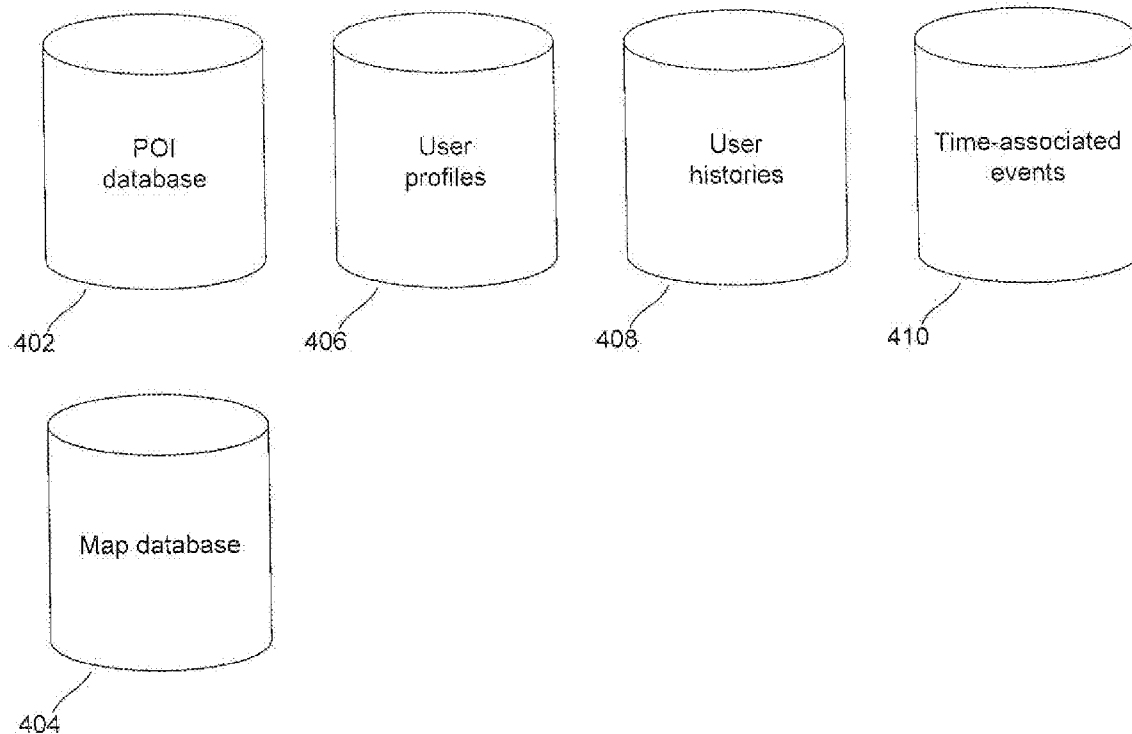




US 20100185605A1

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Chu et al.(10) **Pub. No.: US 2010/0185605 A1**(43) **Pub. Date: Jul. 22, 2010**(54) **METHOD AND SYSTEM FOR CONTINUOUS,
DYNAMIC, ADAPTIVE SEARCHING BASED
ON A CONTINUOUSLY EVOLVING
PERSONAL REGION OF INTEREST****Publication Classification**(51) **Int. Cl.**
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SEATTLE, WA 98104 (US)(21) **Appl. No.: 12/693,670**(22) **Filed: Jan. 26, 2010****Related U.S. Application Data**(63) Continuation of application No. 11/825,145, filed on
Jul. 3, 2007, now Pat. No. 7,720,844.**ABSTRACT**

Embodiments of the present invention are directed to flexible, user-adapted, continuous searching, on behalf of a particular user, for points of interest relevant to the user's current location within a specifically computed personal region of interest. In a general case, the personal region of interest is computed as a function of the user's level of disposition towards the searched-for points of interest. The level of disposition towards the searched-for points of interest may, in turn, be based on two or more of the user's location, the current date and time, a history of the user's interaction with the POI-searching system, including user-initiated searches and user selections from displayed search results, a user profile developed for, and continuously updated on behalf of, the user, and a current context for the search, as specified by a search query or by other context-specifying means. The personal region of interest generally defines an abstract area, volume, or hypervolume within which method and system embodiments, of the present invention search for points of interest.



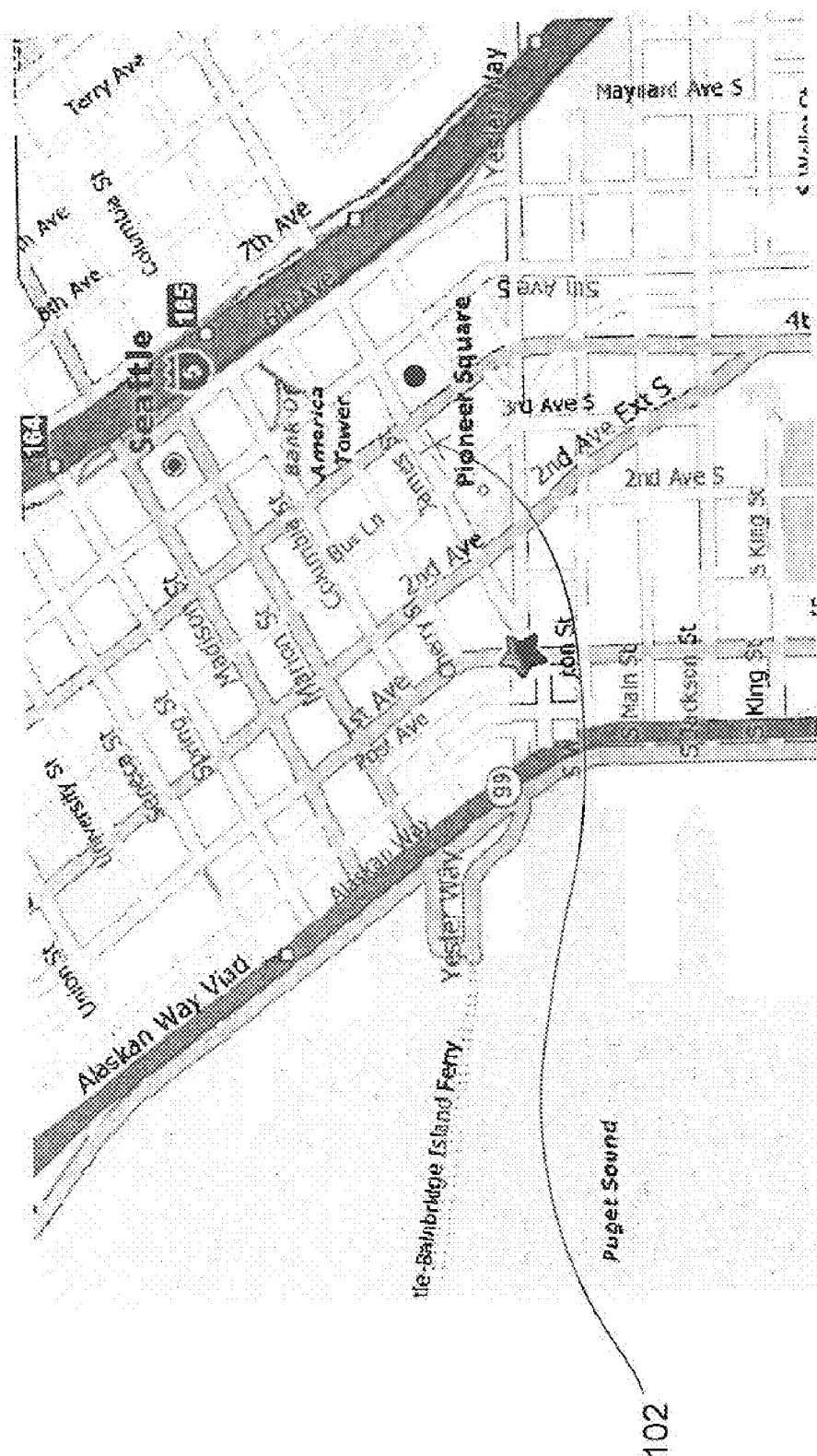


Figure 1A
Prior Art

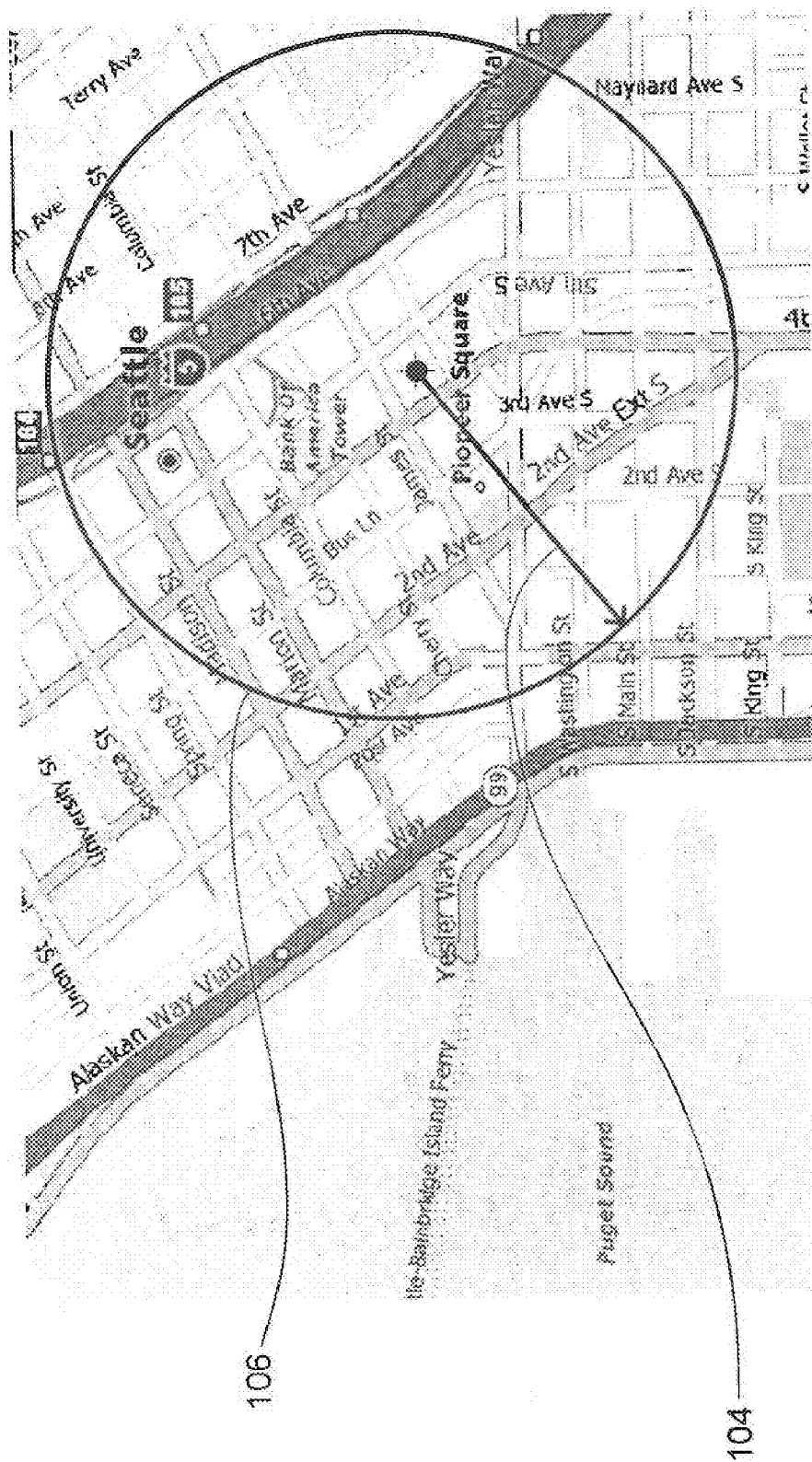


Figure 1B
- Prior Art -

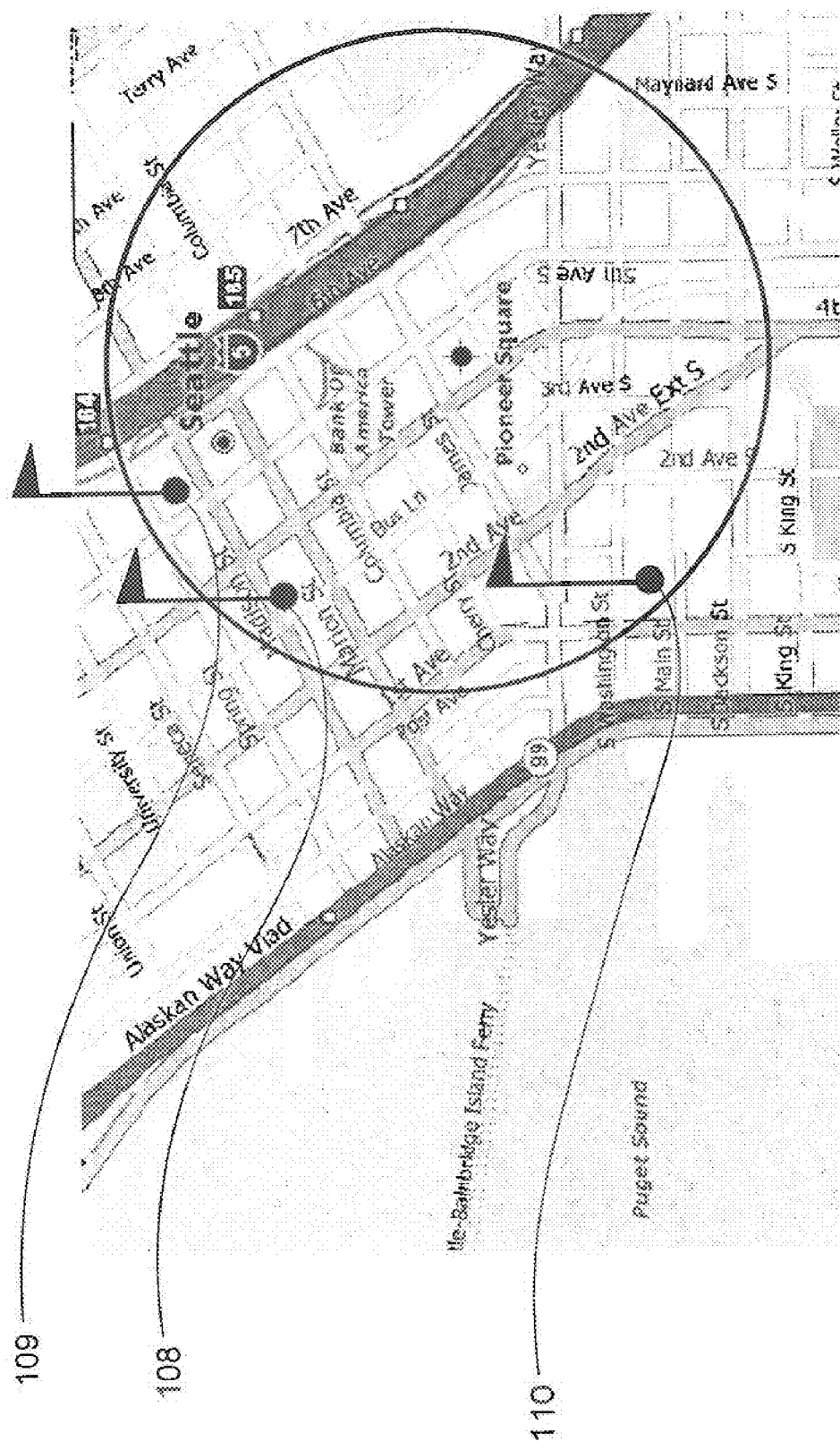


Figure 1C
Prior Art

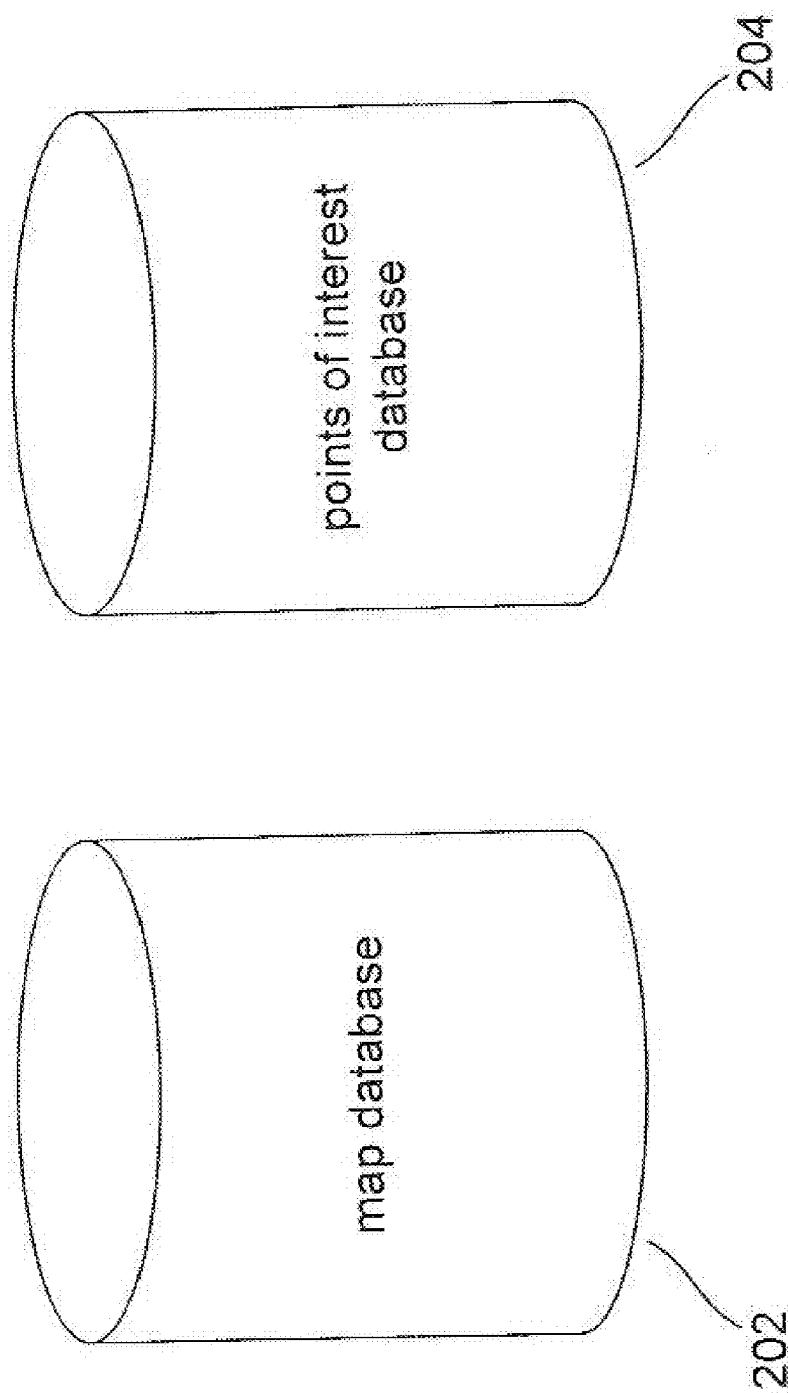


Figure 2
- Prior Art -

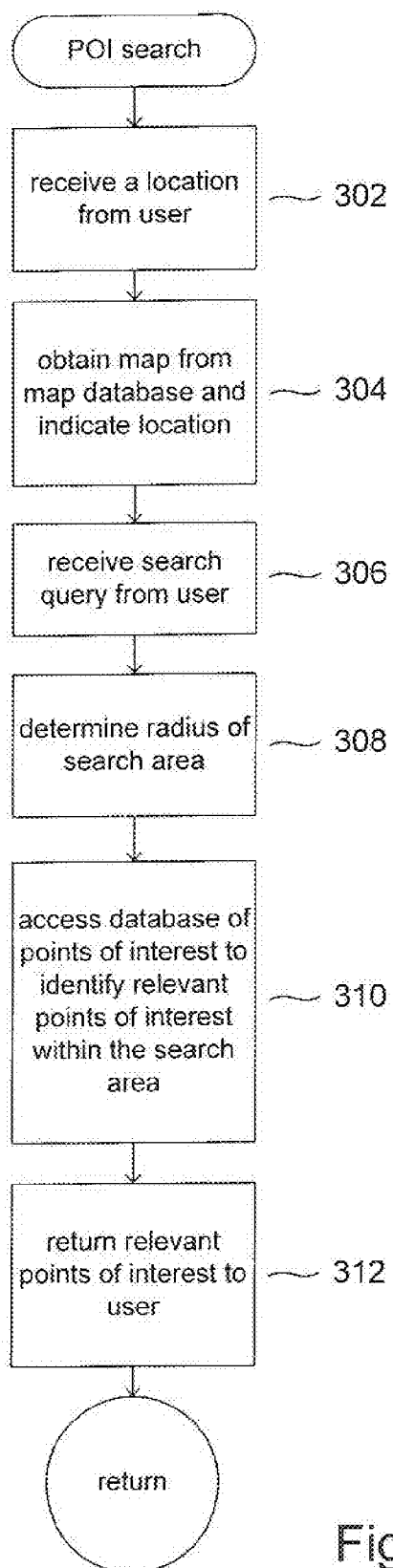


Figure 3
- Prior Art -

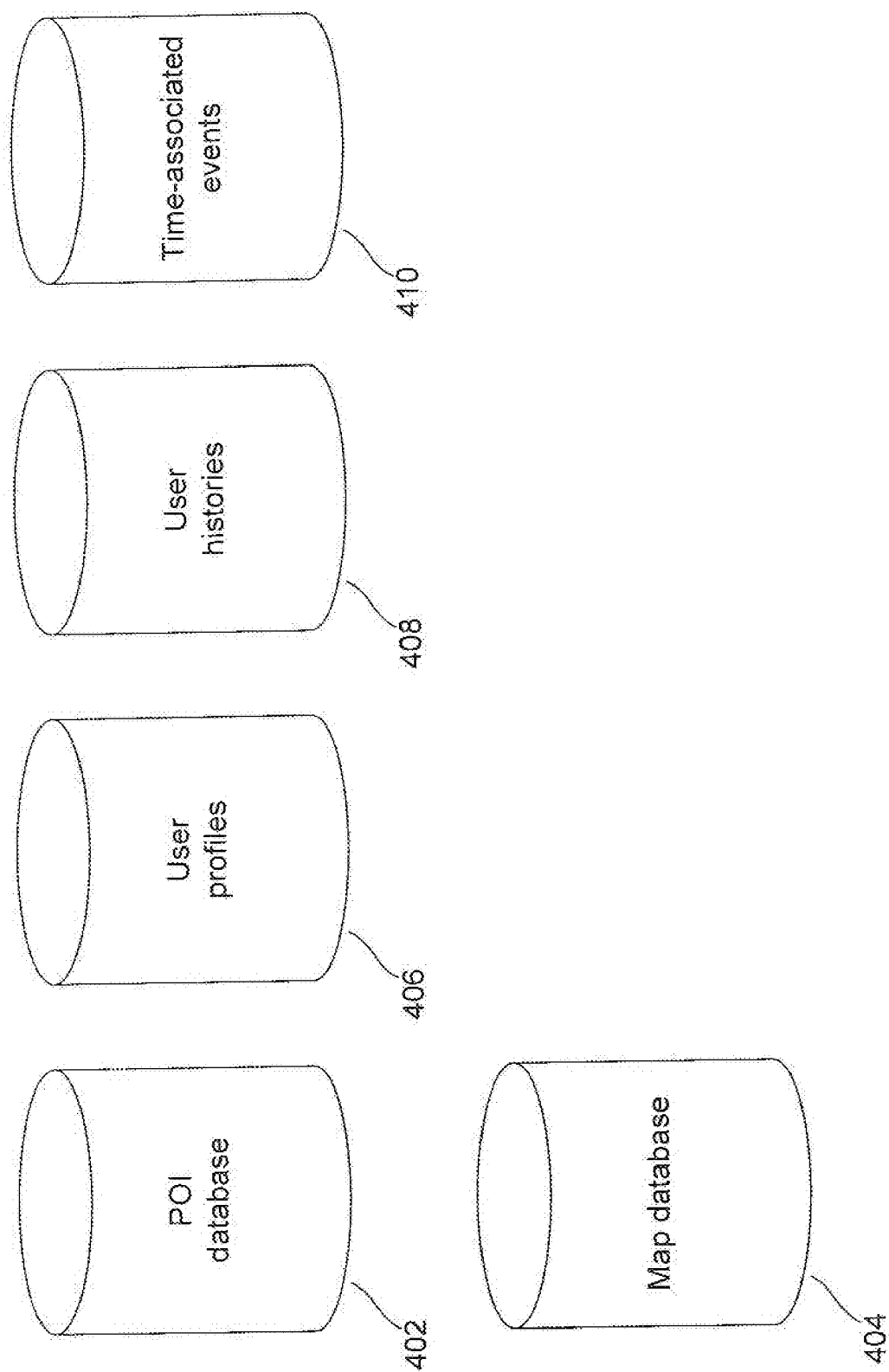


Figure 4

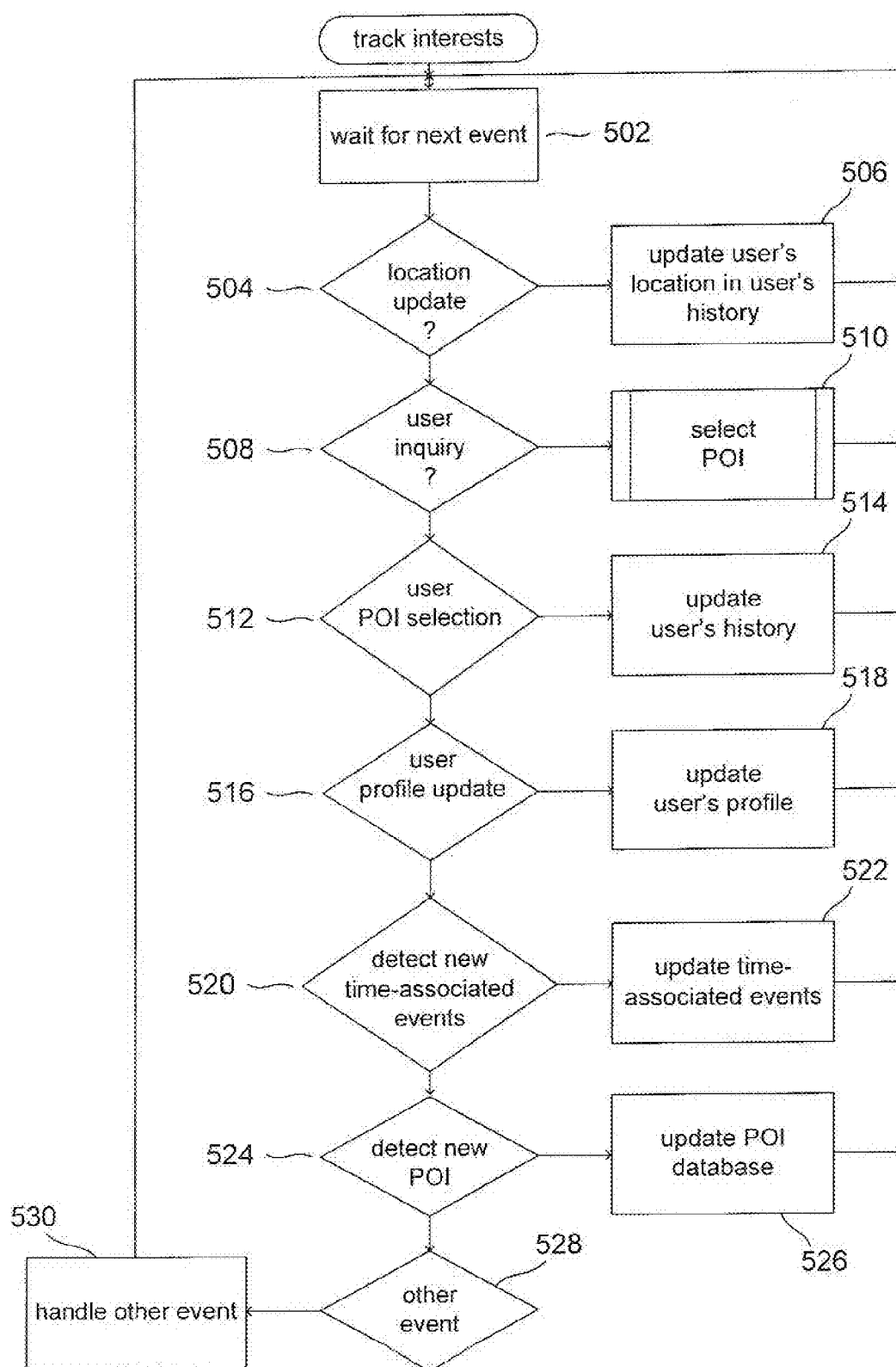


Figure 5

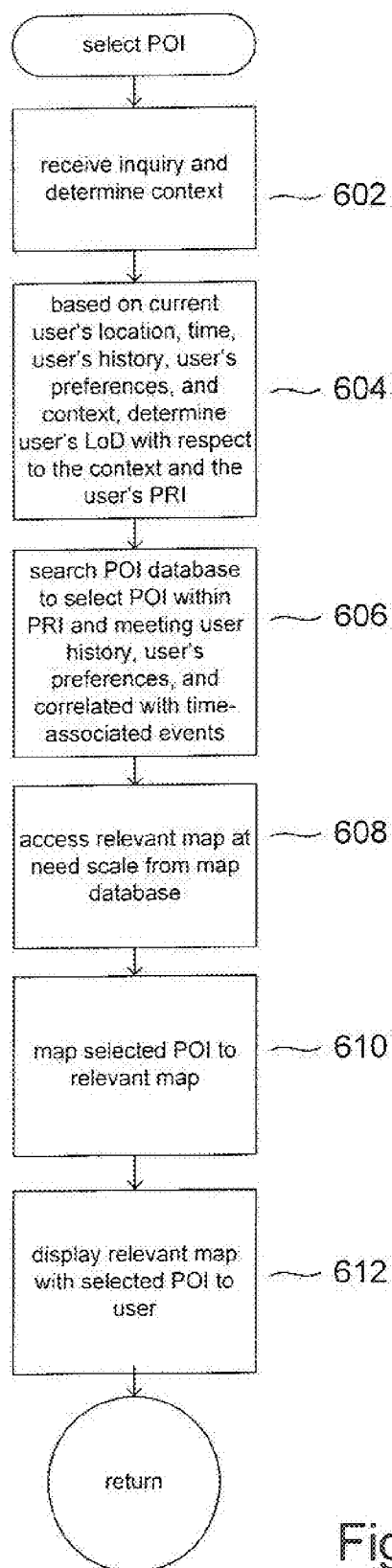


Figure 6

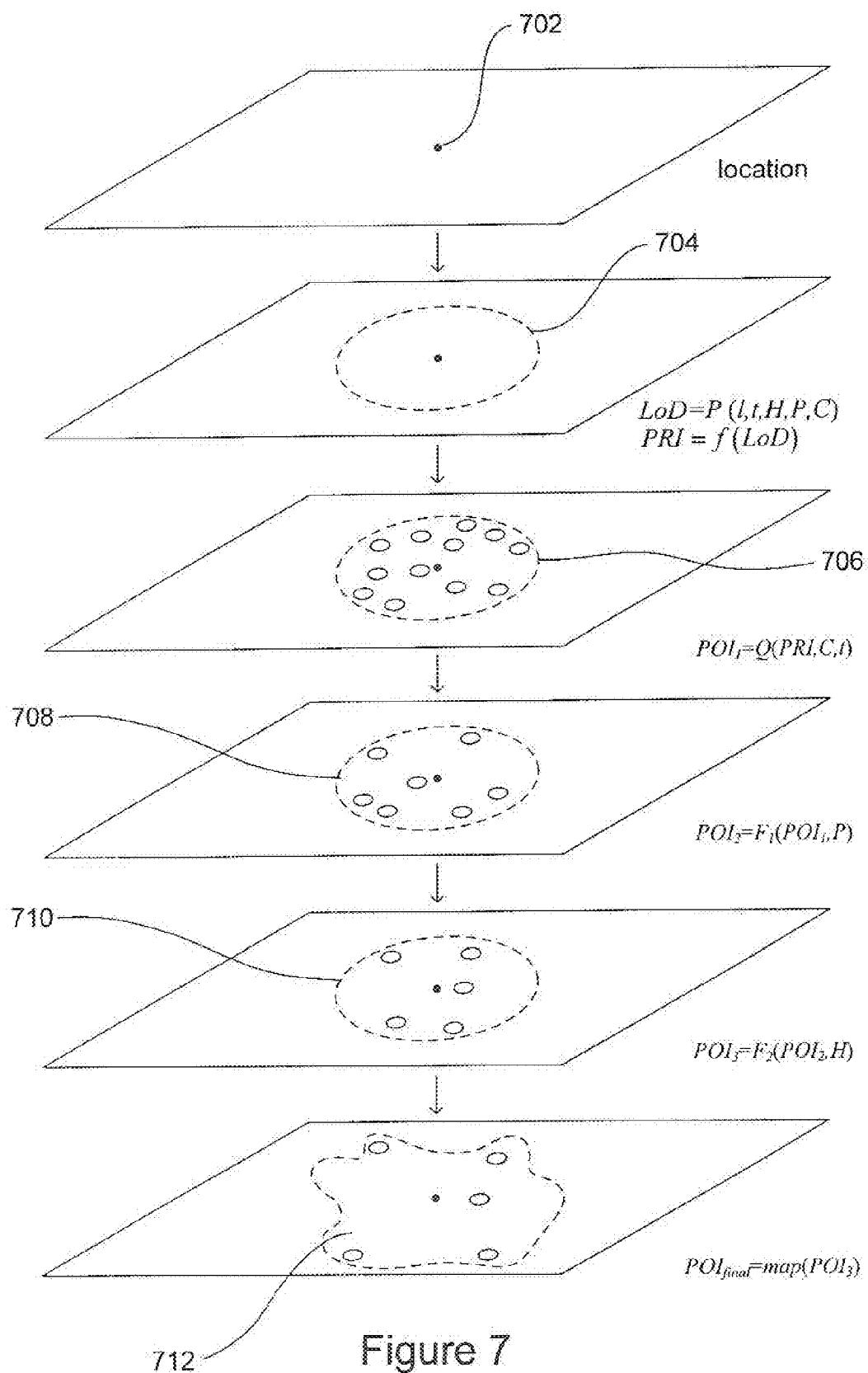


Figure 7

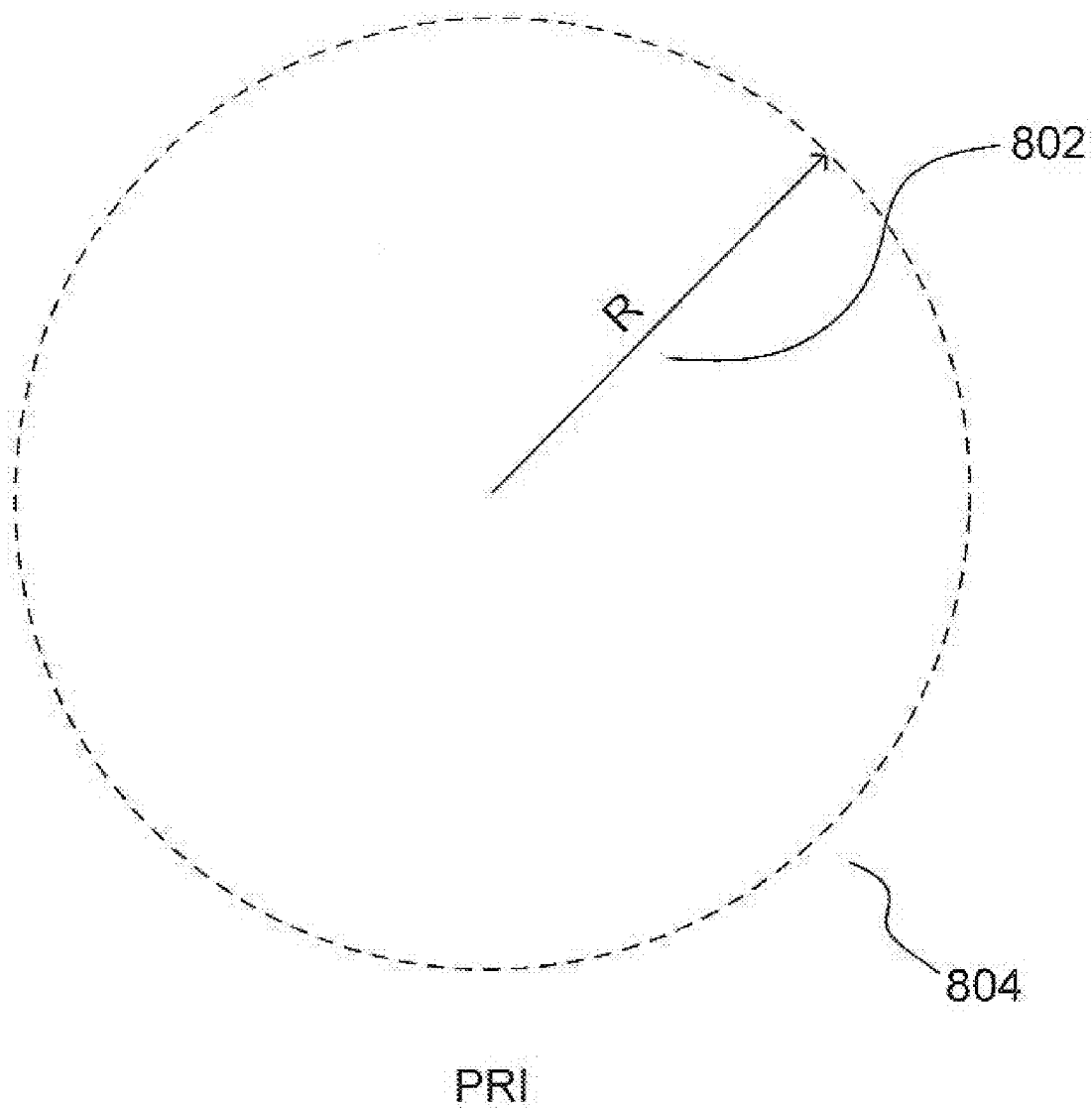


Figure 8

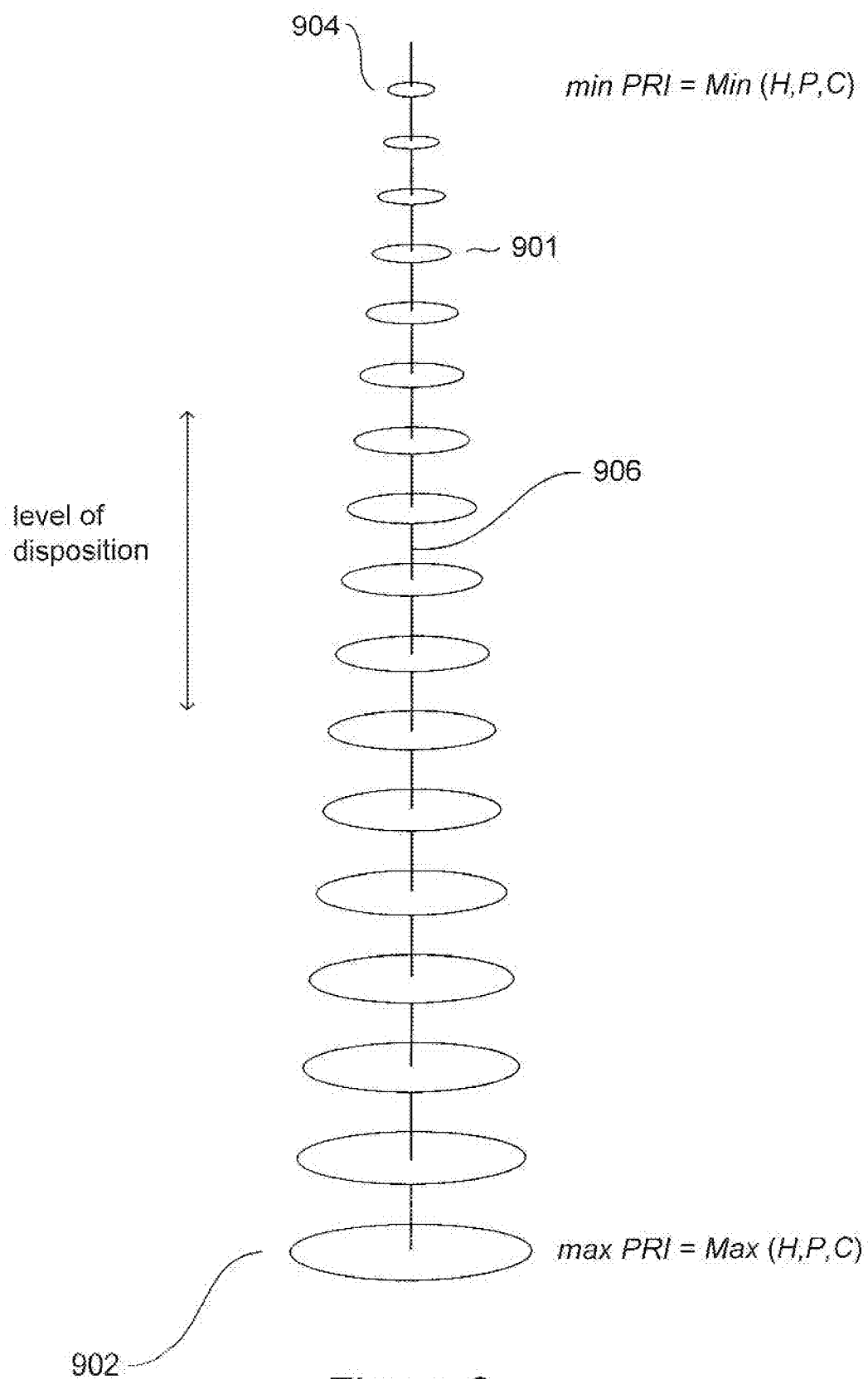


Figure 9

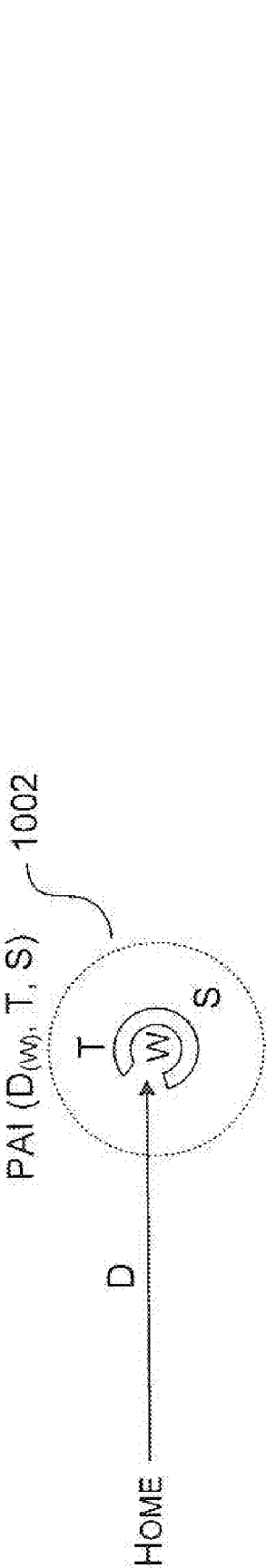


Figure 10A

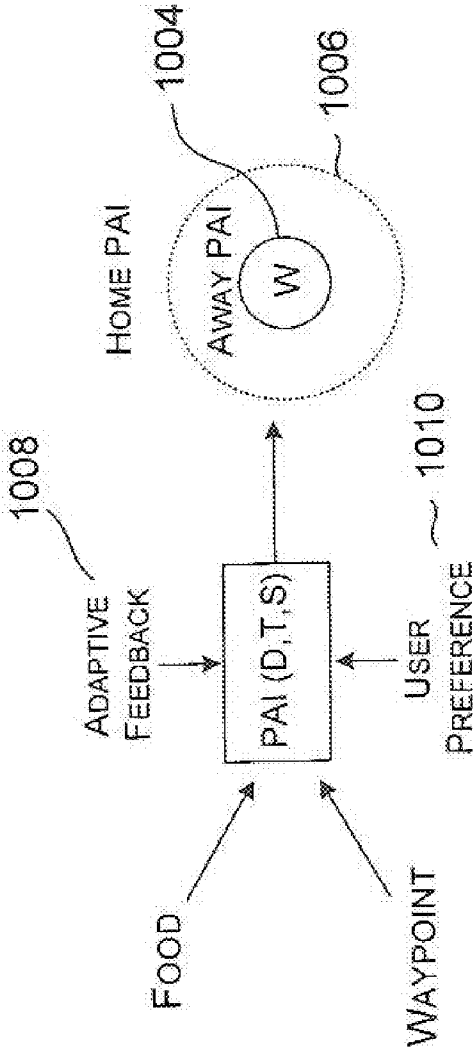


Figure 10B

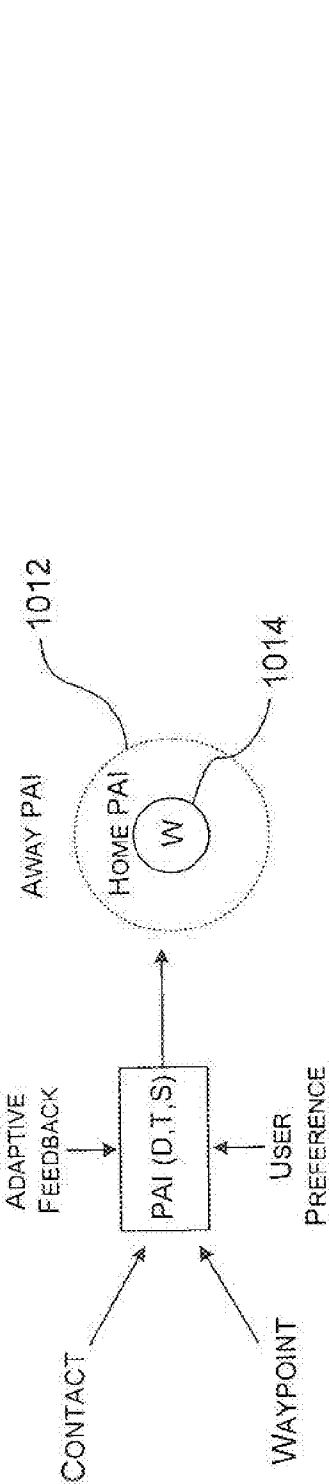


Figure 10C

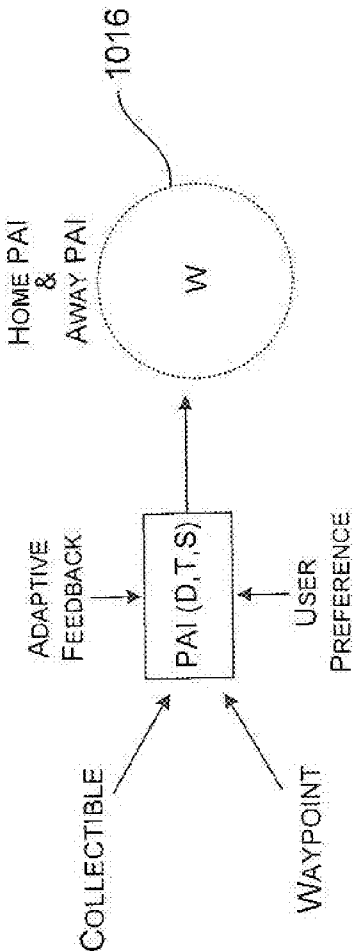


Figure 10D

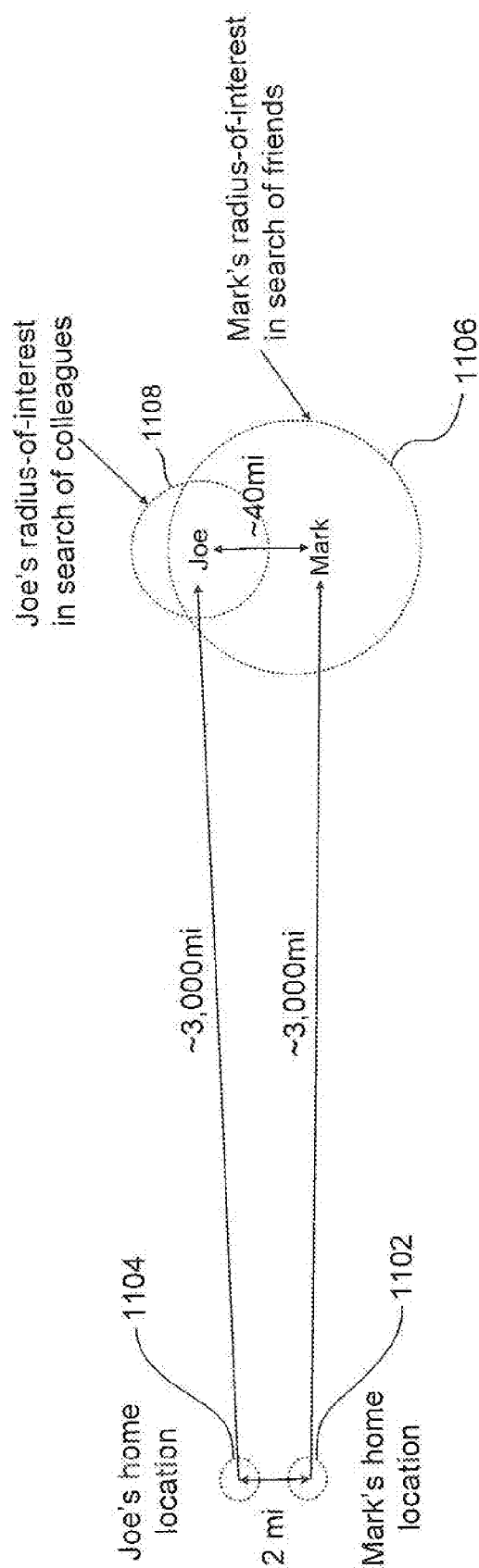


Figure 11A

| Mark's Contact | Relationship Factor |
|----------------|---------------------|
| Joe | Friend |
| Tammy | Acquaintance |
| Tim | Buddy |
| Brian | Enemy |
| Jane | Colleague |

Figure 11B

| Joe's Contact | Relationship Factor |
|---------------|---------------------|
| Mark | Colleague |
| Bilbo | Buddy |

Figure 11C

| Relationship Factor | Disposition Weight |
|---------------------|--------------------|
| Enemy | -10 |
| Acquaintance | -3 |
| Colleague | 0 |
| Friend | 2 |
| Family/Buddy | 4 |

Figure 11D

| Distance from Home (in mi) | Joe's Base Disposition (to meet a contact) | Mark's Base Disposition (to meet a contact) |
|-------------------------------|---|--|
| 0 | 0 | 0 |
| 100 | 1 | 1 |
| 500 | 2 | 2 |
| 1000 | 4 | 3 |
| 1500+ | 6 | 5 |

Figure 11E

| Relationship Factor | Joe's Adjusted Disposition (to meet a contact in NY) |
|---------------------|---|
| Enemy | 0 |
| Acquaintance | 3 |
| Colleague | 6 |
| Friend | 8 |
| Family/Buddy | 10 |

Figure 11F

| Relationship Factor | Mark's Adjusted Disposition (to meet a contact in NY) |
|---------------------|--|
| Enemy | 0 |
| Acquaintance | 2 |
| Colleague | 5 |
| Friend | 7 |
| Family/Buddy | 9 |

Figure 11G

| Level-of-Disposition | Radius-of-Interest (in mi) |
|----------------------|-------------------------------|
| 0 | 0.2 |
| 1 | 3 |
| 2 | 7 |
| 3 | 10 |
| 4 | 17 |
| 5 | 25 |
| 6 | 32 |
| 7 | 44 |
| 8 | 50 |
| 9 | 56 |
| 10 | 63 |

Figure 11H

| Event | Location | Time spent at location (days) | Disposition Modifier |
|---------|-----------|-------------------------------|----------------------|
| Contact | Manhattan | 0 | 0 |
| Contact | Manhattan | 7 | -1 |
| Contact | Manhattan | 21 | -2 |
| Contact | Manhattan | 60 | -3 |
| Contact | Manhattan | 180+ | -4 |

Figure 11I

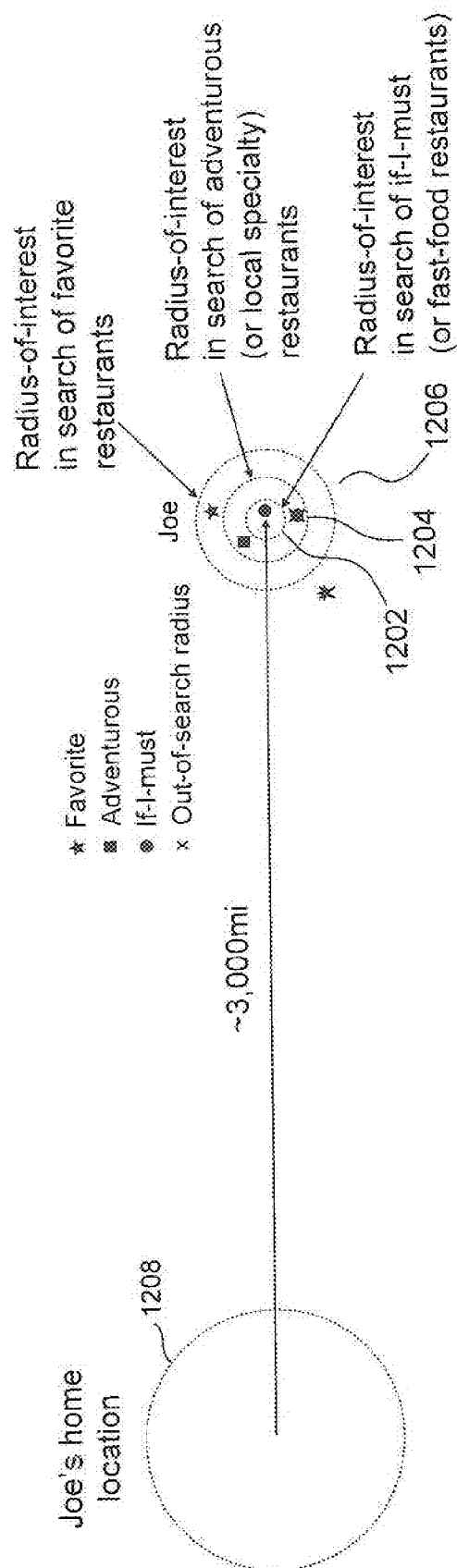


Figure 12A

| Category of Interest | Restaurant | Genre |
|----------------------|------------|------------------|
| If-I-must | Any | Fast-food |
| Adventurous | Any | Local speciality |
| Recommended | Any | Any |
| Favorite | Today | Japanese |

Figure 12B

| Category of Interest | Disposition Weight |
|----------------------|--------------------|
| If-I-must | -2 |
| Adventurous | 0 |
| Recommended | 2 |
| Favorite | 4 |

Figure 12C

| Distance from Home (in mi) | Base Disposition (search for food) |
|-------------------------------|---------------------------------------|
| 0 | 6 |
| 100 | 5 |
| 500 | 3 |
| 1000 | 2 |
| 1500+ | 1 |

Figure 12D

| Category of Interest | Joe's Adjusted Disposition (search for food in NY) |
|----------------------|---|
| If-I-must | 0 |
| Adventurous | 1 |
| Recommended | 3 |
| Favorite | 5 |

Figure 12E

| Level-of-Disposition | Radius-of-Interest (walking in ft) | Radius-of-Interest (driving in mi) |
|----------------------|---------------------------------------|---------------------------------------|
| 0 | 50 | 0.5 |
| 1 | 250 | 1.5 |
| 2 | 500 | 3.0 |
| 3 | 800 | 5.0 |
| 4 | 1100 | 7.0 |
| 5 | 1500 | 9.5 |
| 6 | 1900 | 12.0 |
| 7 | 2350 | 15.0 |
| 8 | 2800 | 18.0 |
| 9 | 3300 | 22.0 |
| 10 | 3800 | 26.0 |

Figure 12F

| Event | Location | Time spent at location (days) | Disposition Modifier |
|-------|-----------|----------------------------------|-------------------------|
| Food | Manhattan | 0 | 0 |
| Food | Manhattan | 1 | 2 |
| Food | Manhattan | 2 | 4 |
| Food | Manhattan | 3+ | 5 |

Figure 12G

| Category of Interest | Wish List |
|----------------------|-------------------|
| Nice-to-have | Rabbit's Food |
| Hard-to-find | Ming-Dynasty Vase |
| Got-to-have | Mona Lisa |

Figure 13B

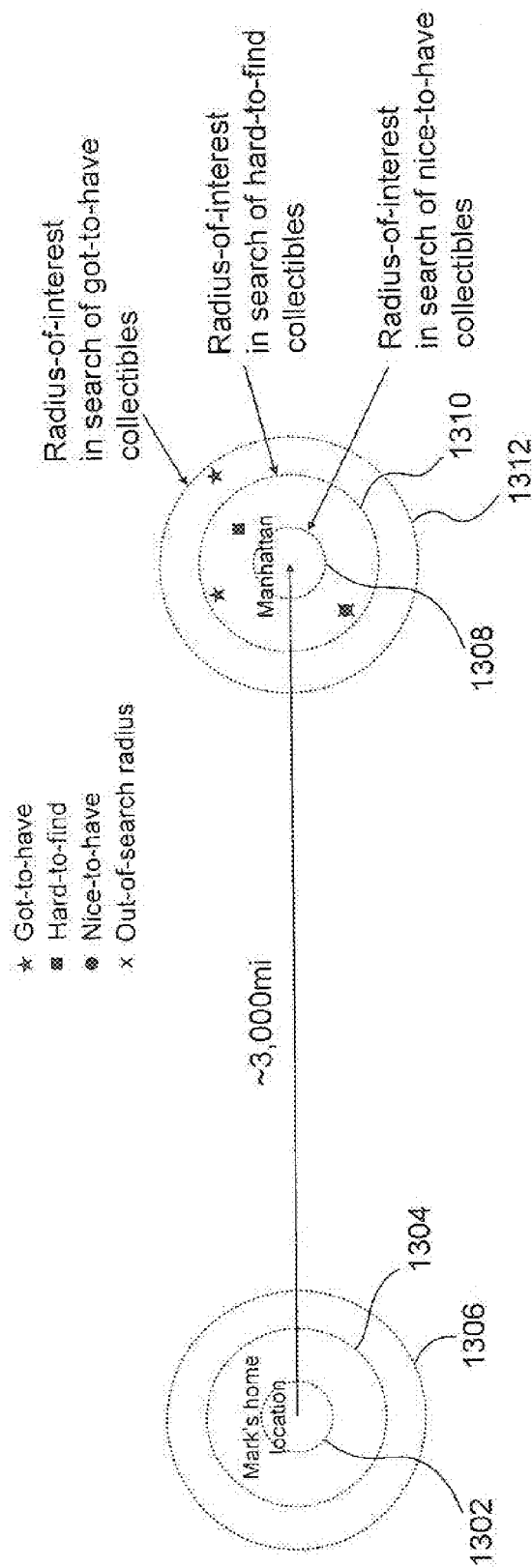


Figure 13A

| Category of Interest | Disposition Weight |
|----------------------|--------------------|
| Nice-to-have | 0 |
| Hard-to-find | 2 |
| Got-to-have | 5 |

Figure 13C

| Distance from Home (in mi) | Base Disposition (search for collectible) |
|-------------------------------|--|
| 0+ | 5 |

Figure 13D

| Category of Interest | Mark's Adjusted Disposition (search for collectible in NY) |
|----------------------|---|
| Nice-to-have | 5 |
| Hard-to-find | 7 |
| Got-to-have | 10 |

Figure 13E

| Level-of-Disposition | Radius-of-Interest (in mi) |
|----------------------|-------------------------------|
| 0 | 0 |
| 1 | 3 |
| 2 | 6 |
| 3 | 10 |
| 4 | 15 |
| 5 | 20 |
| 6 | 25 |
| 7 | 34 |
| 8 | 49 |
| 9 | 74 |
| 10 | 105 |

Figure 13F

| Event | Location | Time spent at location (days) | Disposition Modifier |
|-------------|-----------|----------------------------------|-------------------------|
| Collectible | Manhattan | 0+ | 0 |

Figure 13G

METHOD AND SYSTEM FOR CONTINUOUS, DYNAMIC, ADAPTIVE SEARCHING BASED ON A CONTINUOUSLY EVOLVING PERSONAL REGION OF INTEREST

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation of application Ser. No. 11/825,145, filed Jul. 3, 2007.

TECHNICAL FIELD

[0002] The present invention is related to personalized search methods and systems and, in particular, a method and system for providing personalized searches based on continuously evolving regions of interest

BACKGROUND OF THE INVENTION

[0003] Search techniques are the cornerstone of information retrieval in many different information-distribution environments and problem domains. For example, search methods based on card catalogs and the Dewey Decimal System provided the foundation for library research for many decades prior to the advent of cheap personal computers. For a significant period of time, dial-up information systems were the primary searching tool available for scientific and medical researchers. Currently, Internet search engines are among the most frequently used and highest-revenue-generating tools provided on the Internet, and electronic searching is being incorporated into an ever-increasing number of different electronic devices; from automobile navigation systems to cell phones.

[0004] One increasingly widely available information-retrieval method offered to users of various electronic devices involves locating points of interest ("POIs") with respect to a user's current location, as specified by the user or as detected by global positioning services ("GPS") devices incorporated into the electronic devices, including automobile navigation systems, cell phones, personal digital assistants, mobile personal computers, and other electronic devices. FIGS. 1A-C illustrate an example of currently available location-based POI searching. In this example, as shown in FIG. 1A, the user's current location is indicated by a graphical object 102 superimposed on a street map. Next, as shown in FIG. 1B, a radius 104 with an endpoint coincident with the user's current location specifies a disk-like search area 106 within which the user wishes to locate points of interest. The radius 104 may be specified by the user or may be a default distance value incorporated into the location-based POT search system. As shown in FIG. 1C, the location-based POI search system then finds and displays the locations of a class of points of interest specified by the user. For example, in FIG. 1C, the user has specified, through a text query or through interaction with a user interface, a desire to find gift-card shops proximal to the user's current location. The location-based POI search system has located and displayed the locations of three gift-card shops 108-110. Although the display formats, query inputs, and other features and characteristics of various location-based POI search systems vary, currently available location-based search systems essentially display a map for a region that includes a user's location and that is annotated with points of interest corresponding to a search query or, alternatively, may provide a list of POIs and corresponding addresses and/or travel directions.

[0005] FIG. 2 illustrates the data components of the location-based POI search system described above, with reference to FIGS. 1A-C. The location-based POI search system employs a map database 202 as well as a points-of-interest database 204. These two database components, along with software-encoded logic for receiving, parsing, and executing search requests and displaying search results, enable location-based POI search queries to be fielded from, and location-based POI search results to be returned to, users of a large number of different types of electronic devices, from personal computers to automotive navigation systems and cell phones.

[0006] FIG. 3 is a simple control-flow diagram that illustrates logical steps executed by a generalized, currently-available location-based POI search system, such as the location-based POI search system discussed above, with reference to FIGS. 1A-C. In step 302, a location is received from a user, either specified by the user through a user interface, or obtained via a GPS component or other location-determining component of an electronic device. Next, in step 304, a suitable map corresponding to the received location is searched for, and retrieved from, the map database, and indication of the user's location is superimposed on the map, as shown in FIG. 1A. Next, in step 306, a search query is received from the user. The search query may be typed into a user interface, selected from an icon display on a touch screen, or generated by other, similar means. Then, in step 308, the radius of the search area is obtained or determined. The radius of the search area may be specified by a user, or retrieved as a default value from memory or from a database. Then, in step 310, the POI database is accessed in order to identify relevant POIs and their corresponding locations within the search area, according to the specification of desired POIs represented by the received search query. Finally, in step 312, indications of the identified POIs within the search area are superimposed graphically onto the map and displayed to the user. Many of these steps may be combined together in various types of search systems, and, as discussed above, lists of POIs may be returned, rather than annotated maps.

[0007] Location-based POI searches provide great convenience and utility to users of various devices. However, the currently available POI search systems and methods, discussed above with reference to FIGS. 1-3, are associated with a number of deficiencies. First, currently available POI searching generally returns the same results to any user specifying a particular type of search. For example, a location-based search for sporting-goods stores would return the same result to a sophisticated professional athlete or professional team manager who has traveled to a city for an upcoming professional sporting event as returned a high-school student looking for a pair of sneakers close to home. The professional athlete or professional team manager would likely not be interested in general department stores with shoe departments that sell sneakers, while the high-school student likely would not be interested in a high-end store selling professional sports equipment. Moreover, the professional athlete or professional team manager may be willing to travel many miles for a necessary piece of equipment, while the high-school student might be willing to walk or ride a bus to a destination within a distance of no more than several miles from home. POI searches are not well-tailored to particular users, particular user's contexts, and particular user's circumstances, and generally return a large amount of unneeded and unappreciated information, while often not returning results that would be of great benefit to a particular user. For this reason, users of

location-based POI search systems, designers and vendors of location-based POI-search software, and designers, manufacturers, and vendors of a wide variety of electronic devices that feature location-based POI searching have all recognized the need for location-based POI searching better adapted to particular users.

SUMMARY OF THE INVENTION

[0008] Embodiments of the present invention are directed to flexible, user-adapted, continuous searching, on behalf of a particular user, for points of interest relevant to the user's current or projected location within a specifically computed personal region of interest. In a general case, the personal region of interest is computed as a function of the user's level of disposition towards the searched-for points of interest. The level of disposition towards the searched-for points of interest may, in turn, be based on two or more of the user's current or projected location, the current date and time, a history of the user's location and interaction with the POI-searching system, including user-initiated searches and user selections from displayed search results, a user profile developed for, and continuously updated on behalf of, the user, and a current context for the search, as specified by a search query or by other context-specifying means. The personal region of interest generally defines an abstract area, volume, or hypervolume within which method and system embodiments of the present invention search for points of interest.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIGS. 1A-C illustrate an example of currently available location-based POI searching.

[0010] FIG. 2 illustrates the data components of the location-based search engine described above, with reference to FIGS. 1A-C.

[0011] FIG. 3 is a simple control-flow diagram that illustrates logical steps in execution of a location-based POI search, such as the location-based POI search discussed above, with reference to FIGS. 1A-C.

[0012] FIG. 4 illustrates database components of certain general method and system embodiments of the present invention.

[0013] FIG. 5 is a control-flow diagram of the interests-tracking component of general method and system embodiments of the present invention with respect to a particular user.

[0014] FIG. 6 is a control-flow diagram for the routine "select POI," called in step 510 of FIG. 5, which represents an embodiment of the present invention.

[0015] FIG. 7 graphically illustrates location-based POI searching according to various system and method embodiments of the present invention.

[0016] FIG. 8 shows a simple, disk-like-area representation of an PRI.

[0017] FIG. 9 illustrates the concept of a "level of disposition."

[0018] FIGS. 10A-D illustrate the types of PAI, a special case of PRI, involved in three example points-of-interest searches.

[0019] FIGS. 11A-11I illustrate an exemplary contacts search.

[0020] FIGS. 12A-G illustrate an exemplary food-related POI search.

[0021] FIGS. 13A-G illustrate an exemplary collectibles-related POI search.

DETAILED DESCRIPTION OF THE INVENTION

[0022] The present invention is directed to highly user-adapted, continuous, dynamic, and adaptive location-based POI searching methods and systems. Unlike currently available location-based POI searching methods and systems, method and system embodiments of the present invention maintain user profiles and user histories that constantly evolve through user interaction with the location-based POI-searching systems of the present invention. Location-based POI searching, according to method and system embodiments of the present invention, is based on a personal region of interest that is computed, on a search-by-search basis, from the values of various parameters and various types of stored data in different method and system embodiments of the present invention.

[0023] In contrast to the two-database-component location-based POI searching described with reference to FIGS. 1-3, the general method and system embodiments of the present invention employ a greater number of data components and more sophisticated, software-implemented logic. FIG. 4 illustrates database components of certain general method and system embodiments of the present invention. The database components include a POI database 402 and a map database 404, as employed by currently available methods. However, general method and system embodiments of the present invention also employ a user-profiles database 406, a user-histories database 408, and a database of various time-associated events 410. The database components shown in FIG. 4 are not exhaustive. Additional database components may be employed in various embodiments of the present invention, and fewer database components may be employed in other embodiments of the present invention. Moreover, the database components are not necessarily separate databases, or discretely implemented, but may be implemented, for example, as different sets of tables in a single, extensive relational database, or may be implemented as two or more databases of various types residing locally or remotely. In addition, the types of stored information and databases, discussed above, may instead be obtained by secondary searching of various information sources, including the world-wide web, electronic information streams, and various types of broadcast information.

[0024] In contrast to currently available methods, method and system embodiments of the present invention track users' interactions with search-system embodiments over time in order to track and continuously refine a stored representation of the users' interests with respect to a variety of different contexts. FIG. 5 is a control-flow diagram of the interests-tracking component of general method and system embodiments of the present invention with respect to a particular user. The control-flow diagram of FIG. 5 is represented as an endless loop, with user-interest tracking carried out continuously or at regular intervals as a user moves through, and interacts with, the user's environment and with the search system. In step 502, the interests-tracking method waits for a next event. When a next event occurs, the interest-tracking method determines what type of event has occurred, and responds accordingly. If a location-update event is detected, in step 504, then the user's current or projected location is updated, in step 506. The user's location may be stored in the user's history, or in some other database or data-storage loca-

tion, including an electronic memory. If, instead, the detected event corresponds to a user inquiry or user search, as determined in step 508, then the routine “select POI” is called, in step 510. The routine “select POI” is discussed below, in greater detail. If the detected event corresponds to selection, by the user, of a displayed POI for additional information or other interaction, as determined in step 512, then the user’s history is correspondingly updated, in step 514, so that, over time, the user’s history can be employed to refine POI searches as well as to update and refine a user’s profile, or, in other words, stored user’s preferences. If the detected event is a user profile update, as determined in step 516, then the user’s profile is updated, in step 518. A user may explicitly, through interaction with the system, specify or update preferences stored in the user’s profile. Alternatively, a user-profile-update event may be generated as a result of other activities and events, including updates to a user’s history or selection by a user of displayed results.

[0025] If the detected event corresponds to detection, by the system, of new time-associated events, as determined in step 520, then the time-associated-events database is updated in step 522. Just as the search system continuously or periodically tracks a user’s location and monitors a user’s interaction with the system, the search system also tracks various information sources in order to accumulate timely information about various events and occurrences that may be relevant to POI searching. As one example, POI searching for musical events may rely on continuous detection and updating of a calendar of musical events stored in the time-associated-events database. If the detected event is a new point of interest, as determined in step 524, then the POI database is updated in step 526. Just as the system continuously monitors information sources in order to detect a variety of different time-associated events, the system also monitors information sources in order to identify new points of interest for inclusion in the POI database. Any of various other events, detected in step 528, are accordingly handled in step 530. The interests-tracking method shown in FIG. 5 is carried out by system embodiments of the present invention on behalf of all users. Interests tracking, in turn, provides POI searches initiated by users, or automatically initiated due to detection of associated events, such as changes in users’ current or projected locations, or various interactions of the user with the system, that are as specifically tailored to individual users as possible, so that the POI searches return current, up-to-date POI information, as constrained by the user’s current preferences, accumulated history, and the up-to-date time-associated events stored in the time-associated-events database.

[0026] FIG. 6 is a control-flow diagram for the routine “select POI,” called in step 510 of FIG. 5, which represents an embodiment of the present invention. In step 602, the routine “select POI” receives an inquiry from a user and determines a context for a POI search. The user may explicitly enter search criteria, through a user interface, may indicate search criteria through interaction with an icon-based, touch screen, or other such interactive system, or the search inquiry may be generated by other events, such as changes in the user’s current or projected location, access by the user to various features of an electronic device, such as a cell phone, and may be triggered by other events and activities. A context is a collection of search-subject constraints and search-subject-related parameters associated with a search. A context may be largely derived from a search query, but may also be derived from

additional information, including information stored for a user by the location-based POI search system.

[0027] In step 604, a personal region of interest (“PRI”) is computed based on the user’s level of disposition (“LoD”), in turn based on two or more of: (1) the user’s current location; (2) the current time and date; (3) the user’s location and POI selection history; (4) the user’s preferences stored in the user’s profile; (5) the context determined above in step 602; (6) a projected user location; (7) a future time and date; and (8) any of numerous other types of information relevant to computing the LoD with respect to the context for the search. Specific examples of LoDs and PRIs are discussed, below. Then, in step 606, the POI database is searched to select POIs within the computed PRI that meet various constraints embodied in the context, user’s history, user’s preferences, and as correlated with time-associated events. In step 608, the map database is accessed to retrieve a relevant map at a relevant scale. Then, in step 610, the retrieved POIs are mapped to the relevant map retrieved in step 608. Finally, the relevant map with indications of the selected POIs is displayed to the user in step 612. It is important to note that the PRI computed in step 604 is an abstract area, volume, or hypervolume, rather than a fixed, disk-like geographical area as computed by currently available methods, discussed above with reference to FIG. 1B. Because the PRI is abstract, the PRI may not represent a simple, geometrical area or volume, such as the disk-shaped search area shown in FIG. 1B. In alternative embodiments of the present invention, results may be returned as lists of POIs along with addresses and/or travel directions, rather than as map annotations, or lists of POIs along with times and other relevant information for non-geographic POIs.

[0028] FIG. 7 graphically illustrates POI searching according to various system and method embodiments of the present invention. The POI searching begins with a user’s location 702, either current or projected. The user’s location is continuously monitored by the system as, for example, by continuously monitoring GPS or other location-determining-component signals produced by electronic equipment carried by the user. Alternatively, the user’s location may be monitored by user interaction with various personal electronic devices, including personal computers, or by the user’s interaction with various other devices, such as ATM machines, airport ticket machines, credit-card-processing machines, telephones, and other such devices. In other cases, the starting location may be a projected location, where the user will travel to at a future point in time. Next, a PRI 704 is computed from the user’s LoD, the LoD computed from, in general, the user’s location **1**, the current time and date **t**, the user’s location and POI selection history **H**, the user’s preferences **P**, and the search context **C**. The PRI is a fundamental constraint on POI searching. In certain instances, the LoD may be computed on fewer than the above-discussed number of input parameters, and in other embodiments of the present invention, additional input parameters may be used. The computed PRI may then be populated by POIs obtained in an initial search based on the computed PRI, the current context **C**, and the current time **t** 706. These initially selected POIs may then be filtered, as well as supplemented, based on the user’s preferences 708 and on the user’s history 710. In general, filtering decreases the number of POIs, although additional POIs may be added as a result of consideration of the user’s preferences and histories. Finally, the POIs are mapped to geographical locations, in the case of geographically located

POIs, or mapped to some other specified space **712**. As an example of additional types of spaces, POIs may be searched for with respect to proximity in time, rather than, or in addition to, geographical location, and the selected POIs may be displayed along a timeline relative to the current time, rather than as geographical positions relative to the current user's location. In other cases, both location and time may be considered, and in still additional cases, various other parameters may be considered, including cost, product specification, associated features, and many other such considerations and dimensions.

[0029] At an abstract level, a PRI may be conceptually imagined to be a disk-shaped region specified by a radius. FIG. **8** shows a simple, disk-like-area representation of a PRI. However, as noted above, a PRI may be a computed volume, rather than an area, in cases where three-dimensional locations are relevant, or in cases where additional, non-geographic dimensions are employed. The PRI may be a hyper-dimensional volume in a higher-dimensional space. Moreover, the radius **802** by which a PRI **804** is specified may represent a single constraint, such as distance, or multiple constraints, such as time and distance, distance and convenience, or many other such dimensions and/or considerations. As one example, a user currently located in a particular department, on a particular floor, of a multi-story department store or shopping mall may wish to search for points of interest within a three-dimensional volume proximal to the user's location, rather than a two-dimensional area on the floor on which the user is currently located. As another example, a user may wish to search for POIs within a certain distance of the user's current position as well as POIs reachable within some maximum amount of time, regardless of distance. These criteria may become quite complex. For example, the user may have separate time, distance, and convenience thresholds for different types of available transportation that, in turn, depend on the user's location. For example, the user may be willing to travel four miles or up to 15 minutes by subway, but only one-half mile and up to 20 minutes by foot.

[0030] In non-geographical spaces, a wide variety of different types of constraints may be employed to define a LoD from which a PRI is computed. For example, in a search for books on the Internet, the LoD may be defined by timeliness of shipping, publication date, and other such considerations.

[0031] FIG. **9** illustrates the concept of a "level of disposition." In FIG. **9**, each disk-like object, such as disk-like object **901**, represents a particular LoD value, or, more particularly, a PRI computed from a particular LoD values. In general, LoDs are constrained to fall between a maximum LoD, represented by the maximally sized PRI **902**, and a minimum LoD, represented by the minimally sized PRI **904**. The maximum and minimum LoD can be computed based on the user's history, preferences, and the current context. A computed LoD, based on additional factors that may include current location, current time, projected location, projected time, various time-associated events, and other such factors, can then be thought of as falling within the range of possible LoD values within the range of LoD values between the maximally sized LoD **902** and minimally sized LoD **904**, shown at intervals along an LoD axis **906**. In other words, PRIs are generally bounded by maxima and minima, with ranges of possible values, and with particular values selected by a various parameters and characteristics that together specify a level of disposition.

[0032] Next, three different simple examples of PRI-and-location-based. POI searching according to method and system embodiments of the present invention are provided, with reference to FIGS. **10A-13G**. FIGS. **10A-D** illustrate the types of PRI involved in these examples. In all three examples, the PRIs are personal areas of interest ("PAIs"), a special, two-dimensional case of the more general PRI. In general, PRIs are directly computed from LoDs, so LoD and PRI or PAI are used interchangeably. In general, as shown in FIG. **10A**, the PAI **1002** centered at a particular waypoint, or current or projected user location, W, and has an area determined by the distance of the waypoint W from the user's home, the time T recently spent by the user at the waypoint W, and the search criteria of the search for which the PAI is computed. In one example, as shown in FIG. **10B**, the PAI is computed to facilitate a search for food-related points of interest, and the area of the PAI ranges from a small area **1004** at locations distant from the user's home to a large area **1006**, for a food-related search when the user is at home. The general concept is that a user is more willing to travel further, at home, than in distant locations in order to find a suitable restaurant. However, of course, this general concept may be modified, over time, by feedback **1008** collected as a user history, by explicitly specified or implicitly derived user preferences **1010**, or by the passage of time should the user remain in a distant, non-home location. In another example, as shown in FIG. **10C**, a search is made for personal contacts, with the distance a user is willing to travel to meet a personal acquaintance or friend greater at a location distant from the user's home than at the user's home, reflected in the larger PAI **1014** for contact searches at distant locations than the smaller PAI **1014** for contact searches at home. In yet another example, as shown in FIG. **10D**, the PAIs **1016** associated with distance locations and home locations have identical areas, suggesting that a user's willingness to find collectibles is generally location independent. Again, in the latter two examples, the PAI computation may also be directed by additional information, including history and preference information.

[0033] In a first example, introduced above with reference to FIG. **10C**, two acquainted users Mark and Joe may search for personal contacts, including each other, both at their respective homes in Seattle and at a distant location, in the example Manhattan. FIGS. **11A-11I** illustrate this exemplary contacts search. As shown in FIG. **11A**, the PAIs at Mark's and Joe's homes **1102** and **1104** are smaller, in area, than the PAIs computed for Mark and Joe (**1106** and **1108**, respectively) at distant locations. In other words, the two acquaintances, who live within two miles of each other and who might get together occasionally when at home, are much more eager to meet when both happen to be in distant locations, even when, at the distant locations, they are separated by a considerably larger distance than the distance of separation of their homes.

[0034] A user-profile database contains tables or views that represent Mark's and Joe's level of relationship, as shown in FIGS. **11B-C**. The level of relationship may be user-defined, adapted, and/or inferred from a degrees-of-separation analysis, for example. A degrees-of-separation analysis may be based on one or more user communities in which Mark and Joe participate, and subgroups within such communities to which Mark and Joe belong. A weight can be associated with each level of relationship factor, with respect to a contact search, and can also be user-defined, adapted, and/or inferred from a degrees-of-separation analysis of user communities in

which Mark and Joe participate. FIG. 11D shows a table or view that represents both Mark's and Joe's weights associated with relationship factors. FIG. 11E shows a table or view that represents Mark's and Joe's base dispositions to meet an acquaintance or friend at various distances from home. These tables can be used to compute adjusted dispositions for Mark and Joe to meet people associated with different relationship factors, as represented by the tables or views shown in FIGS. 11F and 11G. The table or view shown in FIG. 11H indicates the radius for a computed PAI associated with different, possible level-of-disposition values. The PAI radii for a contact search initiated by Mark and Joe when both are in Manhattan are easily obtained from the above-described tables. In this example, Joe's disposition to meet any contact considered a "colleague" is 6, which corresponds to a PAI with a 32-mile radius. Mark's disposition to meet any contact considered as a "friend" is 7, which corresponds to a PAI with a 44-mile radius. In this scenario, a search for contacts by Joe in Manhattan would not return Mark, but a search for contacts by Mark in Manhattan would return Joe. Finally, the table or view shown in FIG. 11I indicates that, as Joe and Mark spend more time at the distant locations, their dispositions to meet contacts may decrease. For example, after 180 days, Mark's overall disposition to meet any contact identified as a "friend" is 3, which corresponds to a PAI with a 10-mile radius.

[0035] The second example, introduced with reference to FIG. 10B, concerns a search for food-related points of interest. FIGS. 12A-G illustrate this exemplary food-related POI search. As shown in FIG. 12A, PAIs 1202, 1204, and 1206 reflect searches for increasingly desirable types of food-serving establishments, and are all considerably smaller than the PAI for food-related POI searches at a user's home location 1208. FIG. 12B shows a table or view indicating categories of interest related to food-serving establishments. FIG. 12C shows a table or view representing disposition weights associated with each category of interest. FIG. 12D shows base dispositions with respect to selected distances from home. FIG. 12D shows the adjusted dispositions for the user Joe when in Manhattan for each category of interest, obtained by applying the base disposition of "1" for locations greater than 1500 miles from home, in the table or view shown in FIG. 12D, to the disposition weights for each category, in the table or view shown in FIG. 12C. The table or view shown in FIG. 12F shows PAI radii for walking or driving for each of 11 possible level of dispositions, and FIG. 12G shows the increase, over time, of disposition with time spent at a distant location. In this example, a search for food-serving establishments by Joe, directly after arriving in Manhattan, returns: (1) a fast-food chain right next door to the hotel that matches Joe's disposition of 0, corresponding to a PAI with a 50-foot radius; (2) a local specialty Italian restaurant that matches Joe's disposition of 3, corresponding to a PAI with an 800-foot, radius; and (3) a Todai Japanese restaurant that matches Joe's disposition of 5, corresponding to a PAI with a 9-mile radius. The first two PAIs are based on walking to the restaurants, while the third is based on driving. However, after 3 days, Joe's overall disposition to seek his favorite restaurant Todai is 10, which corresponds to a PAI with a 3800-foot radius, when walking, and a PAL with a 26-mile radius, when driving.

[0036] The third example, introduced with reference to FIG. 10D, concerns a search for collectibles. FIGS. 13A-G illustrate this exemplary collectibles-related POI search. In this example, as shown in FIG. 13A, the PAIs computed for

various categories of collectibles at Mark's Seattle home location 1302, 1304, and 1306 are equal, in size, to PAIs computed for the same categories of collectibles at the distant location of Manhattan 1308, 1310, and 1312. The tables or views shown in FIGS. 13B and 13C include various categories of interest for collectibles and the disposition weights for the categories, respectively. The base disposition for collectibles is contained in the table or view shown in FIG. 13D, which, when applied to the disposition weights for various categories of interest, provide the adjusted dispositions for the categories of interest contained in the table or view shown in FIG. 13E. Radii of PAIs for various disposition levels are shown in FIG. 13F, and the static nature of the PAIs with respect to time spent at a location is reflected in the table or view shown in FIG. 130. In this example, a search by Mark returns information regarding a rabbit's foot that matches Mark's disposition of 5, corresponding to a PAI with a 20-mile radius, information regarding a Ming-dynasty vase that matches Mark's disposition of 7, corresponding to a PAI with a 34-mile radius, and a Mona Lisa painting that matches Mark's disposition of 10, corresponding to a PAI with a radius of 105 miles.

[0037] Thus, the location-based POI searching methods and systems of the present invention consider stored information particular to a user, as well as a search context, to compute, for each search conducted on behalf of a user, a PRI within which POIs are selected for display to the user. In the, above discussion, PRIs are circular, spherical, or hyperspherical, but, in alternative embodiments, may have other geometries and configurations. For example, PRIs may be square or rectangular, when PRIs are defined by city-block distance, rather than by straight line distance. PRIs are not necessarily reflective of geographical areas, timeline distances, or metrics associated with other real-world spaces, since PRIs may be defined by many different types of constraints. For example, a PRI constrained by a maximum distance of 4 miles or by a maximum time of travel of 20 minutes may have outer boundaries that, arc quite non-circular, instead resembling an octopus with tentacles corresponding to major arterials or subway lines. As discussed above, a user's current location may be geographical, but also may be a location in time, or in other types of dimensioned spaces.

[0038] Although the present invention has been described in terms of particular embodiments, it is not intended that the invention be limited to these embodiments. Modifications within the spirit of the invention will be apparent to those skilled in the art. For example, as discussed above, a large variety of different types of PRIs may be computed for a large variety of different types of location-based POI searches. Location-based POI searching systems that represent embodiments of the present invention may employ many different types of databases and stored data, may be implemented in hardware, software, firmware, or a combination of two or more hardware, software, and firmware, using different programming and circuit-design languages, modular organization, control structures, variables, and difference in other such design parameters. User profiles may include preferences, contacts, favorites, and wish lists. POIs may include retail establishments, friends, transient events, local entertainment and attractions, and myriad products and services. PRIs may be continuous and connected, or may be a collection of discreet, smaller continuous regions.

[0039] The foregoing description, for purposes of explanation, used specific nomenclature to provide a thorough under-

standing of the invention. However, it will be apparent to one skilled in the art that the specific details are not required in order to practice the invention. The foregoing descriptions of specific embodiments of the present invention are presented for purpose of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings. The embodiments are shown and described in order to best explain the principles of the invention and its practical applications, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalents:

1. A location-based points-of-interest searching system, implemented in one or more computer systems, comprising: information, stored in one or more database components within the one or more computer systems; and searching logic, implemented as computer instructions that are executed within the one or more computer systems, that receives a points-of-interest search request from a user, computes a current personal region of interest with respect to the user and the received points-of-interest search request, searches for points of interest within the current personal region of interest, and returns, to the user, one or more points-of-interest found by searching for points of interest within the current personal region of interest.
2. The location-based points-of-interest search system of claim 1 wherein the searching logic: computes a level of disposition with respect to the received search request and the user; and computes the current personal region of interest based on the level of disposition.
3. The location-based points-of-interest search system of claim 2 wherein the searching logic computes a level of disposition with respect to the received search request and the user based on two or more of: a current location of the user; a future location of the user; a current time; a projected, future time, a current date; a projected, future date; the received points-of-interest search request; and a portion of the stored information.
4. The location-based points-of-interest search system of claim 3 wherein the stored information includes one or more of: a database of maps; personal preferences for the user; location and POI selection history for the user; a database of points of interest; and time-associated events.
5. The location-based points-of-interest search system of claim 3 wherein the current and projected location of a user may be a geographical location, a spatial location, a location in time, or a location in a dimensioned space, the search system further including:

monitoring logic that continuously or periodically update stored information related to the users' preferences and histories.

6. The location-based points-of-interest search system of claim 1 wherein the current personal region of interest is computed from one or more of:

- a current location of the user;
- a context at least in part obtained from the received points-of-interest search request;
- user preferences stored in a user profile;
- the user's history of interaction with the user's environment and with the location-based points-of-interest search system;
- time-associated events stored by the location-based points-of-interest search system; and
- the current date and time; and a portion of the stored information, and searches for points of interest within the current personal region of interest.

7. The location-based points-of-interest search system of claim 1 wherein the current personal region of interest is one of:

- a geographical region;
- a spatial, three-dimensional region;
- a portion of a timeline; and
- a volume or hypervolume in a hyper-dimensional space.
- a spatial location, a location in time; and
- a location in any dimensioned space.

8. The location-based points-of-interest search system of claim 1 further including:

- monitoring logic that monitors the user's interactions with the location-based points-of-interest search system and with the user's environment to continuously or periodically update stored information related to the user's preferences and histories.

9. The location-based points-of-interest search system of claim 1 wherein the current personal region of interest computed for a search for personal contacts has a first size when the user's location is within a threshold distance from the user's home, and wherein the current personal region of interest computed for the search for personal contacts has a second size larger than the first size when the user's location is beyond the threshold distance from the user's home.

10. The location-based points-of-interest search system of claim 1 wherein the searching logic returns, to the user, one or more points-of-interest found by searching for points of interest within the current personal region of interest by one or more of:

- returning a map that includes the current personal region of interest and annotations;
- returning a graphically displayed list of points of interest, accompanied with location specifying text;
- returning an audio rendering of a list of for the one or more points-of-interest found by searching for points of interest, accompanied with location specifying text; and;
- returning graphically displayed icons.

11. A method, carried out by computer instructions executed within a location-based points-of-interest searching system implemented in one or more computer systems, for searching for points of interest on behalf of a user, the method comprising:

- receiving, by the location-based points-of-interest searching system, a points-of-interest search request from the user,

computing, by the location-based points-of-interest searching system, a current personal region of interest, with respect to the user and the, received points-of-interest search request;

selecting, by the location-based points-of-interest searching system, points of interest within the current personal region of interest, and

returning, to the user by the location-based points-of-interest searching system, the, selected points of interest.

12. The method of claim **11** wherein the current personal region of interest is one of:

- a geographical region;
- a spatial, three-dimensional region;
- a portion of a timeline; and
- a volume or hypervolume in a hyper-dimensional space.

13. The method of claim **11** wherein the level of disposition is computed with respect to the received search request and the user based on two or more of:

- a current location of the user;
- a future location of the user;
- a current time;
- a projected, future time;
- a current date;
- a projected, future date;
- the received points-of-interest search request;
- a portion of the stored information;
- a context specified, at least in part, by the received points-of-interest search request; and
- additional stored information.

14. The method of claim **13** wherein the additional stored information includes one or more of:

a database of maps;
personal preferences for the user;
histories of location and. POI selection interactions for the user;

a database of points of interest; and
time-associated events.

15. The method of claim **11** further including:
continuously or periodically monitoring the user's current location.

16. The method of claim **15** wherein the user's current location is one of:

- a geographical location;
- a spatial location;
- a location in time; and
- a location in any dimensioned space.

17. The method of claim **11** further including:
monitoring the user's interactions with the location-based points-of-interest search system and with the user's environment to continuously or periodically update stored information related to the user's preferences and histories.

18. The method of claim **11** wherein returning, to the user the selected points-of-interest further includes:

- returning a map that includes the current personal region of interest and annotations for the one or more points-of-interest found by searching for points of interest;
- returning a list of one or more points-of-interest found by searching for points of interest; and
- displaying one or more points-of-interest found by searching for points of interest on a graphical user interface.

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