

LOCATION SYSTEM AND METHOD

FIELD OF THE INVENTION

By locating the position of the mobile phone carried by people, their whereabouts can be tracked. Over a period of time, associating the places they
5 had been to and the people they had met, it is possible to deduce their activities. More specifically, this method relates to the tracking of identified suspects and associating with their movement pattern to deduce their activities.

BACKGROUND OF THE INVENTION

With the increase threat of terrorism activities, there is a need to track the
10 locality of a large group of suspected individuals over huge geographical area for extended period of time. Using association and deduction technique, one can determine if there are any correlations of the places visited by these individuals together with the people they've met or called. In the event of suspicious activities among various individual, investigative actions can be taken to further
15 explore the details.

Common real-time tracking of human location involve the use of "Identification Tag" (transponder) coded with an identification code to be worn by each individual in the group. For an active "ID Tags", it may transmit information at regular time interval to the "ID stations" to determine their locality. On the
20 other hand, a passive "ID Tags" will only respond when polled by the "ID stations". Numerous "ID stations" will be strategically placed within the environment of interest for end-users to activate a request on the system to locate the group of individuals, and to display a map indicating their location. A couple of US Patents employ similar technique such as US6344794 Ulrich et al,

US6424264 Giralдин et al, US6747562 Giralдин et al, US6798349 Richley et al, and US6802005 Berson et al.

Implementation such tracking system requires each individual, who are to be tracked, to consciously put on the "ID tag". Multiple "ID stations" have to be
5 setup to ensure sufficient coverage in the area of interest for tracking the people. This dictates the need to predict the possible places that the people will be visiting during the tracking period and have the "ID stations" installed in advance. Any inaccurate prediction will affect the tracking coverage and failed to track the people once they are out of the tracking area. In order to track these individuals
10 over large geographical area, many ID stations have to be setup and can be very costly. In addition, to monitor suspicious individual dictates the need of not alerting them during the tracking operation, thus the mandatory of wearing "ID tags" system is not a feasible solution.

Another commonly used technique to determine the location of people or
15 object of interest is GPS . Coupled with a radio transmitter (preferably a mobile phone) and/or a datalink transmitter, an individual's location or position can be transmitted to and monitored by the remote station. This solution requires that the individual carry the GPS system wherever they go, and hence not suitable for suspicious character monitoring. GPS based solutions are described in
20 US5225842 Brown et al, US5379224 Brown et al, US5752218 Harrison et al, US6226622 Dabbieri, and US6744403 Milnes et al.

US6542621 Brill et al describes a tracking system using a video solution. () The system compares video frames taken at different times. A video directed approach, however, is suited only for tracking individuals in a very limited space
25 such as a convenient store area.

Mobile phone networks are also used for tracking purpose. Common applications include locating movable objects in an emergency, such as vehicles, cyclists, and pedestrians. US5515419 Sheffer et al describes one such system. In such systems a central monitoring station is provided for receiving the emergency
5 signals generated by the individual, and computing an approximate location of the mobile phone. Non-emergency applications include assistance or position-related, "yellow pages" information systems such as US6047192 Maloney et al.

Tapping on the existing infrastructure of the mobile phone networks coupled with its wide coverage and all time availability, it make sense to utilize
10 this platform for other innovative applications other than those listed above.

The present invention seeks to expand the usage of the mobile phone network for human tracking purposes, and further associate their calls pattern and physical movement to deduce their type of activities.

SUMMARY OF THE INVENTION

15 It is an object of the present invention to provide a tracking system that overcomes the above disadvantages or at least provides the public or industry with a useful choice.

Accordingly in a first embodiment the present invention consists in a method of identifying associated parties and their location comprising the steps of:

20 identifying the mobile cellular phone used by a plurality of parties;

storing a location and/or time of each call made or received by each of said plurality of parties; and

identifying associated parties based on the location and/or time of calls

Preferably said associated parties are identified based on their location at the time each call is made.

Preferably said associated parties are identified based on the time each call is made.

- 5 Preferably the location of a said party when a call is made is identified using mobile cellular phone network systems.

Accordingly in a second embodiment the present invention consists in a system for identifying associated parties and their location comprising:

- means for identifying the mobile cellular phone used by a plurality of
10 parties;

storage means for storing a location and/or time of each call made or received by each of said plurality of parties; and

means for identifying associated parties based on the location and/or time of calls

- 15 Preferably said associated parties are identified based on their location at the time each call is made.

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- Preferably the location of a said party when a call is made is identified
20 using mobile cellular phone network systems.

In a third embodiment, the present invention consists in software for affecting the above methods.

In a fourth embodiment, the present invention consists in storage media containing software affecting the above methods.

This invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more of
5 said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

10 **BRIEF DESCRIPTION OF THE DRAWINGS**

Disclosed embodiments and methods of utilizing the invention will be further described, with reference to the accompanying figures, by way of example only and without intending to be limiting, wherein;

Figure 1 is an illustration of a tracker carrying a tracking system input
15 device and a suspect carrying a mobile phone,

Figure 2 is an illustration of the process of tracking system input device updating the tracking system through the mobile phone network while tracking the suspect mobile phone location,

Figure 3 is a block diagram on the interface of the tracking system 303
20 with existing mobile phone networks,

Figure 4 is a flow diagram of the process of determining the mobile phone number carried by a suspect with sufficient information input by the tracker,

Figure 5 is a flow diagram of the process of mobile phone location tracking and calls monitoring.

Figure 6 is a flow diagram of the process of correlating and determining the relationship of numerous suspects based on the time information in the database of suspects list,

Figure 7 is a flow diagram of the process of correlating and determining
5 the relationship of numerous suspects based on the location information in the database of suspects list,

Figure 8 is a flow diagram of the process of correlating the information in time and location domains to identify the group of suspects.

DETAILED DESCRIPTION OF THE INVENTION

10 In this context, the person who carries the “tracked” mobile phone is called the “Suspect”. The person who observes and tails the suspect is called the “Tracker”.

Harnessing on the existing mobile phone networks, it is possible to narrow down and pinpoint the locality of a mobile phone. The tracker will observe the
15 suspect for a short period of time and provide information to the Tracking System on the locality of the suspect at regular interval. Other information such as the time and place when he uses his mobile phone will be useful too.

With sufficient inputs from the tracker, the Tracking System will be able to determine the mobile phone number of the suspect. Armed with this information,
20 the Tracking System will be able to perform all day tracking on the positions of the suspect as well as the people he called together with the recording of the content of their conversations. Any computer system will be able to perform the required tracking task provided the processing power is sufficient. The system can include the existing mobile phone system processor or a separate computer system
25 linked to the existing mobile phone system processors.

By expanding the tracking to multiple suspects and associating their activities among each other, it is possible to check for a correlation among their activities. Any suspicious activities will deserve a more in-depth investigation by the tracker.

5 Referring to Figure 1 a tracker 101 using a tracking system input device 102 follows a suspect 103 around. The job of the tracker is to assist in identifying the number of a mobile telephone 104 in the suspect's possession. The tracker 101 having identified a suspect 103 to track physically tails the suspect 103 for a short period of time. During this time, the tracker 101 regularly inputs the location
10 of the suspect 103 using the input device 102. The tracker 101 will in addition record information such as the time the suspect 103 uses their mobile phone 104.

All information is transmitted to the tracking system through the mobile phone network. Referring to figure 3 the tracking system 303 uses the numerous base stations 201 and the switching center 302 of the mobile network.

15 Referring to Figure 4 once the tracker 101 has notified the system 402 of the suspect's location the system 303 using the information provided by the tracker 101 including time of call or location 405 will trace all mobile phones in the vicinity —406 of the base station 303 that the trackers message was relayed through. The system 303 stores the information. The system 303 does this for
20 every location and/or call update 408.

When the system 303 has sufficient information, the system 303 checks which mobile phone numbers are common in all the record occurrences 410. This will narrow the list of to a small number of mobile phone numbers if not one. If the list is not small enough 413, the system will prompt the tracker 101 for more
25 inputs 414. The purpose of this process is to determine the mobile phone number carried by the suspect 103 so that a track can be initiated on this mobile number.

Once identified, the system 303 will automatically track the desired mobile phone number(s) without any further input from the tracker or other human intervention by obtaining the information from the database 502. The "location" information of the suspect's mobile phone is recorded at regular interval, and all
5 calls made to/from the suspect's mobile phones are captured with the conversation content recorded. Any calling parties not in the original suspect list 506 can be added to it and be tracked.

After the desired track duration, the tracker is able to examine the movement profile of the suspects and whom they meet using a correlation process.
10 In the time domain referring to Figure 6 the suspects are divided into different groups at each predefined time of the day 604. Intersection processes 606 are conducted by the system on each time group with the rest of the groups based on the "location" information to determine the commonality of the suspects appearing at the same time at the same place. The telephone numbers of those in close
15 proximity and within the desired time frame are identified to the tracking system user 608.

In the location domain referring to figure 7 the suspects are divided into different groups based on their locality 704. Intersection processes 706 are carried out on each location group with the rest of the groups based on the "time" information to determine the duration of the suspects meeting together. The
20 telephone numbers of those in close proximity and within the desired time frame are identified to the tracking system user 708.

To further reduce the suspect list and narrow down to a specific group of suspects gathering together, intersection process can be applied to the "time" group
25 and the "location" group to determine the common suspects. Referring to figure

8, the list of mobile phone based on "time" 803 or based on "location" 802 can be correlated with one another 808, 812 to narrow the suspect list further.

When the system user wishes to extract a list of suspects coming together within a certain time period and also at certain location, this process illustrated in
5 Figure 8 is useful. Thus the user will decide whether the "time list" or the "location list" is sufficient for their use 804, 805. If individually they are not then the user can opt to intersect the two lists 808, 812.

Once there is sufficient evidence that a group of suspects has gathered for extended periods of time, investigation can be done to probe their traveling habits
10 and the places they visit. Further, detailed investigation by other means can be deployed too.

The foregoing description of the preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed, since many
15 modifications or variations thereof are possible in the light of the above teaching. All such modifications and variations are within the scope of the invention. The embodiments described herein were chosen and described in order best to explain the principles of the invention and its practical application, thereby to enable others skilled in the art to utilise the invention in various embodiments and with
20 various modifications as are suited to the particular use contemplated thereof. It is intended that the scope of the invention be defined by the claims appended hereto, when interpreted in accordance with the full breadth to which they are legally and equitably suited.

CLAIMS

1. A method of identifying associated parties and their location comprising the steps of:

identifying the mobile cellular phone used by a plurality of parties;

5 storing a location and/or time of each call made or received by each of said plurality of parties; and

identifying associated parties based on the location and/or time of calls

2. A method of identifying associated parties and their location as claimed in
10 claim 1 wherein said associated parties are identified based on their location at the time each call is made.

3. A method of identifying associated parties and their location as claimed in
15 claim 1 wherein said associated parties are identified based on the time each call is made.

4. A method of identifying associated parties and their location as claimed in
anyone of claims 1 to 3 wherein the location of a said party when a call is made is
identified using mobile cellular phone network systems.

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5. A system for identifying associated parties and their location comprising:

means for identifying the mobile cellular phone used by a plurality of parties;

storage means for storing a location and/or time of each call made or received by each of said plurality of parties; and

5 means for identifying associated parties based on the location and/or time of calls

6. A system for identifying associated parties and their location as claimed in claim 5 wherein said associated parties are identified based on their location at the
10 time each call is made.

7. A system for identifying associated parties and their location as claimed in claim 5 wherein said associated parties are identified based on the time each call is made.

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8. A system for identifying associated parties and their location as claimed in any one of claims 5 to 7 wherein the location of a said party when a call is made is identified using mobile cellular phone network systems.

20 9. Software for affecting the method of any one of claims 1 to 4.

10. Storage media containing software for affecting the method of any one of claims 1 to 4.