identifying at least one user activity from the plurality of user activities and able to record the activity. In one example, the user performs the activity of 'walking', the smart wearable devices which is worn by the user in both hands, identify the activity and records the steps covered by the user during walking activity and total step count recorded in each of the smart wearable device are transmitted to the mobile device for further processing of step count accuracy determination.

[0017] In an embodiment, the step count from first smart wearable device worn in left hand is equal to the sensor data from the second smart wearable device. Then, the mobile device which receives both activity data (for example, steps recorded by the device through accelerometer or pedometer sensor) from two smart wearable devices is capable of displaying the at least one sensor data, when both data are equal.

[0018] When the step count received from two smart wearable devices are unequal or mismatch, the mobile device employs one or more algorithms, statistical calculations or machine learning algorithms or methods to accurately determine step count data of the user, based on historical data of the user, type of activity, duration of activity, location of activity performed (such as terrain), inclination, distance covered, calories burnt, finding smart wearable device having minimum or maximum data, identifying arm/hand of the user performing more activity, segregating the activity data of both smart wearable devices in to hour wise activity data. The accurate activity data is determined and displayed on the mobile device and updated in both of the smart wearable devices and may also be shown on their displays. The final step count data is determined based on comparison of activity data received from both devices and finding the minimum step count, maximum step count for the activities performed by the user for the whole day. In one embodiment, the step count received from first wearable device (worn in left hand) is minimum, whereas, the step count received from the second smart wearable device (worn in right hand) is maximum for the entire day. Then, the final step count data is minimum step count data received, because it may be the actual data

achieved (actually walked) by the user, whereas the second smart wearable device having comparatively higher step count data may be due to frequent use or movement of right hand by the user, for example, performing activities such as writing, mannerism of moving right hand while talking (when sitting), typing etc.

[0019] In another embodiment, when minimum and maximum step count data is identified, a mean value between the step count data is determined, which becomes the final step count. In yet another embodiment, when minimum and maximum step count data is identified, an average value between the step count data is calculated, which becomes the final step count. In yet another embodiment, final step count data is determined by employing one or more statistical algorithms, or methods or machine learning algorithms or wherein variance and standard deviation are derived for the hour wise step count data and thereby analyzing a step count data for all hours for the entire day, omitting irrelevant hourly step count data and combining valid step count data.

[0020] FIG. 1B illustrates the second example system 140 comprising a plurality of one or more sensor clusters, having distributed sensors configured therein. As shown there, the system 140 comprising a plurality of sensor clusters not limited to cluster 1 (150), cluster 2 (155), cluster 3 (160) and cluster 4 (165), a mobile device 115, an application server 120 and a database 125.

[0021] In an embodiment, the one or more sensor clusters comprise at least one sensor or similar set of same or different sensors which are placed, configured, worn, patterned, arranged, framed, assembled in one or parts or places of human body either internal or external, configured to monitor one or more activities of body, body parts, hands, and sense one or more health parameters (for example, heart rate, fatigue), gait, one or more gestures, one or more user actions or any other parameter related to the body or activity of the user. In another embodiment, the one or more sensor clusters may be placed on any dress, cloth, costumes, apparels, gloves, shoes, or any bodily material. In yet another embodiment, the one or more sensor clusters comprise plurality of different sensors that are configured and capable of sensing and monitoring at least one activity or plurality of activities, one or more body health parameters (for example, heart rate, fatigue), gait, one or more gestures, or any other parameter related to the body of the user.

[0022] In one aspect of the present invention, the sensor values from at least one cluster may be combined together to determine the accurate activity data relating to the at least one activity, health parameter, gait and gesture. In an embodiment, the determination of accurate activity data related to at least one user activity is achieved by taking minimum activity data received

amongst plurality of smart wearable devices, mean or averaging the activity data received from one or more similar set of sensors or sensor clusters of plurality of smart wearable devices. In another embodiment, the sensor data received from one or more sensor clusters may be used to determine the accuracy of other set of sensor clusters whose categories are same, similar, identical or different. In one example, sensors are placed in 2 hands and 2 legs forming 4 cluster of sensors. Each sensor cluster may have at least one or more sensor to capture any activity of the user. In this example, accelerometer sensor is configured in all of 4 sensor cluster. When user performs a walking activity, the sensor data is primarily captured from the 2 of the sensor cluster placed in both legs, however, the sensor data from 2 of the sensor cluster placed in both hands, helps to determine the user's activity that he is actually 'walking' or making a 'walking action' (swinging both legs, when sitting). If the user is actually walking, then data from all 4 sensor clusters (both legs and hands) are considered, compared and appropriately normalized by employing one or more algorithms or averaged to determine accurate steps (based on the total duration) walked by the user. If the user is not walking, when the sensor data from all 4 sensor clusters are processed, the data (for example, step count data, duration of activity) from hands may not appropriately match with the data from legs since the user is idle and not walking, thereby also determining the current state of the user (idle, active, sedentary etc).

[0023] In an embodiment, a framework for each activity is defined, designed and configured. Each sensor or sensor cluster or smart wearable device may have a weightage value (or weightage score) based on their position, location or distribution, collective operation in the body. In an embodiment, the weightage for each sensor or sensor cluster or smart wearable device may differ based on its importance level, degree of use. In an embodiment, the weightage may be configured by user in the mobile device or determined based on the user's preferences, or configured by the application server itself. In another embodiment, the weightage configuration is device specific, activity specific, environment specific or context specific. In an embodiment, the weightage value is a primary parameter in determination of accurate activity data from plurality of sensors, sensor clusters or smart wearable devices. In another embodiment, during processing and combining each sensor data or activity data, the weightage of each and every sensor is considered. In an embodiment, the sensor cluster may have a separate weightage value depending on their operation, position, location, and importance level. The importance level is either set by the user or automatically set by the application server based on the user's current, past preference, or user's community preference (for example, sports community), or any social preference or environmental preference, or health preference. In an embodiment, each of smart wearable device or sensor cluster or sensor

module may have but not limited to an accelerometer, gyroscope, magnetometer, position sensor, inertial navigation sensors, Heart rate monitoring (HRM), blood pressure sensors, blood sugar sensors or glucometer, ECG sensor, Oximeters, EMG sensor, pressure sensors, body temperature sensor, pedometer sensor, camera (to capture gestures), light sensors, pedometer a GPS module, or combination of one or more sensors thereof.

[0024] FIG. 2 illustrates the example components of a smart wearable device 200. The components of smart wearable device 200 include, a controller 210, a communication module 220, a power supply unit 230, a I/O unit 240 and sensor modules 250 (plurality of sensors).

[0025] In an embodiment, the sensor modules 250 may comprise at least one of, a heart monitoring sensor, a GPS module, a pedometer, an accelerometer, a gyroscope and a magnetometer. The heart monitoring sensor determine the heart rate of the user. The accelerometer and gyroscope determine the position and orientation of the smart wearable device, respectively. The magnetometer is used to determine the direction of a position/location. The smart wearable device 200 is further configured with a built-in GPS system. The GPS may determine the current location of the smart wearable device (user). A pedometer sensor is used to count the steps of the user.

[0026] The communication module 220 may connect to, but not limited to, plurality of mobile devices, application server, and other smart devices. In an embodiment, communication module 220 is also configured to receive data from one or more sensors or sensor clusters. The controller 210 is capable of analyzing the data from communication module 220, I/O unit 240 and sensor modules 250 and determining the suitable output. The communication module 220 sends collected sensor data to the mobile device.

[0027] The mobile device is configured with a mobile application which is capable of receiving the values from one or more smart wearable devices, sensor modules or one or more individually connected sensors or sensor clusters in real-time. In another embodiment, the mobile application is further configured to share the corresponding sensor values received from one or more smart wearable devices, sensor modules or one or more individually connected sensors or sensor clusters with the application server and database in real-time.

[0028] In an embodiment, the sensor module of smart wearable device may further comprise, accelerometer or pedometer, position sensor, inertial navigation sensors, Heart rate monitoring (HRM), blood pressure sensors, blood sugar sensors or glucometer, ECG sensor, Oximeters, EMG sensor, pressure sensors, body temperature sensor, camera (to capture gestures), light sensors. The power supply unit is capable of supplying adequate power to all components of smart wearable device.

[0029] In one example, activity data is both step count data and direction of travel, wherein the user travels from source to destination location in a direction. The user wears both smart wearable devices in left and right hands. The smart wearable device is capable of identifying the real-time location of the user through one or more sensors (GPS, magnetometer). In an embodiment, subject real-time location data is being recorded by the mobile device. Further, the mobile application supplies the route information (from source to destination) to the two smart wearable devices. In another embodiment, at least one of smart wearable is capable of making at least one notification to the user, in any one of the smart wearable devices, when there is a deviation/turn/road change/diagonal road in the route. The notification may be one of but not limited to, buzzing, color change or indication etc. Through this, the user need not have to take his mobile device to check the route while navigating, the smart wearables on the hands alone can navigate the user to the destination. In one example, whenever the user wants to make a left turn, the left-hand smart wearable device may glow in red color (at regular intervals) or buzz for a while until, the user takes the left turn. In the similar fashion, one or more navigational notifications are delivered to the smart wearable devices from the mobile device. In an embodiment, the user can configure the type of notification (for example, buzzing, or color change) to be notified. The step counts recorded in both smart wearable devices are retrieved and analyzed to determine accurate number of steps actually covered (by means of walking or running) by the user.

[0030] In an embodiment, two smart wearable devices are worn by the first user, in both hands. The two smart wearable devices are configured to monitor and collect sensor data relating to at least one activity of the user. The activity of user or sensing of sensor includes, but not limited to, walking, running, jogging, swimming, climbing steps, performing yoga or other physical exercise, determining the direction of travel, assistance in navigation, health parameters of body, gait, gestures, environmental conditions etc.

[0031] In one aspect of the invention, the accelerometer which is configured in the smart wearable devices are capable of providing the values (for example, x, y and z axis values) of every action, or activity performed by the user. In an embodiment, these values are obtained in every equal interval from one or more smart wearable devices to determine the accuracy of data with respect to one or more activities of the user. Since, the accelerometers are used to capture any motion in the wearables, the sensor module and controller receives all accelerometer sensor values. The controller determines the step count from raw accelerometer data. The action of swinging hands during walking (as an example activity) made by the user

is observed, recorded by the accelerometer values and these values are analyzed for a particular pattern of user action.

[0032] The values of accelerometer may be same (at that particular time instant), but may be opposite in direction (hence, may have a negative value). Further, controller uses gyroscope values to determine the actual angle alignment between one or more smart wearable devices. Following are example accelerometer axis values (x, y and z axis components), Ax of first and second smart wearable device is 1.5 and 1.2 respectively, Ay of first and second smart wearable device is 9.8 and 10.1 respectively, Az of first and second smart wearable device is 8.0 and 8.2 respectively.

[0033] FIG. 3 is a flowchart 300 illustrating the example configuration of smart wearable devices or sensor cluster distributed in an embodiment of the present invention. In step 310, the smart wearable devices connect with the mobile devices. The mobile device scans the surrounding location for the all-smart wearable devices. The user on the mobile device (in the mobile application) displays the list of all smart wearable devices in the vicinity and user select the two smart wearable devices which are worn by him in both right and left hands.

[0034] In step 320, the mobile device receives a first set of information from the at least two smart wearable devices worn by the user. The first set of information may contain, device parameters (list of sensors and corresponding operating and threshold values for one or more sensors), device information (smart wearable MAC ID or unique ID, device name, type of wearable device, power/energy details, type of communication modules configured within) etc. In an embodiment, the first set of information also include, connection/disconnection request, pairing request etc. The smart wearable devices may also pair with the mobile device to share the activity data.

[0035] In step 330, the mobile device segregates the connected smart wearable devices based on device information. In an embodiment, the mobile device makes a list of known, connected and paired smart wearable devices. For example, the user may connect to two smart wearable devices at a time wherein, one is a smart watch and another is an activity tracker, or both of them are smart watches, or both of them are activity trackers. The device type of each of smart wearable devices (2 devices) are always recorded by the mobile device.

[0036] In step 340, the mobile device validates the device information and device parameters. The mobile application of mobile devices checks for the all-available sensors in each of the two smart wearable devices connected. The mobile application ensures operation of those sensors, with its initial settings under device parameters. In step 350, the mobile device configures device parameters of the at least two smart wearable devices. The smart wearable

devices monitor at least one activity of the user, wherein each of the smart wearable device is set with device configuration details includes one of a sensor name and its threshold value. In an embodiment, the mobile device may share the configuration parameters to the connected smart wearable devices (in this case, the configuration info is shared with two smart wearable devices).

[0037] In step 360, the subject smart wearable devices receive or the mobile device send the device configuration details to the corresponding smart wearable devices connected with the mobile device and device configuration details may comprise one or more rules/procedures/instructions to be followed by the smart wearable devices while monitoring the at least one activity of the user. In an embodiment, the configuration parameters may vary for every activity. The instructions may involve, the type of sensor to be active during the activity, its threshold value, optimal value, notification details etc. In another embodiment, the mobile application is capable of choosing relevant sensors for the activities. In another embodiment, the database may maintain a separate configuration table for each activity. The configuration table may contain, sensor list, values, sensors which are relevant for an activity, duration of activity, historical sensor data for a period, etc. setting the device configuration details for at least one of sensors configured

[0038] In step 370, the subject smart wearable devices set their device configuration details for at least one of sensors configured therein. The device configuration details may also contain details such as operation time of sensors, threshold values of sensors etc. In an embodiment, the device configuration details are set only when a new connection or pairing of smart wearable device with the mobile device, for a first time. In step 380, the subject smart wearable devices may initiate the monitoring and recording the activity of the user as per the rules/procedures/instructions in device configuration details shared by the mobile device. The smart wearable devices monitor the activity throughout the day. The activities include but not limited to walking, jogging, running, swimming and paying. In an embodiment, before starting a new session, each of the smart wearable devices may store step counts so far (for example, data collected for previous activity). In another embodiment, the smart wearable device may time to time share the activity details and associated sensor reading values to the mobile device, whenever both arrive in a communicative range. In yet another embodiment, the smart wearable device may tune or reset the sensor readings (activity data) to deliberately determine the actual step count for an activity (for example, 'running activity'). The smart wearable devices share the activity data (for example, pedometer values for the activity 'running') with the mobile device. In an embodiment, the subject mobile device sends the activity data

(collected from the sensors of two smart wearable devices) to the application server for further processing. In another embodiment, the activity data is processed in the mobile device itself, by one or more algorithms to determine actual step count data. The example user activity may be one of, walking, running, jogging, swimming, navigation, making a payment (paying), presenting, making one or more gestures formulates to a logical action, etc.

[0039] FIG. 4 is a flowchart 400 illustrating an example processing of activity data and determination step count data. In an embodiment, the sensor data is either processed by the mobile application in a mobile device or an application server. The user wears both smart wearable devices in both hands/arms, or plurality of wearable devices on the body or body parts. In step 410, the mobile device receives at least one activity data from all smart wearable devices, for at least one activity of the user, for whole day. In an embodiment, the mobile device receives at least two activity data from two smart wearable devices for at least one activity of the user, performed for the whole day (24 hours). In an embodiment, the mobile application of mobile device may receive the activity data for each of the completed session of activity. Both smart wearable devices receives and records raw sensor data (accelerometer or pedometer sensor readings) and converts raw data to an activity data by means employing one or more algorithms and feature extraction techniques.

[0040] In step 420, the mobile device analyzes and compare the activity data received from all smart wearable devices. In an embodiment, mobile device analyzes and compare the activity data received from at least two smart wearable devices. Each of the two smart wearable devices share the activity data to the mobile device, including total activity data and hourly activity data (step count recorded in each hour). The mobile device may analyze both activity data and compare the activity data. In an embodiment, the mobile device may compare the hour wise activity data of two smart wearable devices. The activity data may also be shared hour wise, where the variation in activity data (step count data) with respect to both smart wearable devices are also observed and identified. In an embodiment, the mobile device may compare the hour wise activity data of two smart wearable devices. For example, when the user is walking, between 8:00 am to 9am, the activity data from first and second smart wearable devices with respect to that duration may be 500 and 600 steps respectively. In the similar fashion, the activity data with respect to all hours (24 hours) and variation of activity data is identified and over a period of time may able to determine whether any smart wearable device is undercounting or over counting or normally counting actual values.

[0041] In step 430, the mobile device (through the mobile application) checks whether the activity data (for example, step count) from all smart wearable devices are equal to one another,

if activity data are equal, then the control is transferred to step 440, otherwise, the control is transferred to step 460. In an embodiment, the mobile device checks whether the activity data (for example, step count) from at least two smart wearable devices are equal. In an embodiment, the mobile device simultaneously verify weightage for each sensor data received from smart wearable devices.

[0042] In step 440, the mobile device selects activity data from at least one smart wearable device among the plurality of smart wearable devices. In an embodiment, the mobile device selects activity data from at least one smart wearable devices among two smart wearable devices. The mobile device randomly chooses the activity data (step count) from one of the smart wearable devices. any one and combines subject activity data, when the sensor data is equal. The mobile device may also choose based on the weightage of smart wearable device. The weightage either assigned by the user or automatically set by the system based on the accuracy of sensors configured in the smart wearable devices. However, this weightage is always increasing and improving. For example, if the weightage of two smart wearable device is 1 and 2. The mobile device chooses the smart wearable device having weightage value 2. The mobile device may also combine and group the sensors based on their weightage and combine the activity data.

[0043] In step 450, the mobile device displays the activity data (final step count data), to the user, placed on the screen of the mobile device. In an embodiment, this final step count data is shared with both smart wearable devices and are displayed on their display.

[0044] In step 460, the mobile device finds the minimum activity data amongst all smart wearable devices, when the activity data (step count data) received from all smart wearable devices are different and not equal. In an embodiment, mobile device finds the minimum activity data amongst two smart wearable devices, when the activity data (step count data) received from two smart wearable devices are different and not equal. For example, the activity data (step count data) received for entire 1 day (24 hours) in first smart wearable device (worn in left hand of user) is 2000 steps and the activity data received in second smart wearable device (worn in right hand of user) is 2400 steps, then the minimum value among the two activity data received, is determined and selected as final step count data (i.e 2000 steps is selected), since it is the actual data achieved (actually walked) by the user, whereas the second smart wearable device having comparatively higher step count data (maximum value) may be due to frequent use or movement of right hand by the user, for example, performing activities such as writing, mannerism of moving right hand while talking (when sitting), typing etc. In an embodiment, the selected and determined activity data is the final activity data.

[0045] In another aspect, the maximum activity data (maximum value) amongst all smart wearable devices is considered, which may be case when all other smart wearable devices are observed as undercounting or not counted during any instance in the whole day. For example, the activity data of first and second smart wearable devices are 2000 and 2400 steps respectively, then the maximum activity data i.e 2400 steps is selected as final step count value.

[0046] In step 470, the mobile device displays the final activity data, to the user, placed on the screen of the mobile device. In an embodiment, the final activity data is the final step count data. The final activity data In an embodiment, this final step count data is shared with all smart wearable devices and are displayed on their display. The final step count data is displayed on the display of both smart wearable devices. In an embodiment, the activity data of first smart wearable device is shared with the second wearable device so as to improvise the accuracy factor of second smart wearable device and vice versa happens when activity data of second smart wearable device is minimum and selected as a final step count data.

[0047] FIG. 5 is a flowchart 500 illustrating a second example processing of activity data and determination step count data. In an embodiment, the sensor data is either processed by the mobile application in a mobile device or an application server. The user wears both smart wearable devices in both hands/arms, or plurality of wearable devices on the body or body parts. In step 510, the mobile device receives at least one activity data from all smart wearable devices, for at least one activity of the user, for whole day. In an embodiment, the mobile device receives at least two activity data from two smart wearable devices for at least one activity of the user, performed for the whole day (24 hours). In an embodiment, the mobile application of mobile device may receive the activity data for each of the completed session of activity. Both smart wearable devices receives and records raw sensor data (accelerometer or pedometer sensor readings) and converts raw data to an activity data by means employing one or more algorithms and feature extraction techniques.

[0048] In step 520, the mobile device analyzes and compare the activity data received from all smart wearable devices. In an embodiment, mobile device analyzes and compare the activity data received from at least two smart wearable devices. Each of the two smart wearable devices share the activity data to the mobile device, including total activity data and hourly activity data (step count recorded in each hour). The mobile device may analyze both activity data and compare the activity data. In an embodiment, the mobile device may compare the hour wise activity data of two smart wearable devices. In step 530, the mobile device (through the mobile application) checks whether the activity data (for example, step count) from all smart wearable devices are equal to one another, if activity data are equal, then the control is transferred to step

540, otherwise, the control is transferred to step 560. In an embodiment, the mobile device checks whether the activity data (for example, step count) from at least two smart wearable devices are equal. In an embodiment, the mobile device simultaneously verify weightage for each sensor data received from smart wearable devices.

[0049] In step 540, the mobile device selects activity data from at least one smart wearable device among the plurality of smart wearable devices. In an embodiment, the mobile device selects activity data from at least one smart wearable devices among two smart wearable devices. The mobile device randomly chooses the activity data (step count) from one of the smart wearable devices. any one and combines subject activity data, when the sensor data is equal. The mobile device may also choose based on the weightage of smart wearable device. The weightage either assigned by the user or automatically set by the system based on the accuracy of sensors configured in the smart wearable devices. However, this weightage is always increasing and improving. For example, if the weightage of two smart wearable device is 1 and 2. The mobile device chooses the smart wearable device having weightage value 2. The mobile device may also combine and group the sensors based on their weightage and combine the activity data.

[0050] In step 550, the mobile device displays the activity data (final step count data), to the user, placed on the screen of the mobile device. In an embodiment, this final step count data is shared with both smart wearable devices and are displayed on their display.

[0051] In step 560, the mobile device finds the mean or average of activity data amongst all smart wearable devices, when the activity data (step count data) received from all smart wearable devices are different and not equal. In an embodiment, mobile device finds the mean value of activity data amongst all smart wearable devices, for example, mean value of activity data between two smart wearable device is determined. The mobile device may also receive the hourly activity data (step count data) from each of the smart wearable devices. For example, the activity data (step count data) received for entire 1 day (24 hours) in first smart wearable device (worn in left hand of user) is 3000 steps and the activity data received in second smart wearable device (worn in right hand of user) is 3500 steps, then the mean value (or an average value) among the two activity data received is determined and selected as a final step count data (mean or average value of 3000 and 3500 steps is $3000+3500/2=3250$ steps), since this may be the steps which may actually walked by the user and when the first smart wearable device undercounts or does not count in particular activity duration, when the hourly data was analyzed. In an embodiment, the selected and determined activity data is the final activity data.

[0052] In step 570, the mobile device displays the computed final activity data, to the user, placed on the screen of the mobile device. In an embodiment, the final activity data is the final step count data. In an embodiment, this computed final step count data is shared with all smart wearable devices and are displayed on their display. The computed final step count data is displayed on the display of both smart wearable devices.

[0053] In one aspect of the invention, the final step count data which is determined by the mobile device which employs one or more algorithms not limited to, mean, average, median or statistical calculation algorithms, standard deviation, variance methods, or one or more machine learning algorithms to process, compute, calculate, determine the accurate final activity data. In another embodiment, the weightage value of each and every wearable device or sensor, or sensor cluster are considered in an instance or plurality of instances while processing, computing, calculating and determining the accurate final activity data, relating to at least one activity or action performed by the user or any health-related activity, for a day. In an embodiment, the activity data is shared as a notification to the mobile device or the smart wearable devices by means of buzz, vibration.

[0054] FIG. 6 is a flowchart 600 illustrating example method of determining the activity data and to find most used hand of the user. The user wears both smart wearable devices in both hands/arms, or plurality of wearable devices on the body or body parts. As shown there, in step 610, the mobile device receives at least one activity data from all smart wearable devices, for at least one activity of the user, for whole day. In an embodiment, the mobile device receives at least two activity data (step count) from two smart wearable devices (worn in both hands) for at least one activity of the user, performed for the whole day (24 hours). In an embodiment, the mobile application of mobile device may receive the activity data for each of the completed session of activity. Both smart wearable devices receives and records raw sensor data (accelerometer or pedometer sensor readings) and converts raw data to an activity data by means employing one or more algorithms and feature extraction techniques.

[0055] In step 620, the mobile device analyzes and compare the activity data received from all smart wearable devices. In an embodiment, mobile device analyzes and compare the activity data received from at least two smart wearable devices. Each of the two smart wearable devices share the activity data to the mobile device, including total activity data and hourly activity data (step count recorded in each hour). The mobile device may analyze and compare both activity data (as a whole day or hour wise data).

[0056] In step 630, the mobile device finds the at least one smart wearable device having high or maximum activity data. In an embodiment, the mobile device receives activity data from the

at least two smart wearable devices and is capable of determining the maximum activity data recorded by a smart wearable device among all, by means of comparing the activity data. In step 640, the mobile device identifies arm/hand of the user performing more activity. In an embodiment, when the smart wearable device is recorded with maximum of high values, either it is overcounting or the respective hand in which subject smart wearable device is being used or operated or moved frequently irrespective of the using other hand, for example, performing activities such as writing in right hand, mannerism of moving right hand while talking (when sitting), typing in right hand etc. The mobile device finds whether it is a left or right arm of the user which is being frequently moved. In an embodiment, an improvement or modification in step count algorithm relating to the subject wearable device is made in order to minimize excess counting of steps of the user, when the user idle.

[0057] FIG. 7 is a flowchart 700 illustrating a third example processing of activity data and determination step count data. In an embodiment, the sensor data is either processed by the mobile application in a mobile device or an application server. The user wears both smart wearable devices in both hands/arms, or plurality of wearable devices on the body or body parts. In step 710, the mobile device receives at least one activity data from all smart wearable devices, for at least one activity of the user, for whole day. In an embodiment, the mobile device receives at least two activity data from two smart wearable devices for at least one activity of the user, performed for the whole day (24 hours). In an embodiment, the mobile application of mobile device may receive the activity data for each of the completed session of activity. Both smart wearable devices receives and records raw sensor data (accelerometer or pedometer sensor readings) and converts raw data to an activity data by means employing one or more algorithms and feature extraction techniques. In step 720, the mobile device analyzes and segregate the activity data into hour wise data. In an embodiment, the mobile device may also receive hour wise activity data and full data activity data. In step 730, the mobile device compares the hour wise activity data of at least two or more smart wearable devices. For example, when the user is walking, between 4:00 pm to 5pm, the activity data from first and second smart wearable devices with respect to that subject duration may be 1200 and 1300 steps respectively. Similarly, the activity data with respect to all hours (24 hours) and variation of activity data is identified.

[0058] In step 740, the mobile device finds common hours having equal or gradual increase or gradual decrease in activity data of at least two or more smart wearable devices. For example, in a whole day activity data received from two smart wearable devices, between 6:00am to 12:00pm, data with respect to each hour is compared, activity data from 07:00 to 08:00 am and

10:00 am to 11:00pm is recorded 350 steps in both smart wearable devices. In another example, the activity data from 06:00am to 07:00 is 150 steps in both smart wearable devices. Now, there is a gradual increase in activity data from 06:00am to 07:00 TO 07:00 am to 08:00am data. Whereas, the activity data from 11:00am to 12:00pm is 250 steps and 300 steps respectively as recorded by first (left hand) and second (right hand) smart wearable devices. In step 750, the mobile device selects only activity data from subject common hours having equal data. In an embodiment, the mobile device identifies common hours where the activity data is equal or nearly equal and omit all other hours having received irrelevant or redundant activity data. In step 760, the mobile device performs at least one of activity data calculation for the common hours of activity data received from both the smart wearable device, to find a final step count data for the day (24 hours). The activity data calculation involves at least one of minimum value, maximum value, mean or average, median, any statistical calculations, one or more machine learning algorithms to determine final step count data. In step 770, the mobile device displays the computed activity data (final step count data), to the user, placed on the screen of the mobile device. In an embodiment, this computed final step count data is shared with all smart wearable devices and are displayed on their display. The computed final step count data is displayed on the display of both smart wearable devices.

[0059] In another aspect of the present invention, the distributed sensor system, or sensor cluster, or plurality of smart wearable devices is configured either internal or external to the body of the user. Sensors configured internal to the body may be used to monitor the activity of any organ, tissue, function of any organ, parts, and also capable of supplying necessary medication to subject organ. Following are few examples, where distributed sensor system, or sensor cluster, or plurality of smart wearable devices may be configured.

[0060] Gesture based actions – for activating or controlling one or more IoT components, in office or home. Detection and determination of balance of body (actions performed by left and right hand altogether or sensor clusters through the body). The right side of brain controls left side part of body and left side of brain controls right side part of the body. The use of left and right hands shall be monitored by the smart wearable device. Such data is further analyzed to determine the pattern and practice of left and right brain. Physiological parameters and health of the user can be precisely found. Load sharing between the smart wearables devices, meaning one set of IoT components are connected to the smart wearable configured (worn) in the left hand and other set of IoT components are connected to the smart wearable configured (worn) in the right hand. Collecting context-based information, analyzing more about the environment of the user. One wearable may be monitoring the actions of the user and other wearable may

be monitoring the actions around and notifying the user. The user can also configure the context based on his need and requirement. Virtual gaming- Use of one or more smart wearables can bring more integration in gaming especially virtual gaming, where one or more user actions are simultaneously captured by two smart wearables or set of sensors and implemented to the system in real-time. Transfer and exchange of data – The data in one format (for example, in digital medium) can be moved to another digital medium, through one or more user gestures performed by user through two smart wearables at a time (which are interconnected in a manner). Creating a digital slate – through two smart wearables (projecting a digital content) between hands (when hands placed in a manner or through a gesture). Authorization of one more action of user – Digital signatures (digital authentication through encrypted certificate, digital signature of documents, verification of user, verification of health-related parameters). Digital health card – where user is provided with current health status, activity parameters, vaccinations records. Digital wallet, where digital passport, visa, authorizations are kept. Recording the user activity through Gait analysis (way of swinging the hands)-Authentication mechanism based on gait. Projection of image – while the users are on the call or performing any activity.

CLAIMS

We Claim,

- 1) A method for processing activity data and determining a step count data, the method comprising:
 - receiving, by the mobile device, at least one activity data from at least two of the smart wearable devices connected within, wherein, the smart wearable devices are worn by the user in left and right hand respectively;
 - analyzing and comparing, by the mobile device, the activity data received from plurality of smart wearable devices;
 - checking, by the mobile device, the received activity data is equal in at least two of the smart wearable devices, wherein, the mobile device evaluates each activity data received from the at least two of the smart wearable devices with one another;
 - selecting, by the mobile device, the activity data of at least one smart wearable device, wherein, when each activity data received from plurality of smart wearable devices are equal, wherein, the selected activity data is the final activity data; and
 - displaying and notifying, by the mobile device, the final activity data to the user, on the display.
- 2) The method of claim 1, further comprising:
 - finding, by the mobile device, a minimum activity data amongst the at least two of the smart wearable devices, by means of comparing the at least two activity data with one another, wherein when the received activity data is not equal in at least two of the smart wearable devices, and the selection and determination of final activity data;
- 3) The method of claim 1, further comprising:
 - finding, by the mobile device, final activity data through at least through one form of determining: a mean value of activity data, an average value of activity data, and a maximum value of activity data, amongst the at least two of the smart wearable devices, by means of comparing the at least two activity data with one another, wherein when the received activity data is not equal in at least two of the smart wearable devices;
- 4) The method of claim 1, wherein, final activity data is at least one of final step count data of the user, stroke count of the user, skipping count of the user, providing a direction route information to a user from start to destination location.
- 5) The method of claim 1, wherein, the at least one of smart wearable device notify the activity data to the user, by means of vibration, voice command, buzz, visual display, change of color on the display.

- 6) A method of configuring plurality of smart wearable devices distributed over a communication network, by a mobile device comprising:
- connecting the at least two smart wearable devices with the mobile device;
 - receiving a first set of information from at least two smart wearable devices, wherein the first set of information comprises device information and device parameters;
 - segregate the smart wearable devices, based on their device information, wherein, the device information comprises at least one of device name, device type;
 - validating the device information and device parameters, wherein, the device parameters of each of the smart wearable device consists of list of sensors with corresponding operating and threshold values of one or more sensors;
 - configuring the device parameters of the at least two smart wearable devices connected with the mobile device, to monitor at least one activity of the user, wherein each of the smart wearable device is set with device configuration details includes one of a sensor name and its threshold value;
 - sending device configuration details to the corresponding smart wearable devices connected with the mobile device;
 - setting the device configuration details for at least one of sensors configured in plurality smart wearable devices; and
 - monitoring an activity of the user, wherein activity is at least one of, walking, jogging, running, swimming, and paying.
- 7) The method of claim 5, wherein, device information is at least one of unique ID, energy and type of communication modules configured therein in a smart wearable device.
- 8) A system for processing activity data comprising:
- a first and second smart wearable device, worn by a user, capable of monitoring at least one activity of the user, wherein a first and second activity data is generated by the first and second smart wearable device for performing the first activity, by the user; and
 - a mobile device capable of receiving at least one activity data from the at least two smart wearable devices, for at least one activity of the user, wherein, the subject activity is an ongoing or a completed activity;
 - a mobile application configured in the mobile device and is capable of performing the steps of:

analyzing each of the activity data received from at least two smart wearable devices, for the first activity of the user, for the given time;

comparing the first and second activity data;

finding, a minimum activity data amongst the at least two of the smart wearable devices, by means of comparing the at least two activity data with one another, wherein when the activity data not equal received from at least two of the smart wearable devices; and

displaying the final activity data to the user, by means of mobile display, wherein the final activity data is final step count data of the user.

- 9) The system of claim 8, wherein, the mobile application is further capable of performing step of:

selecting, the activity data of at least one smart wearable device, wherein, when each activity data received from plurality of smart wearable devices are equal, wherein, the selected activity data is the final activity data;

- 10) The system of claim 8, wherein, the mobile application is further capable of performing step of:

finding final activity data through at least one manner of determining: a mean value of activity data, an average value of activity data, and a maximum value of activity data, amongst the at least two of the smart wearable devices, by means of comparing the at least two activity data with one another, wherein when the received activity data is not equal in at least two of the smart wearable devices;