

METHOD, SYSTEM AND DEVICE FOR SOCIAL DISTANCING AND CONTACT TRACING

FIELD OF THE INVENTION

[0001] The present invention relates generally to tracking devices and more particularly, a network of users relates for determining the proximity and history of proximity of one or more devices and thus one or more users.

BACKGROUND OF THE INVENTION

[0002] Generally, every mobile device has a built-in GPS circuitry which tracks the user and updates the location of the user to the application server, periodically. Currently, it is possible to track the location of a mobile phone using means like triangulation, Global Positioning System (GPS) co-ordinates and so on. In triangulation, the position of a mobile phone is tracked by measuring the strength of the signal received by the mobile phone from at least three mobile base stations. In GPS, the location of the mobile phone is tracked using co-ordinates in terms of longitude and latitude received from a plurality of medium earth orbit satellites. The co-ordinates of the mobile phone, obtained using triangulation or GPS may be sent to a distant location and used to track the location of the mobile phone. However, for the above methods to work, mobile phone should be turned on. Only if the mobile phone is turned on, the GPS module present in the mobile phone work, and the mobile phone will be able to transmit its co-ordinates to a distant location. When location tracking is disabled or any location update is turned off due to accident, man-handling, crushing and other means, such user cannot be tracked by any means and location of the user becomes unknown.

[0003] Social distancing is an infection prevention and control intervention implemented to avoid and to decrease contact and contact distance between people, so as to stop or slow down the rate and extent of disease transmission in a community. Social distancing leads to decrease in spread, morbidity and mortality due to the disease. The people who has infection must be traced effectively to avoid further spread of the infection in a community. However, the current contact tracing methods and devices are not effective when the infection becomes pandemic and people should be accurately monitored or should be knowing the persons who are infected with. The GPS requires at least mobile device with active internet connection to update and track the infected person, which becomes a tedious when the person switches off the internet or mobile data. In addition, GPS does not work effectively when you are indoor. Hence, there is a need and requirement to effectively tracking and tracing the infected person, and to provide a novel solution to maintain a distance when operating in an outside environment, without

using any GPS location tracking systems. The following paragraphs provide a novel solution to trace and track an infected person or persons and to effectively maintain the social distancing in a crowd source environment.

SUMMARY OF THE INVENTION

[0004] In one aspect of the present invention, a smart wearable device for alerting a user comprising, a set of sensors, a first communication module, a second communication module and an alert unit. The set of sensors are capable of monitoring one or more user activities of a user, and recording sensor values. The first communication module capable of communicating to a mobile device, wherein, the smart wearable device is paired with the mobile device through the first communication module and enters "non-discoverable" mode when connected with the mobile device. The second communication module capable of, searching and scanning the current location of user for one or more devices of other users in the range and identifying the distance between the smart wearable device and one or more nearby devices of other users through the corresponding received signal strength indicator (RSSI) values between them and wherein, the second communication module remain in 'discoverable mode' and the alert unit capable of alerting the user by means of vibration or voice output, when the distance between the smart wearable device and one or more devices of other users comes within a range of 5m.

BRIEF DESCRIPTION OF FIGURES

[0005] FIG. 1 is a block diagram of a system tracing and tracking the users of network through smart wearable devices in an embodiment of the present invention.

[0006] FIG. 2 is a block diagram illustrating the components of smart wearable device in an embodiment of the present invention.

[0007] FIG. 3A and 3B illustrates the example scanning operation through a smart wearable device.

[0008] FIG. 3C is a flowchart illustrating the steps of notifying and alerting the user, when the scanning operation is performed by a second BT module of the smart wearable device.

[0009] FIG. 4A and 4B illustrates the example scanning operation through a mobile device.

[0010] FIG. 4C is a flowchart illustrating the steps of notifying and alerting the user, when the scanning operation is performed by the mobile device.

[0011] FIG. 5A illustrates the example scanning operation through a mobile device, when a smart wearable device having only one BT module.

[0012] FIG. 5B is a flowchart illustrating the steps of notifying and alerting the user, when the scanning operation is performed by the mobile device, when the mode of first BT module of smart wearable device is toggled, in an embodiment of the present invention.

[0013] FIG. 6 is a flowchart illustrating the steps of notifying and alerting the user to maintain a safe distance in open environment.

[0014] FIG. 7 is a flowchart illustrating the steps of tracing and tracking a person through the smart wearable device.

[0015] FIG. 8 is an example illustration of smart wearable device configured with dual Bluetooth in an embodiment of the present invention.

[0016] FIG. 9 illustrates the example scanning of first smart wearable device in reference to the illustration shown in FIG. 8.

[0017] FIG. 10 illustrates an example scanning by a mobile device of first user, when a second BT module of smart wearable device is only discoverable.

[0018] FIG. 11 is an example illustration of smart wearable device configured with single BT module in an embodiment of the present invention.

DETAILED DESCRIPTION

[0019] FIG. 1 is a block diagram of a system 100 tracing and tracking the users of network through the smart wearable devices in an embodiment present invention. The system 100 is shown comprising smart wearable devices 110₁-110_n, mobile devices 120₁-120_n, a communication network 130, an application server 140, and database 150. Each element is described in further detail below.

[0020] The smart wearable devices 110₁-110_n (or a smart wearable) monitors and records one or more activities of the user, through one or more sensors, and also alerts the user to perform the activity. The alert may be one of a notification, vibration in the smart wearable devices, voice out, or providing a display in wearable device, wherein the user can able to see and get the alert message. The smart wearable devices 110₁-110_n consists of at least one or more communication modules, a battery unit, an alert unit, and at least one sensor, which includes but not limited to accelerometer, pedometer, gyroscope. The sensors are capable of recording the activities of the user and prepare set of sensor values for transmission along with the respective user's device details. The device data includes at least one of unique id which includes but not limited to, a device id or MAC id or SSID or identifier which particularly distinguishes subject smart wearable from other smart wearable devices in the networking environment. The smart wearable devices and mobile device are connected to a near field communication channels (not shown) such as Bluetooth, BLE or other short distance communication standards etc. This network also provides short distance communication channels to establish one-to-one, one-to-many and many-to-one connection between the smart wearable devices 110₁-110_n and the mobile devices 120₁-120_n. The mobile devices 120₁-120_n

connects to one or more smart wearable devices 110_1-110_n through this network. The smart wearable device 110_1-110_n may include, but not limited, to a smart watch, smart fitness bands (ex: activity trackers), smart wrist bands, smart shoes, smart glass, smart earphones/headphones, a smart sticker, smart clothing, smart body mounted devices (ex: implantables), smart jewellery (ex: rings, pins), devices having any form factor for monitoring and alerting user to name a few.

[0021] During the first time, when a person connects with the mobile device, and registers himself as a 'user' of a system by connecting to the application server and saves the personal data, device data in the database. In an embodiment, the first user's smart wearable device has first and second communication modules which are Bluetooth modules (BT). When these Bluetooth modules (BT) are initialized, by enabling the Bluetooth (BT) in the subject device, provides two different Bluetooth addresses or identifiers. The example for an identifier may be a MAC address. These two Bluetooth addresses along with a single smart wearable device id (for example, a company specific id, Band_4438, KAHA_12345) are shared with the connected mobile device of first user. Further, this device information along with personal details of first user are transmitted to the application server, and is processed and which enables the subject first user to register with the application or network system.

[0022] A profile is created in a database based on the information provided by the first user during the registration process. The profile is specific to the user, which contains, first user's personal details, mobile device name & version no of first user, mobile application version, device details (device id, addresses or identifiers of two Bluetooth modules), firmware version of smart wearable device, health data, fitness data, activity data, sensor data, buddies data, locality data, emergency contact information etc.

[0023] The profile data is used to monitor a user at any point of time, also helps to track the location of first user in real-time. In an embodiment, the profile also maintains a location history for a first user, wherein which provides the information about the geo graphical locations visited by the user at least for a period of 1 month from current date. The location history of user is updated either by the GPS data provided by the mobile device of the first user. In an embodiment, the location of first user is updated by the one or more data provided second BT module configured in the smart wearable device of first user. In an embodiment, the mobile device of first user updates and syncs the location visited by the first user in the location history, whenever the first user connected with the WiFi or mobile data. In another embodiment, the mobile application configured in a mobile device captures the location data in order to update with the location history. In yet another embodiment, when the first user is infected with a

disease, the location history of one or more users of the network considered and retrieved to track and trace the other users who were under in 'frequently visited' or vice versa.

[0024] In an embodiment, the smart wearable devices 110₁-110_n are configured with one or more communication modules, wherein, the first communication module predominantly connects with the mobile device of the first user, whereas, the second communication module is kept always in 'discoverable' mode and further scans the current location of the user to trace and identify presence of other similar smart wearable devices in the close vicinity or range. For example, the range between the devices must be at least 2-3 feet. When the smart wearable devices are identified in close range, the gap or distance between the two users who has the smart wearable devices is also narrow.

[0025] In an embodiment, the first communication module is a slave, which can only be 'discoverable', which is connected and paired to the mobile device, which is a master. The second communication module is a master, wherein, which able to scan the nearby vicinity of the user and also 'discoverable' to other devices which comes in the vicinity.

[0026] In an embodiment, the first and second communication modules are Bluetooth modules or BT modules. In another embodiment, the BT modules are Bluetooth Low energy (BLE) modules, which operates in much less power compare to normal BT modules. When the Bluetooth (BT) is turned on in the smart wearable device, the first BT module (a slave modules) connects and pairs with the user's mobile device and enters "non-discoverable" mode, whereas, the second BT module (a master module) remain in 'discoverable mode' and capable of searching and scanning the current location of user for one or more devices in the range and capable of identifying their distance through signal strength normally, the received signal strength indicator (RSSI), of one or more those nearby devices. RSSI is the strength of the beacon's signal as seen on the receiving device, e.g. a mobile device, smart wearable device. The signal strength depends on distance and broadcasting power value and RSSI represents the power present in a received radio signal. At maximum Broadcasting Power (+4 dBm) the RSSI value ranges from -26 (a few inches) to -100 (40-50 m distance). In general, higher the RSSI value, the stronger the signal and smart wearable devices which are in range having higher RSSI value, the devices which are in range are very close to each other. Further, when RSSI value is measured in negative numbers, the number which is closer to zero usually means a better signal and smart wearable devices which are in range having higher RSSI value are very close to each other. For example, RSSI value of -50 is a pretty good signal (devices are in very close range), -75 is fairly reasonable signal (devices are in medium range), and -100 is no signal at all (devices are out of range).

[0027] The second BT module scans the vicinity of first user and search for the RSSI signal strength of other devices which are in range of first user, thereby identifying the distance between the first and one or more smart wearable devices. In an embodiment, the smart wearable device is capable of capturing the addresses or identifiers of one or more identified devices along with RSSI data, in the vicinity of the first user. The smart wearable device prepares a first data which comprises, sensor data, device data, a list of device ids found in the range of first user, along with RSSI values of subject device ids, time stamp, duration in which devices are in range. The smart wearable device also shares first data with the mobile device and the application server for further processing. In an embodiment, the smart wearable device itself may have the capability to analyze the RSSI values of identified device Ids of one or more devices in the range of the first user and also retrieve other user details such as name, health data (for example infection status) etc. In an embodiment, health data also contains the infection status wherein which has been categorized into 4 types namely, 'infected', 'quarantined', 'cured' and 'not infected'. In another embodiment, the smart wearable device closely monitors the vicinity of first user, for the possible presence of any infected or quarantined users in the range, and alerts the first user and other users to maintain a safe distance of at least 5m and to be cautious, when any device ids are retrieves the data with infection type, 'infected' and 'quarantined' . The application server primarily triggers and alerts the first user and other user to maintain the safe distance and secondarily application server fetch the infection status of one or more users who are in the vicinity of first user based on the device ids captured by the second BT module of smart wearable device of first user. In an embodiment, the alert message is continuous and provided to all users who are in the vicinity until the safe distance is reached by the all the users. In another embodiment, if at least one user is in the vicinity of first user, then the continuous alert is provided to both first and second user, also when the second user approaches the first user from a distance.

[0028] The mobile devices 120₁-120_n may perform preliminary signal processing of the data provided by the wearable devices 110₁-110_n before transferring the data to the application server 140. Mobile devices 120₁-120_n may monitor and maintain the status of all the connected wearable devices 110₁-110_n, and further initialize them to perform one or more actions. The mobile devices 120₁-120_n are configured with mobile application (not shown) that receive data/inputs from the wearable devices 110₁-110_n, and to provide a user interface to control and monitor the smart wearable devices 110₁-110_n and the data reports. Also, the mobile application sends appropriate data to the wearable device. The mobile application is also configured to appropriately display the data received from the application server 140. The mobile devices

120₁-120_n through mobile application is capable of displaying a list of persons with respect to their infection state. In an embodiment, the mobile application further marks specific locations in the map to avoid, wherein which those locations may contain plurality of infected or quarantined persons. Also, the mobile application suggests to avoid visiting those locations in the near future.

[0029] The communication network 130 provides long distance communication channels to establish one-to-one, one-to-many and many-to-one connection among the mobile devices, the application server 140 and the database 150. The communication network 130 may comprise the GSM, CDMA, satellite communication long distance RF communication network, 4G, 5G communication networks and other advanced long distance and cellular communication networks for example.

[0030] The application server 140 operates to provide various functionalities to the system 100. In that, the application server 140 may be configured to interact with the mobile devices 120₁-120_n and also with wearable devices 110₁-110_n through mobile devices, over communication network 130. The application server 140 may comprise plurality of server processors deployed at different locations and connected together by means of a dedicated connectivity, Local Area Network (LAN), Wide Area Network (WAN) etc. The application server 140 operates by running multiple application to provide one or more desired functionalities.

[0031] The database 150 stores all the data provided by the wearable devices 110₁-110_n, mobile devices 120₁-120_n and the application server 140. The database 150 may archive the data and maintain the reports and other results of the processing performed at the application server 140, mobile device 120₁-120_n and wearable devices 110₁-110_n for further processing and/or for retrieval on request/query. The database 150 may be deployed at different locations and capable of collecting the data from the wearable devices 110₁-110_n, mobile devices, and application server 140. Further, a local database (a local storage unit) may be deployed in the wearable devices 110₁-110_n and mobile phones 120₁-120_n. The local database is capable of storing the data temporarily for a period, and further shares the data with database 150 and updates the associated data tables (for example, data synchronization between one or more connected devices). The database 150 is indexed to retrieve any data whenever requested by the user through the application server 140. The database 150 stores the profiles of each and every user of the subject network. The profile information includes but not limited to name of user, address, gender, age, unique ids of smart wearables, list of smart wearables, phone number, health data, activity data, group data etc. The health data provides all current, past medical conditions of user such as blood group, current medical condition, diseases of user, diagnosis

reports, medication taken, infection status, quarantine details etc. In an embodiment, the health data is highly confidential data of the user, which may be shared with government bodies on request.

[0032] The wearable device 110₁-110_n collects numerous data, information through various sensors, process the information and output the processed information in the form of text, picture media, light, sound, and vibration. The wearable device is attached to the person so as to measure, monitor, collect and capture several body parameters, health parameters and movements. The wearable device 110₁-110_n provides the measurement, or the processed data to the mobile devices 120₁-120_n. Each wearable device may have a unique identification number (UID), device id, or MAC ID, SSID, serial number to recognize subject wearable device and appropriately segregate the data.

[0033] In first example, during pandemic and virus infectious situations, people need to maintain safe distance (at least a distance of 5m) and avoid touching or being very close to other persons. If a virus infected person comes in contact with normal healthy person, then there are high chances of getting virus infection from the infected person to the normal person. So, when the normal person maintains a safe distance from infected person or person who is in quarantine, then there are less chances of getting the virus from infected person to normal person. Since, people use mobiles devices and wears smart wearable devices, and subject invention involves capturing of device Ids and identification of smart wearable devices in the vicinity of a user. The smart wearable devices (device Ids) may belong to a virus infected user or a user under quarantine, or a normal healthy user or a cured user. So, whenever, the smart wearable devices of other users of network comes in particular range (measured by RSSI value-signal strength of mobile devices and smart wearable devices), the smart wearable device of first user automatically and triggers an alarm, that there is another user who is very close to you and alerts to maintain a safe distance of at least 5m from the second user. In an embodiment, the smart wearable device may, speak out a message 'kindly avoid close contact and maintain a safe distance for at least 5 feet or 5m, while the user is in the public or open environment or any circumstances, such as, a super market, a grocery shop etc.

[0034] In an embodiment, a device Ids of smart wearable devices are mainly listed in four categories such as device Ids of normal healthy users, device Ids of virus infected users, device Ids of cured users and device Ids of users who are in quarantine. In another embodiment, with these smart wearable devices and their device Ids, which scans the vicinity of users, the distance between the normal to normal user, normal to infected user, normal to quarantined user is effectively identified in the open environment, for example, a super market, a grocery shop etc.

In yet another embodiment, when the normal healthy user's (a first user) smart wearable device identify a device Id of virus infected person (a second user) in a range, then the smart wearable devices of first and second users both send out alert messages or speak out audio alerts, to maintain the safe distance and to be extra cautious.

[0035] In second example, when the smart wearable device of first user scans, monitors and records the device Ids of all nearby users of network, who are in particular range. In an embodiment, the database stores these device Ids data captured through the second BT module of the first user's smart wearable device along with their distance, day wise, week wise, month wise and year wise, so that, at any point in time, the list of users who were in contact with the first user can be identified and traced.

[0036] In one situation, the first user is healthy user and do not have any symptoms of virus. But, the first user frequently goes outside and do not maintain a social distancing and over a period of time, the first user is infected with virus. But, the first user never knows, that he is infected with virus nor having any symptoms of the disease. The first user continues to go outside and operate normally. When the first user gets the symptoms, he approaches the hospital and gets treated or quarantined. The hospital or government could not able to trace other people who were in the close vicinity of first user and who are likely to be infected by the virus due to the connection with the first user. In this situation, the smart wearable device of first user and subject database provide the location history, list of device Ids of persons whom in which the first user visited for the past days (for at least 10-15 days), with their range of vicinity (very close, moderate, not close) in meters. The smart wearable device helps to trace and track those users who may be likely to be infected, and can be quarantined at the initial stage itself and the chances of severe disease spread due to those users are further avoided. For example, the disease may show a symptom in users in 0-15 days of potential infection.

[0037] FIG. 2 is a block diagram illustrating the components of smart wearable in an embodiment of the present invention. The smart wearable 110 is worn by the first user. The components include a first BT module 210, a second BT module 220, sensors 230 and an alert unit 240. The smart wearable 110 is a dual BT device wherein, each BT module has a separate Bluetooth addresses or identifiers. And, the smart wearable 110 may have a specific device id, such as COVE_Band_4438, KAHA_12345. The first BT module 210 of smart wearable device connects and pairs with the mobile device 120 (slave mode). Whereas, the second BT module 220 is in 'discoverable mode' as well as 'scan mode' (master) so that, it can scan the location of the first user and find other devices which are in range and also discovered by other devices

which are in the range. The first phase is scanning and the second phase is discoverable, wherein, the first and second phase happens simultaneously in second BT module 220.

[0038] In an embodiment, the Bluetooth scanning range of second BT module 220 may be up to 25m. The smart wearable 110 prepares the first data with the captured list of devices with their device Ids (for example, KAHA_43452, KAHA_67376), and their RSSI value, through second BT module, along with the address or identifier of second BT device 220 and send the first data to the paired mobile device 120. In an embodiment, the device ids of smart wearable devices in a network may have similar identification pattern such as a prefix, KAHA, before the ID. Firstly, the smart wearable device 110 is capable of identifying the set of users who are in the vicinity of first user and immediately alert one or more users including the first user to maintain the social distancing of at least 5m.

[0039] Secondly, when the smart wearable 110 could not able to identify the users in the vicinity, then the application server which performs various operations in the system, and receives the first data from mobile device and perform a cross verification with the database. The database which usually maintains the profile details of one or more users of the network. can identify the device Ids in the first data shared by the smart wearable device of first user. The database may provide a list of user's names to the first user and may send the trigger the alert message to each and every user (through the smart wearable device) in the vicinity of first user to keep a safe distance, including the first user. Further, the application server can centrally monitor those users including the first user to maintain the social distancing among them. In an embodiment, the application server also shares and triggers respective alert message to the user's mobile devices, in case smart wearable devices are not reachable.

[0040] In an embodiment, the application server may retrieve the list of user's name, along with their health data having the infection status. The smart wearable device may initiate a second level alert or warning, when the infection status of nearby users is either with 'infected' or 'quarantined'. The sensors record the activities of the user and the sensor data is transmitted to mobile device in a separate manner. The alert unit is used to initiate an alert message when at least one other device comes in the range of the smart wearable of the user. The alert message may be a recorded audio, a visual display, a buzz, or a vibration or a text message on the smart wearable.

[0041] FIG. 3A and 3B illustrates the example scanning operation through a smart wearable device. As shown in FIG. 3A, the smart wearable 320 is predominantly paired and connected to the mobile device 310 of first user (User A) and smart wearable 340 is predominantly paired and connected to the mobile device 330 of second user (User B), through the first BT modules,

having a similar set or first set of BT addresses. The smart wearables (320 and 340) configured with the second BT modules having separate BT addresses which are capable of scanning the current location of the first and second user, respectively. Since, the second BT modules in 'scan' and 'discoverable' mode, the device Ids of both smart wearables (320 and 340) becomes visible to each other when the first and second users come in a range, for example 5-10m. In other words, the smart wearable of first user identifies the smart wearable of second user and vice versa, wherein, the first and second users are users of the network, may be known or unknown to each other. By the time, the smart wearables (320 and 340) are visible to each other and are in range, they are capable of analyzing and recording the device Ids, and based on corresponding RSSI values of each device with respect to another device. In an embodiment, the smart wearables (320 and 340) also records the duration in which both devices are in range, and time stamps of subject RSSI values collected. The smart wearables (320 and 340) prepares the first data for transmission to mobile device and application server.

[0042] In real time, the application server receives the first data of both first and second smart wearables (320 and 340) of first and second user through their respective mobile devices and process them. In an embodiment, the first data of first smart wearable, contains the device id of second smart wearable, RSSI value of second smart wearable with respect to first smart wearable, identifier of second BT device of first smart wearable. In another embodiment, the first data of second smart wearable, contains the device id of first smart wearable, RSSI value of first smart wearable with respect to second smart wearable, identifier of second BT device of second smart wearable.

[0043] The application server employs one or more algorithms or machine learning algorithms to determine and retrieve the corresponding profile information of first and second user based on their respective device Ids. In an embodiment, the search in database may start with the identifier or address of second BT module of first and second smart wearable which confirms the device ids of first and second smart wearables. The distance between the first and second user is determined by the respective RSSI values, and trigger is initiated irrespective of difference in RSSI values with respect to first and second smart wearable. The first and second smart wearable initiates a trigger or alert message to the first and second user when it satisfies a basic RSSI value range to trigger an alert (for example, -50dB or 5m at least). In another embodiment, the respective health data of second user along with their location history, is shared with first user and the respective health data of first user along with their location history is shared with second user, on request.

[0044] The profile information includes but not limited to name of user, address, gender, age, unique ids of smart wearables, list of smart wearables, phone number, health data, activity data, group data etc. The health data provides all current, past medical conditions of user such as blood group, current medical condition, diseases of user, diagnosis reports, medication taken, infection status, quarantine details etc.

[0045] FIG. 3B illustrates the example scenario between the first and second smart wearables wherein, which these devices scan the location of first user to determine and identify presence of any devices in the vicinity of first and second users, when any device found in the range, both devices are capable of determining the distance between the first smart wearable and second smart wearable which are in the vicinity. In an embodiment, when first and second users are found in a range through the respective RSSI values, the alert units of first and second smart wearables initiate the alert message in the respective smart wearables by means of a vibration or voice audio out or display or text message, with or without involving the application server. In another embodiment, the primary alert message for the users is to maintain a safe distance (social distancing), whereas, the secondary alert (warning message) and notify the other users, that at least one of user is in the range is infected by virus, when the at least plurality of profiles are retrieved and health data (having infection status) is processed by the application server.

[0046] The example alert (audio out) primary and secondary messages may be, Hi 'John', 'Keep away, and maintain a safe distance of 10m from 'Alex'. Hi 'John', 'Mr. Alex' who is found in your close vicinity is infected with a virus, 'please maintain a safe distance of at least 10m'. The example alert (vibration) messages in smart wearables may be, one vibration is for any user who comes in range, two vibrations or continuous vibrations for infected user in range.

[0047] FIG. 3C is a flowchart 350 illustrating the steps of notifying and alerting the user, when the scanning operation is performed by a second BT module of the smart wearable device.

[0048] In step 352 of, scanning the current location of first user for one or more second devices through a second BT module of a first device. The first user wears the first device. The first device is a first user's smart wearable device which has two BT modules, namely first and second BT module. The first BT module is connected to the mobile device of first user and second BT module is capable of scanning and searching the one or more devices in the vicinity of the first user, and is in 'discoverable' mode. Second devices are one or more smart wearable devices of one or more users of the network.

[0049] In step 354 of, identifying at least one or more second devices in the vicinity of the first user by the first device. In step 356 of, checking whether one or more second devices are located within the predetermined distance value. The first device of first user may list all second

devices with their device Ids, which are in the vicinity of first device with their signal strength (RSSI) value through the first device. If any second devices are found, then first device prepares a first data and shares it with the application server through the mobile device and then the control is transferred to step 358, otherwise, the control is transferred to step 352.

[0050] In step 358 of, alerting at least the first and other second users by means of audio alert, vibration or text message to maintain a safe distance and to avoid direct contact, by the smart wearable device. In step 360 of, tracing and retrieving the details of one or more identified second devices of users of the network by the application server, with the help of database. The application server retrieves profile information of one or more users whose devices are found in the vicinity of the first user. In an embodiment, the profile information contains health data and infection status of every user.

[0051] In step 362 of, checking whether at least one of identified second users is having an infection status of 'infected' or 'quarantined'. If they are infected with a disease or virus and/or quarantined then the control is transferred to step 364, otherwise when the infection status of nearby second users is 'normal' then control is transferred to step 368. In step 364 of, the application server automatically informs local authority, health department about the infection status of one or more second users in the location of the first user, and shares the location of first user with them, in order to address the infected second users and to provide a cure. Further, in step 366 of, the application server through the mobile device and the first device alerts the first user, by means of audio alert, vibration or text message to immediately vacate that place and primarily maintain the safe distance and due to the presence of one or more infected or quarantined second users in the current location of first user, secondary warning is also provided with such details. In step 368 of, saving the information of one or more users along with the nearness data in the database through the application server. The information includes name, contact details, device Ids of one or more devices in the vicinity along with their RSSI values with respect to first user etc. The nearness data is the distance between first user and one or more other users in the vicinity, regularly determined by the RSSI values of one or more devices and which is converted and measured in meters, for example, distance between first and another user is 5m. In an embodiment, the application server also periodically checks the profile information of the user, in order to verify the infection status. In an embodiment, the user may modify or mark the infection status, whenever the user gets examined and confirmed for any virus infection or disease.

[0052] In another embodiment, the Government healthcare department may release list of infected persons or quarantined persons in a locality. The list may contain, name, address, age,

locality, mobile number, infection date, status of recovery, quarantine duration, severity of infection etc. This list released by the Government is confidential and can only be used to track and trace one or more people who were in contact with the infected or quarantined person. The application server gathers this confidential information and verifies the data with the mobile number, and name of person, if any user is found with the same mobile number and name, then the application server automatically updates and marks the health data having infection status as 'infected' or 'quarantined' for the subject identified user. In an embodiment, the user himself can able to update the health data and mark the infection status (as infected or quarantined), when he undergoes any checkup with doctor and finds out the infection, for any disease or viral infection. Hence, the application server is capable of providing and using the health data and infection status of all users of the network in real time to have an updated data with respect to the infection status.

[0053] FIG. 4A and 4B illustrates the example scanning operation through a mobile device. As shown in FIG. 4A, the smart wearable 420 is predominantly paired and connected to the mobile device 410 of first user (User A) and smart wearable 440 is predominantly paired and connected to the mobile device 430 of second user (User B), through the first BLE modules (slave), having a similar set or first set of BT addresses.

[0054] The smart wearables (420 and 440) are configured with the first and second BT modules, which are only in the 'discoverable mode' (slave). The first BT module is always connected with the first mobile device of first user, and second BT module is discoverable but may not able to scan the first user's current location, i.e the second BT module is a BT slave only. While in the 'discoverable mode', the device Ids of both smart wearables (420 and 440) having second BT modules becomes visible to all the nearby devices through the addresses of subject second BT modules. The mobile devices (410 and 430) are capable of scanning the smart wearables which are in 'discoverable mode'. In an embodiment, the mobile devices (410 and 430) initiate the scanning operation and identifies one or more smart wearables in the vicinity or current location of the first and second users. The mobile devices may have higher BT scanning range compare to the smart wearables, for example, 10-15m, detects the smart wearables, when the first and second user comes within the range.

[0055] The first and second users are users of the network, which are known or unknown to each other. Since, the second BT modules in 'discoverable mode' the device Ids of both smart wearables (420 and 440) becomes visible and mobile devices which are in range may able to analyze, capture and record the device Ids and corresponding RSSI values with respect to each smart wearable device (capturing the RSSI values of respective second BT modules) in the

range. In an embodiment, the mobile devices (410 and 430) also records the duration in which these smart wearables (through second BT modules) are in range, and time stamps of subject RSSI values. In an embodiment, the first data of first mobile device 410, contains the device id of second smart wearable, RSSI value of second smart wearable with respect to first mobile device. In another embodiment, the first data of second mobile device 420, contains the device id of first smart wearable, RSSI value of second smart wearable with respect to second mobile device. The first data is transmitted to the application server by the first and second mobile devices.

[0056] In real time scenario, the application server receives the first data at least from one mobile device and process them. In an embodiment, the first data contains device ids of one or more smart wearables and their corresponding RSSI values. As shown in FIG. 4A, the mobile devices of first and second users may scan, capture and transmit the device ids of smart wearables with their RSSI values to the application server.

[0057] The application server employs one or more algorithms or machine learning algorithms and retrieves the corresponding profile information of first and second user based on the match on their device Ids. In an embodiment, the distance between the first and second user is determined by the RSSI values. In an embodiment, the alert is triggered in the smart wearables (through the mobile devices) of both first and second users to maintain the safe distance. Further, when the respective profile information having health data, location history of second user along with the distance between them (first and second user), is shared with first user and the respective profile information having health data, location history of first user along with the distance between them (second and first user), is shared with second user, on request.

[0058] FIG. 4B illustrates the example scenario between the first mobile device and second smart wearables wherein, which the first mobile device initiates the scanning operation for possible presence of devices in the vicinity or current location of the first user.

[0059] When the second smart wearables come in the range of first mobile device, then the first mobile device captures and records the device id of second smart wearable (through the address of second BT module) along with the RSSI value. In an embodiment, when first and second users are found a in range through the RSSI values, the alert units of first and second smart wearables or mobile devices may initiate the alert message in the respective smart wearables by means of a vibration or voice audio out or text message. In another embodiment, the primary alert message for the users is to maintain a safe distance (social distancing), whereas, the secondary alert (warning message) and notify the other users, that at least one of

user is in the range is infected by virus, when the at least plurality of profiles are retrieved and health data (having infection status) is processed by the application server.

[0060] FIG. 4C is a flowchart 450 illustrating the steps of notifying and alerting the user, when the scanning operation is performed by the mobile device. In step 452 of, scanning the current location of first user for one or more second devices through a BT module of a mobile device. The second BT module of first device and other second devices are kept only in the 'discoverable mode'. The first user wears the first device and uses a first mobile device to scan the smart wearable in the vicinity of first user, which were discovered by those second BT modules. In step 454 of, identifying at least one or more second devices in the vicinity of the first user by the first mobile device. In step 456 of, checking whether one or more second devices are located within the predetermined distance value. The first mobile device of first user may list all second devices with their device Ids, which are in the vicinity of first mobile device with their signal strength (RSSI) value. In an embodiment, the first mobile device is configured with the mobile application to view and display the list of second devices to the first user, with their RSSI values in the vicinity of first user. If any second devices are found, then first mobile device prepares a first data and shares it with the application server and then the control is transferred to step 458, otherwise, the control is transferred to step 452. In step 458 of, alerting at least the first and other second users by means of audio alert, vibration or text message to maintain a safe distance to avoid direct contact by the smart wearable. In step 460 of, tracing and retrieving the details of one or more identified second devices of users by the application server, with the help of database. The application server retrieves profile information of one or more users whose devices are found in the vicinity of the first user. In an embodiment, the profile information contains health data and infection status of every user in the network.

[0061] In step 462 of, checking whether at least one of identified second users are having an infection status of 'infected' or 'quarantined'. If they are infected with a disease or virus or/and quarantined then the control is transferred to step 464, otherwise when the infection status of nearby second users is 'normal' then control is transferred to step 468. In step 464 of, the application server automatically informs local authority, and health department about the infection status of one or more second users in the location of the first user, and shares the location of first user with them, in order to address the infected second users and to provide a care. Further, in step 466 of, the application server through the mobile device and the first device alerts the first user, by means of audio alert, vibration or text message to immediately vacate that place and primarily maintain the safe distance and due to the presence of one or

more infected or quarantined second users in the current location of first user and, secondary warning is also provided with such details. In step 468 of, saving the information of one or more users along with the nearness data in the database through the application server. The information includes name, contact details, current health status, device Ids of one or more devices in the vicinity along with their RSSI values with respect to first user etc.

[0062] FIG. 5A illustrates the example scanning operation through a mobile device, when a smart wearable device having only one BT module.

[0063] As shown there, the smart wearable 520 is predominantly paired and connected to the mobile device 510 of first user (User A) and smart wearable 540 is predominantly paired and connected to the mobile device 530 of second user (User B), through the first BT modules (operates only in slave mode). In one embodiment, the first BT module is capable of switching between 'non-discoverable mode' to 'discoverable mode' and vice versa. In one example, for every 10 minutes, the smart wearable disconnects from the paired mobile device and enters a 'discoverable mode'. During this 'discoverable' mode, the BT of first module of smart wearable may have a different address or identifier altogether, the mobile device of first user may scan the current location of the first user and identify the possible presence of any other device having a common device id in vicinity of the first user. For example, when connected and pair to the mobile device, the smart wearable may have an identifier of 'band_2248', whereas, when disconnected and in 'discoverable' mode, the smart wearable may have an identifier of COVE_TE_001 (a common device id). In an embodiment, the address or identifier of first BT module of smart wearable during the 'discoverable' mode is a common identifiable address or identifier or id, to easily search and identify the users and are toggling address are dedicated only for the network of users.

[0064] During the 'discoverable' mode, the smart wearable of first user is visible to other smart wearables or mobile devices which are in the range. In an embodiment, the mobile device of any user is capable of analyzing, capturing and recording the addresses or identifiers or MAC ids and corresponding RSSI values of those smart wearable devices in the range. Further, after a predetermined time, the smart wearable of first user connects back to the respective mobile device of first user and enters 'non-discoverable' mode. In an embodiment, the predetermined time may be 30 seconds. The advantage is, any smart wearable in the current market can be implemented with above method of tracking the devices through the mobile device in the vicinity of first user at a comparatively lesser cost and with minor changes. As shown in the figure, the smart wearable when in 'discoverable' mode allows other devices to capture the subject device id with RSSI values in the vicinity of user and transmit them to the respective

user's mobile device and application server for alerting and further processing with retrieval of user profile information. In one example, the database stores the profile information with the address of first BT module, device id of smart wearable. In an embodiment, during the toggling of BT address, the respective BT addresses are saved in respective user profiles, identified based on their device id. In another example, a common device id is allotted to each smart wearable in the network, which detectable by one or more users due to the common name, and belonging to the same network. During toggling, the smart wearable switches to common device id wherein, other devices of the same network can able to discover the same or similar set of devices. The database always maintains a separate list of addresses or identifiers or common device ids which are shared with smart wearables of the network, against the respective users. The database also captures the common ids, addresses or identifiers of smart wearables during toggling. In an example embodiment, the band disconnects automatically, for example, every start of the minute (0-30 seconds), the bands will not connect to the any other mobile devices (or apps in mobile devices), the following next 30 seconds in a minute (31-60 seconds), the bands may be connected to the mobile devices.

[0065] The first BT module of smart wearable is configured to disconnect from the mobile device every 30 seconds to make the BT module discoverable by other devices in the vicinity, and connects back to the same mobile device which is already paired. Further, the timing of making the devices toggle and clock of each and every device in the network should have the same time, and discoverable mode and reconnection mode of smart wearable (with mobile device) must happen one after the another. For example, all mobile devices in the network should initiate the scanning at 12:00:00, and scanning of one or more devices in the vicinity may continue till, 12:00:30, the bands on the other hand, may be discoverable between 12:00:00 to 12:00:30. Then, the mobile devices and bands are reconnected to the (respectively paired) devices between 12:00:31 to 12:01:00 and remain paired So, for every 60 seconds, the above process is repeated.

[0066] FIG. 5B is a flowchart illustrating the steps of notifying and alerting the user, when the scanning operation is performed by the mobile device, when the mode of first BT module of smart wearable device is toggled, in an embodiment of the present invention.

[0067] In step 552 of, connecting and pairing the smart wearable with a mobile device. In step 554 of, checking whether the smart wearable is connected and paired with the mobile device at least for a predetermined time. In an embodiment, the predetermined time is at least 10 minutes. If smart wearable is connected and paired for a predetermined time, then the control is transferred to step 556, otherwise, the control is transferred to step 552. In step 556 of,

disconnecting the smart wearable from the mobile device. In step 558 of, toggling the BT mode of first device to 'discoverable' and changing a first device id of first device to a common device id. In an embodiment, the first device is a smart wearable having a single BT module for communication. In another embodiment, the first device id may be 'band_2248' wherein which connects and pairs with the first mobile device of the first user. In another embodiment, the first device id is changed or toggled into a common device Id for example to, 'COVE_TE_001'. In yet another embodiment, the common device id is a common network related device id, wherein which can be easily identifiable by one or more second mobile devices of the network. Further, when the smart wearable disconnects from the first mobile device, then the smart wearable becomes 'discoverable' and can be visible to the one or more second mobile devices. In step 560 of, scanning the current location of first user by the first mobile device at least for one of common device id, at least for 30 seconds. In step 562 of, checking whether any second wearable devices are found with second device id in the vicinity of the first user with a predetermined distance value. The mobile device may list all second wearable devices with such common device Ids, which are in the vicinity of first user with their signal strength (RSSI) value. The predetermined distance is between 0m to 15m. If the list of second devices are found, then the control is transferred to step 564, otherwise the control is transferred to step 568. In step 564 of, alerting at least the first and other second users to maintain a safe distance, through the smart wearable, when at least one second device id is in the vicinity of first user. In step 566 of, tracing and retrieving the profile information of one or more identified second devices of the network with their common device id (for example, second device id), by the application server. In an embodiment, the application server further prepares the list of users who has the identified second devices. The control is transferred to step 568 and 570. In step 568, toggling the BT mode of smart wearable to 'non-discoverable' by changing back the common device id (for example, second device id) to first device id of smart wearable and automatically connecting with the first mobile device of first user.

[0068] In step 570 of, checking whether at least one of identified second users are having an infection status of 'infected' or 'quarantined', by the application server. If they are at risk or infected with a diseases or virus or/ and quarantined then the control is transferred to step 572, otherwise when the infection status of nearby second users is 'normal' then control is transferred to step 576. In step 572 of, the application server automatically informs local authority, and health department about the infection status of one or more second users in the location of the first user, and shares the location of one or more second user (which is also current location of first user) with them, in order to address the infected users and to provide a

care. Further, in step 574 of, the application server through the mobile device and the first device alerts the first user, by means of audio alert, vibration or text message to immediately vacate that place and primarily maintain the safe distance and due to the presence of one or more infected or quarantined second users in the current location of first user and, secondary warning is also provided with such details. In step 576 of, saving the information of one or more users along with the nearness data in the database through the application server. The information includes name, contact details, current health status, device Ids of one or more devices in the vicinity along with their RSSI values with respect to first user etc.

[0069] FIG. 6 is a flowchart illustrating the steps of notifying and alerting the user to maintain a safe distance in open environment. The application server performs the below operations and steps to trigger an alert to one or more users of the network. In step 602 of, scanning the current location of first user for one or more second devices through a second BLE module of a smart wearable, whereas, the smart wearable is connected to the mobile device through the first BLE device. In step 604 of, identifying at least one or more second devices and their addresses or identifiers or MAC Ids along with their RSSI values, in the vicinity of the first user by the smart wearable. In step 606 of, checking whether the RSSI value of at least one of second device is below -25 dB, if the RSSI value is below -25 dB, then the control is transferred to step 608, otherwise, the control is transferred to step 612. In step 608 of, marking the distance between first and second user as less than 1m based on the RSSI value of -25 dB. In step 610 of, alerting both first and second user through the smart wearable to immediately maintain the safe distance of at least 2-3 meters between them. The distance less than 1m is very critical in pandemic situations, so the users are alerted immediately by means of audio out or vibration or vibrating continuously until safe distance is attained by the first and second users, by the smart wearable or mobile devices.

[0070] In step 612 of, checking whether the RSSI value of at least one of second device is between -25dB and -50 dB, if the RSSI value is between -25dB and -50 dB, then the control is transferred to step 614, otherwise, the control is transferred to step 618. In step 614 of, marking the distance between first and second user as less than 5m but more than 1m. In step 616 of, alerting both first and second user to immediately maintain the safe distance between them. The less than 5m distance between the users is also critical in pandemic situations, so the users are alerted immediately by means of audio out or vibration or vibrating continuously until safe distance is attained by the first and second users, by the smart wearable or mobile devices.

[0071] In step 618 of, checking whether the RSSI value of at least one of second device is between -51dB and -100 dB, if the RSSI value is between -51dB and -100 dB, then the control

is transferred to step 620, otherwise, the control is transferred to step 624. In step 620 of, marking the distance between first and second user as less than 10m but more than 5m. In step 622 of, alerting both first and second user to immediately maintain the safe distance between them. The more than 5m distance between the users is acceptable safe distancing during pandemic situations, so the users are alerted immediately when the distance between falls below 5m. In step 624 of, checking whether the RSSI value of at least one of second device is beyond -100 dB, if the RSSI value is beyond -100 dB, then the control is transferred to step 626, otherwise, the control is transferred to step 628. In step 626 of, marking the distance between first and second user as more than 10m and above 10m between the users is a safer distancing in pandemic situations. In step 628 of, second device and second user could not be discovered, by the application server, when RSSI value is more than -100dB. When the second device is not discovered, then the first and other second users are maintaining the safe distance between them and hence social distancing is achieved. The above method to provide monitor safe distancing among the users of network is operated and executed in real time, in combination with various I/O operations between smart wearable, mobile device, application server and the database. In one aspect of the present invention, the range of RSSI value and distance measurement depends on one or more device standards and data accumulated by the one or more smart wearable devices and mobile devices. In other words, the threshold value to determine the closeness of users, and in order to alert the subject users may depend on one or more algorithms implemented in the application server and data (device id, RSSI values, or other parameter which may determine the closeness factor) provided by the one or more smart wearable devices and mobile devices.

[0072] The following paragraphs describe the manner in which contact tracing occurs in an embodiment of the present invention. In order to perform the contact tracing, there are two steps to be performed by the user. The first step is to provide a health-related self-assessment by the user and second step is manually marking the infection status by the user.

[0073] In the self-assessment step, the mobile application configured in the user's mobile device may ask several questions to assess the current medical condition of the user. The mobile application may ask the user to provide at least the following details, gender, full name, age, profession, countries travelling outside for the past 30 days, are you feeling well (yes or no), are you experiencing any of the following symptoms (options – cough, fever, difficulty in breathing, none), have you ever had the any of the following (options – diabetes, hypertension, lung disease, heart diseases, none), have you travelled anywhere internationally in the last 14 days (yes or no). Based on the responses for the above questions, the application server can

able to mark a user with the risk of infection or update infection status and inform the user, that he is at risk or not.

[0074] In manually marking the infection status by the user, the mobile application asks the users to update and mark the infection status manually with respect to their current health data. The infection status is categorized into 4 types namely, 'infected', 'quarantined', 'cured' and 'not infected'. The user has to mark at least one infection type in the mobile application, wherein which the application server may take further steps to monitor such users who marks the status as 'infected' or 'quarantined'. For example, when the user undergoes a test with Doctor, and with the test results and its positive for viral infection, then the user marks the infection status (for example, positive for any viral infection). In an embodiment, the doctor who has been treating such users can mark the infection status against the user, in case the user is not willing to mark the status, or does not marked the infection status within a stipulated time of 12 hours. When user A is infected, with a virus then user A may mark, that he is infected with virus and along with description of virus. When user B comes near to user A, then these smart wearable devices of user A and B, may find out, that they are nearby and immediately alerts both users to maintain the safe distancing of at least 5m apart, between them. Then the application server, further identify and finds out the user A is infected with a virus and to keep away from him.

[0075] In order to trace the contact who may be in connection with the infected or quarantined users, the smart wearable continuously scan the nearby devices, and these data is sent to application server, the smart wearable may scan every 30 seconds (scanning interval), the second BT module of smart wearable may have a name, KAHA_12345. Then, the smart wearable only scans for those devices having a specific group name such as 'KAHA_XXXX' and do not scan for any other devices. This is always and continuous ON scan, whenever the smart wearable or application server finds out, that there is a device with ID 'KAHA_XXXX' is in the vicinity, then the users will get a trigger, that there is another device in the vicinity. Device Id may be an encoded string, wherein, only encoded string may be scanned for potential identifications of nearby devices. The smart wearable may search only for the name of the device, which is the 'advertisement name'. In one example, users who are keeping the devices which belong to common group name, when they are around, for example 3 users who are in the range, then the users will capture respective other device details and send the details to application server, and identify whether they are nearer to any one of the other users.

[0076] Historical contact tracing involves searching the location history of the user and identifying whether this user A has been marked as any virus positive (infected), if so, the application server immediately check, what were the devices ids which were in the vicinity of user A at least for past 10 days, and the application server retrieve all profile, location information of one or more users then those users can be tracked automatically by the application server. Further, those users are immediately notified and instructed to self-quarantine themselves. In an embodiment, the application server may prepare a list for contact tracing with names, device IDs, locality, and which can further be shared with Government health care department, so that, they can quarantine those users at the earliest.

[0077] FIG. 7 is a flowchart illustrating the steps of tracing and tracking a person through the smart wearable device. In step 702 of, monitoring infection status of one or more users of a network. The database which stores the profile information of all users in combination with the methods employed in the application server, the application server monitors the infection status of each and every user of the network which is stored under the health data. In step 704 of, checking whether any user's infection status is changed to 'quarantined' or 'infected'. In an embodiment, based on the inputs and guidelines from Government healthcare department, the application server updates the infection status of those users, which were listed in the official notification. The application server checks those users who are infected or quarantined in the network, and acquires their current location. In another embodiment, the user is allowed to enter and update the current medical status under health data and also allowed to voluntarily update the infection status. In yet another embodiment, the application server periodically checks the infection status of each and every user of the network. If the application server identifies that there is a change or update in the infection status, then the control is transferred to step 706, otherwise, the control is transferred to step 702. In step 706 of, initiating the contact tracing in reference to the 'quarantined' or 'infected' user of the network, by the application server. In an embodiment, the application server makes a list of users whose infection status is changed or updated at least for a period of 15 days to initiate the tracing of users. In step 708, retrieving the list of MAC Ids with their RSSI values at least for the past 15 days by the application server. In an embodiment, the application server retrieves the list of users with their name, address and contact number, current infection status, list of MAC Ids identified at least for past 15 days along with their RSSI values, duration of range, time stamp of MAC ids & RSSI values. In an embodiment, the application server of contact tracing system helps the Government health care department to effectively trace the users who came in the contact of infected person at least for a period of past 15 days. In another embodiment, the user profile

data with their infection status may be shared with Government healthcare department on request.

[0078] In step 710 of, examining the list of users traced who were in contact with the infected person through a self-assessment test. The self-assessment test may be given in the mobile device of the user, through one or more simple questions relating to the health and current activity of the user. When the application server and Government finds, that the person is infected, then the Government healthcare authority provides and initiates an effective quarantine guideline for those infected users and may be eventually admitted to the hospital for quarantine and effective care. Whereas, on the other hand, application server continuously monitors the infection status of each and every user of the network. In the similar way, the application server traces and identifies all users which were in close contact with infected people through the MAC Ids and corresponding RSSI values from the smart wearable and mobile device. In step 712 of, check whether any user in the list of users is at risk (infected or quarantined recently). If it is found that the users are at risk (infected or quarantined recently) then, the control is transferred to step 714, otherwise the control is transferred to step 716. In step 714 of, updating and marking the infection status of subject users to 'at risk' ('infected'), by the user and application server, for further medical attention. In an embodiment, the application server further updates and marks infection status as 'quarantined' for those users who are under home or hospital quarantine. The user may also mark and update the infection status. The users are in infected or quarantined need to maintain their healthcare guidelines to get cured from the diseases. In an embodiment, the application server further updates the infection status to 'cured' when those users are cured from the disease or infection. The application server monitors all users of network irrespective of the infection status, then the control is transferred to step 704. In step 716 of, updating and marking the infection status of subject users to 'normal' after when the Government healthcare department declares that they are free from viral infection or disease.

[0079] FIG. 8 is an example illustration of smart wearable device configured with dual Bluetooth in an embodiment of the present invention. The figure is shown comprising two users namely, Paul and Rita, where both have a band (a smart wearable device) which is connected to their mobile device. In an embodiment, each smart wearable device is configured with two BT modules, namely a first BT module and a second BT module. In another embodiment, the first BT module of first smart wearable device is connected to mobile device of Paul, whereas, the second BT module of first smart wearable device is always discoverable and scanning. Similarly, the first BT module of second smart wearable device is connected to mobile device

of Rita, whereas, the second BT module of second smart wearable device is always discoverable and scanning.

[0080] FIG. 9 illustrates the example scanning of first smart wearable device in reference to the illustration shown in FIG. 8. As shown there, the second BT module of first smart wearable device belongs to first user (for example, Paul), is always discoverable and scanning. In an embodiment, the band (for example, first smart wearable device) scan the second BT module configured in the band (for example, second smart wearable device) of second user (for example, Rita) or Rita itself. Further, the second BT module or Rita is being identified by the distance with respect to the second BT module of first smart wearable device, based on RSSI (signal strength) and which is also useful for tracking the user later point in time. In an embodiment, the smart wearable device of first user immediately warns him to maintain a safe distance, when the second smart wearable device comes within a distance range of 5m. The distance for alerting the first user may vary based on application's implementation, for example, the distance may be 1m, 2m, 3m, 4m, 6m, 7m, 8m, 9m or 10m or so on, and the above method effectively helps in contact tracing. In the similar way, the smart wearable device of second user may warn and alert her when the first user comes with in a range of at least 5m.

[0081] FIG. 10 illustrates an example scanning by a mobile device of first user, when a second BT module of smart wearable device is only discoverable. As shown there, smart wearable device is connected to the mobile device of first user (for example, Paul) through the first BT modules, wherein, second BT module of the smart wearable device is only can be discovered and do not scan the vicinity of first user. However, the scanning is performed through the mobile device of first user. In an embodiment, the second BT module of smart wearable device of all users can only be discovered with common device id, and may not scan the vicinity. The mobile devices of users may initiate the scanning procedure for possible identification of one or more smart wearable devices in the range having a common device id, wherein, the second BT module contains a common device id which can be easily identified and discovered by other mobile devices which are in range. So, the mobile device of first user may scan the device of second user (for example, Rita) or Rita itself. Further, the second BT module or Rita is being identified by the distance with respect to the second BT module of second smart wearable device and mobile device of the first user, based on RSSI (signal strength) and which is also useful for tracking the user later. The mobile wearable device of first user immediately warns him to maintain a safe distance from the second user, when the second smart wearable device comes within a distance range of 5m. In the similar way, the mobile device of second user may warn and alert her when the first user comes with in a range of 5m.

[0082] FIG. 11 is an example illustration of smart wearable device configured with single BT module in an embodiment of the present invention. As shown there, the smart wearable device of first user (for example, Paul), is configured with a single BT module, which is only discoverable. Similarly, smart wearable device of second user (for example, Rita), is also configured with a single BT module. Initially, the single BT module is connected with the respective mobile devices of first and second users. In an embodiment, for every 10 minutes, the smart wearable device (for example, a band), disconnects with the respective mobile device and becomes 'discoverable' with a different identifier or address or name for at least 30 seconds. The different identifier may be a common device id, for example, Kaha_12345. After 30 seconds, the smart wearable device may revert to the original identifier or address or name and connects back to the respective mobile device of user.

[0083] In another embodiment, for every 30 seconds, the smart wearable device (for example, a band), disconnects with the respective mobile device and becomes 'discoverable' with a different identifier or address or name for at least next 30 seconds. The different identifier may be a common device id, for example, Kaha_12345. After 30 seconds, the smart wearable device may revert to the original identifier or address or name and connects back to the respective mobile device of user.

[0084] The implementation of system, method and device primarily deals with the identification of one or more devices in the vicinity of user, alerting and warning the users to maintain a safe distance to enable effective social distancing between them, and to effectively trace and track the one or more users, through their device ids or identifiers when they are infected with a disease or quarantined. The scenario of using a single BT module, dual BT module, scanning through the mobile devices are all implemented in the same system, where the users of the network may use one or more smart wearable devices (having a dual BT module, or single module) and mobile devices to record their activities. For example, a first user may have a smart wearable device having dual BT module, a second user may have a smart wearable device may have a dual BT module, where the second BT module is only discoverable, and a third user may have a single BT module, which toggles its BT module from 'discoverable' mode to 'non-discoverable' mode and vice versa. All three users are users of the network and methods are implemented to identify one or more users who come in the vicinity of the one or more users.

[0085] In an aspect of the present invention, a smart wearable device for alerting a user comprising, a set of sensors, a first communication module, a second communication module, and an alert unit. The set of sensors are capable of monitoring one or more user activities of a

user, and recording sensor values. The first communication module is capable of communicating to a mobile device of user, wherein, the smart wearable device is paired with the subject mobile device through the first communication module and enters "non-discoverable" mode when connected with the mobile device. During "non-discoverable" mode, the address or identifier of subject module may not be visible to other devices which are in range and tries to scan the current location. The second communication module is capable of, searching and scanning the current location of the user for one or more devices (for example, smart wearable devices, mobile devices etc) in the range and identifying one or more such devices based on their device ids and the distance between the user's smart wearable device and one or more nearby devices through the corresponding received signal strength indicator (RSSI) values between them and wherein, the second communication module of smart wearable device and other devices are in 'discoverable mode'. During "discoverable" mode, the address or identifier of subject module may be visible to other devices which are in range, and tries to scan the current location. The alert unit is capable of automatically alerting and warning the user by means of vibration or voice output or display, when the distance between the user's smart wearable device and one or more other devices comes within a range of 5m. In an embodiment, the alert unit may trigger an alert to the user, when the RSSI values of one or more other devices which are in the vicinity of user's smart wearable device falls in the range between -100dB to -25dB. In another embodiment, the first communication module is a first BT module and the second communication module is a second BT module. In yet another embodiment, the second communication module remain only in 'discoverable mode' where, the scanning of one or more other devices by the smart wearable device, in the range of the user is not initiated.

[0086] In another aspect of the present invention, a smart wearable device connected with a mobile device comprising, a set of sensors, a communication module, and an alert unit. The set of sensors are capable of monitoring one or more user activities of a user, and recording sensor values. The communication module is capable of toggling or changing its communication mode from "non-discoverable" to "discoverable" and vice versa at a constant regular interval, wherein the communication module is in "non-discoverable" mode by default. The alert unit is capable of alerting the user by means of vibration or voice output. In an embodiment, the smart wearable device connects and pairs with a mobile device during a first interval, wherein, the duration of first interval is 30 seconds. In another embodiment, the smart wearable device disconnects from the mobile device and becomes "discoverable" during a second interval, wherein, the duration of second interval is 30 seconds and device id of subject smart wearable

device is changed to a common device id. In yet another embodiment, the mobile device scans and searches the current location of the user for one or more devices (example, smart wearable devices) having one or more common device ids in the range of the user and capable of identifying the distance between the subject mobile device and one or more nearby devices through the corresponding received signal strength indicator (RSSI) values. In yet another embodiment, the smart wearable device automatically connects and disconnects with the mobile device when the duration of second and first interval ends.

[0087] In another aspect of the present invention, a system for tracing a user comprising, a smart wearable device, a mobile device, an application server and a database. The smart wearable device further comprises, a set of sensors, at least two communication modules, and an alert unit, wherein, the set of sensors are capable of monitoring one or more user activities of a user, and recording sensor values, wherein, the first communication modules connects and pairs with a mobile device and second communication module in a 'discoverable mode', wherein, the alert unit capable of alerting the user by means of vibration or voice output, when one or more users comes in range of subject user. The mobile device also comprises, a BT module which is capable of scanning and searching the current location of user and capable of recording the one or more device IDs of one or more devices which are in the vicinity of the user with their respective received signal strength indicator (RSSI) values, and prepares and transmits a first data to the application server, wherein, the first data comprises at least one device Id and its RSSI value. The application server is capable of receiving the first data, and capable of processing and identifying the corresponding user information relating to subject device Id by searching the subject device id in a database and alerting the user to maintain a safe distance through the smart wearable device from a second user, when the subject device Id matches with at least one of device Ids stored in the database and identified as the second user and when the RSSI value of subject device Id is within the one of the threshold limits. The database which is connected with the application server, stores the profile information of one or more users of the network, wherein, the profile information includes at least one of a name, and a device Id.

[0088] In another aspect of the present invention, a system for tracing a user comprising, a smart wearable device, a mobile device, an application server and a database. The smart wearable device is configured with at least one communication module to scan and detect at least one or more second devices of one or more users in the vicinity of a first user and capable of preparing a first data and transmitting the first data to a mobile device, wherein, the first data consists of at least one device ID of one or more second devices and its received signal strength

indicator (RSSI) value. The mobile device capable of receiving the first data, and prepares a second data, wherein, the second data consists of first data, device details of the first user. The application server capable of receiving the second data, and capable of processing and identifying the corresponding user information relating to subject device Id by searching the subject device id in a database and alerting the user to maintain a safe distance, through the smart wearable from a second user, when the subject device Id matches with at least one of device Ids stored in the database and identified as the second user, and when the RSSI value of subject device Id is within the one of the threshold limits. The database is connected with the application server, stores the profile information of one or more users of the network, wherein, the profile information includes at least one of a name, a device Id.

[0089] In another aspect of the present invention, a method for notifying and alerting the first user to maintain a safe distance in open environment, through a smart wearable device which is worn by the first user comprising the following steps of, scanning the current location of first user for one or more second devices through a second BLE module of a smart wearable device, wherein, the smart wearable device is connected to a mobile device through a first BT device. Identifying at least one or more second devices and their device Ids along with their RSSI values, in the vicinity of the first user by the smart wearable device. Marking the distance between the first user and other users based on the RSSI values of one or more devices in the vicinity of the first user and alerting the first user when the actual distance between the first user and others fall below preconfigured distance threshold value. In an embodiment, the method further comprises the step of marking a 'distance threshold value' from the RSSI values between the smart wearable device and other devices which are in the range of first user. The distance threshold value is safe distance between any two users in a crowd source environment. The value of 'distance threshold value' may be at least 5m. In another embodiment, the 'distance threshold value' may be determined by an application server time to time, based on data from the smart wearable devices and precautionary norms set by the Government. In one example embodiment, distance threshold value is determined based on the RSSI value, which can be implemented in the following manner, when the RSSI value is below -25dB and then its distance threshold value is less than 1m. When the RSSI value is between -25dB and -50dB then its distance threshold value is less than 5m but more than 1m. When the RSSI value is between -51dB and -100dB then its distance threshold value is less than 10m but more than 5m. When the RSSI value is above -100dB then its distance threshold value is more than 10m.

[0090] In another aspect of the present invention, a method for tracing one or more users of a network through a smart wearable device comprising, the following steps of, monitoring an

infection status of one or more users of a network by the smart wearable device and an application server, wherein, the infection status includes at least one of normal, infected, quarantined and cured. Updating the infection status in the database by a first user through the smart wearable device or the mobile device and the application server, wherein, the infection status of first user is changed from 'cured' or 'not infected' to 'infected' or 'quarantined'. Initiating the contact tracing of the first user, by the application server, through the smart wearable device and/or mobile device, wherein, the device id of smart wearable device used by the first user is identified and retrieving a list of device Ids of one or more devices which were in vicinity of first user at a given point in time, with their corresponding RSSI values by searching the first user's device id from the database, at least for the period of past 15 days. In an embodiment, the user list is prepared based on the RSSI values of each and every device of one or more users of network, who were in close distance (for example, distance threshold value) with the first user.

[0091] In another aspect of the present invention, a method for notifying and alerting the first user to maintain a safe distance in open environment, through a smart wearable device comprising the following steps of, scanning the current location of a first user for one or more second devices through a second BT module of a smart wearable device or a BT module of mobile device. Identifying at least one or more second devices which are in 'discoverable mode' located in the vicinity of the first user, by their device ids (for example, identified by their common device ids) and their respective RSSI values. Tracing and retrieving the profile information of one or more second users, by the smart wearable device or mobile device or an application server from the database, when the RSSI values of subject one or more devices fall below a threshold value. And, alerting (a first-degree alert) and warning the first user by means of vibration through the smart wearable device or through a mobile device, to maintain the safe distance when the RSSI value falls below threshold value. In an embodiment, generating a second-degree alert at the smart wearable device to immediately vacate the place, when the 'infected status' in profile information of one or more second users have been identified with the value of either 'infected' or 'quarantined'.

[0092] While various embodiments of the present disclosure have been described above, it should be understood that they have been presented by way of example only, and not limitation. Thus, the breadth and scope of the present disclosure should not be limited by any of the above-discussed embodiments but should be defined only in accordance with the following claims and their equivalents.