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TEMPORAL/SPATIAL CALENDAR EVENTS AND TRIGGERS

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Abstract

[0001] Spatial and/or temporal triggers may be established so that when actuated, one or more notifications such as reminders may be provided to one or more users. These triggers may be established manually, *e.g.*, by a user operating a user interface, automatically, *e.g.*, by scraping calendar and/or email data to ascertain and/or predict various aspects of upcoming appointments such as start times, duration, date, location, and so forth, or a combination of the two. Spatial triggers may be actuated based on a determination that a user is, or will be, at a particular location. Temporal triggers may be actuated at particular points in time, *e.g.*, at the scheduled time of an event or at some predetermined time interval before or after the event. Using one or more triggers, it is possible to provide notifications to a user at some predetermined time interval prior to a scheduled event, so that the user has sufficient time to make appropriate arrangements, such as buying tickets, making a reservation, scheduling a rendezvous with a friend, and so forth. A calendar system may also be interfaced with to manually or automatically establish triggers.

Background

[0002] When travelling to a particular location, it can be difficult to remember one intended to do once there. For example, a frequent traveler may have friends in cities all over the country or world, but she may not realize or remember when visiting a particular city that one or more friends now lives nearby. Even if the traveler remembers or learns that the friend lives nearby, it may already be too late to arrange a meeting if, *e.g.*, the traveler and/or the friend is busy. Such a meeting may need to be planned ahead of time. The same goes for a point of interest such as a restaurant, attraction, or event: these may require booking well ahead of the traveler's arrival. Even if a particular point of interest does not necessarily require advanced booking, the traveler may simply have forgotten about it while travelling nearby.

Description

[0003] Knowledge about users' schedules and locations may be leveraged to provide users with reminders relating to a variety of tasks and activities. A particular user's upcoming schedule may be ascertained with various degrees of confidence using a variety of techniques

(e.g., calendar entries, scraping email, navigational routing, etc.). Once the user's schedule is ascertained, various temporal and spatial triggers may be established that, when actuated, cause one or more notifications to be provided to the user and/or to one or more other people. These notifications may take a variety of forms and may communicate various types of information (*e.g.*, task reminders, paging someone to a particular location, etc.).

[0004] Fig. 1 illustrates an example environment in which temporal and/or spatial triggers may be established based on a user's ascertained schedule. The example environment includes a client device 106 and a knowledge system 102. Knowledge system 102 may be implemented in one or more computers that communicate, for example, through one or more networks 110. Knowledge system 102 is an example of an information retrieval system in which the systems, components, and techniques described herein may be implemented and/or with which systems, components, and techniques described herein may interface.

[0005] A user may interact with knowledge system 102 via client device 106 and/or other computing systems (not shown). Client device 106 may be a computer coupled to knowledge system 102 through one or more networks 110 such as a local area network (LAN) or wide area network (WAN) such as the Internet. Client device 106 may be, for example, a desktop computing device, a laptop computing device, a tablet computing device, a mobile phone computing device, a computing device of a vehicle of the user (*e.g.*, an in-vehicle communications system, an in-vehicle entertainment system, an in-vehicle navigation system), or a wearable apparatus of the user that includes a computing device (*e.g.*, a watch of the user having a computing device, glasses of the user having a computing device). Additional and/or alternative client devices may be provided.

[0006] Client device 106 and knowledge system 102 each include one or more memories for storage of data and software applications, one or more processors for accessing data and executing applications, and other components that facilitate communication over a network. The operations performed by client device 106 and/or knowledge system 102 may be distributed across multiple computer systems. Knowledge system 102 may be implemented as, for example, computer programs running on one or more computers in one or more locations that are coupled to each other through a network.

[0007] While the user likely will operate a plurality of computing devices, for the sake of brevity, examples described in this disclosure will focus on the user operating client device 106. Client device 106 may execute one or more applications, such as an email client 108, a navigation client 110, a calendar client 114, and/or a reminder application 116. In some instances, one or more of these applications may be operated on multiple client devices operated by the user. A user may operate email client 108 to send and/or receive one or more emails, *e.g.*, related to upcoming events, travel itineraries, and so forth. A user may operate navigation client 110 to obtain directions (*e.g.*, in real time) to a particular destination. A user may operate calendar application 114 to schedule various tasks, events, travel itineraries, etc. A user may operate reminder application 116 to schedule reminders to be provided to the user, *e.g.*, as part of a "to do" list. For example, a user may operate a graphical user interface, provide one or more voice commands, or provide other input to establish one or more notification triggers. In some cases, email client 108, calendar client 114, and/or reminder application 116 may be integrated into a single application.

[0008] Client device 106 may also include one or more location components. A location component may be configured to determine a user's absolute or relative location. In Fig. 1, this includes a global positioning system, or "GPS," component 112. However, other location components may be used in addition to or instead of GPS. For example, some client devices may utilize various multilateration techniques that take advantage of various wireless signals, such as Wi-Fi, cellular, and so forth, to calculate a user's location.

[0009] Knowledge system 106 may include various engines that may be implemented using any combination of hardware and software, and that may be distributed across one or more computing devices. One such engine is a schedule engine 122. Schedule engine 122 may maintain an index 124 that contains various information about schedules of one or more users. While shown as part of knowledge system 102, schedule engine 122 may be implemented in whole or in part on client device 106. For example, and as will be described below, in some instances schedule engine 122 may analyze user interaction with various applications (e.g., navigation application 110) operating on client device 106. In order to do so, schedule engine

122 may maintain some form of presence (*e.g.*, a client monitoring component) on client device 106.

[0010] Schedule engine 122 may be configured to ascertain information about users' schedules using a variety of techniques based on a variety of signals and sources of information. One straightforward source is users' calendars. A user's calendar may be stored in a variety of locations, such as on client device 106, in index 124, or in some combination of both locations. A user's calendar may include various types of entries such as appointments (*e.g.*, "meeting in Houston on April 3"), task reminders (*e.g.*, a "to do" list), travel itineraries (*e.g.*, depart SDF on March 5 at 8:30am EST, arrive MDW on March 5 at 8:30am CST), and so forth.

[0011] Schedule engine 122 may additionally or alternatively ascertain a user's schedule automatically from other sources. For example, schedule engine 122 may scrape a user's email (assuming the user has provided appropriate permission to do so) for information about upcoming events, such as appointments, travel itineraries, hotel bookings, and so forth. Schedule engine 122 may additionally or alternatively ascertain a user's schedule based on various user interaction with various applications (again, with the user's permissions or "opt-ins"). Suppose a user operates navigation application 110 to calculate a travel route to a particular destination that is approximately seven hours away. Schedule engine 122 may determine that, once the user initiates a live routing function of navigation application 110, the user will be at the location in approximately seven hours. Alternatively, even if the use does not operate navigation application 110, various geolocation applications (not depicted) may interface with GPS component 112 to determine that a user is on a plausible route to a previously-flagged destination.

[0012] Schedule engine 122 may ascertain a user's schedule with various degrees of confidence. Suppose a user receives an email inviting the user to visit some location. The system may ascertain based on that email that the user is at least contemplating being at the location at a particular time. That determination may be associated with a relatively low level of confidence, but that may be enough in some instances to establish one or more temporal and/or spatial triggers (as will be described below). The level of confidence may in some instances be at one level prior to the user opening the email invitation, and may increase

slightly once the user opens and reads the email invitation. If the user deletes the invitation without opening, the confidence may bottom out enough such that no scheduling conclusion is drawn.

[0013] Suppose a user operates a web browser (not depicted) operating on client device 106 to search for flights to a particular destination, hotels at the destination, and/or other travel arrangements pertaining to the destination (*e.g.*, rental cars, event tickets, etc.). If the user doesn't make any solid commitments (*e.g.*, she does not purchase anything) and only browses this information, schedule engine 122 may determine with a relatively low level of confidence that the user is planning a trip to the destination at a particular time (*e.g.*, indicated by dates the user selects when browsing flights and hotels). However, that level of confidence may be higher than, for instance, had the user simply received an invitation.

[0014] Suppose the user purchases tickets to a particular event near the destination but does not yet purchase a flight. Schedule engine 122 may determine with a relatively high degree of confidence that the user will be near the destination at the time of the event, and may determine with a lesser degree of confidence that the user will be near the destination in the hours or days leading up to and following the event. Once the user purchases additional travel products, such as a flight and/or hotel, schedule engine 122 may determine with a relatively high degree of confidence that the user has scheduled a trip to the destination during a particular time period. This confidence may be boosted further if the user operates calendar application 114 to create actual appointments near the destination during the pertinent time period. In other words, a confidence in a particular scheduling decision may be related to (e.g., proportional) to a number of and/r type of data points available.

[0015] Trigger establishment engine 126 may create and/or maintain an index of temporal and/or spatial triggers that, when actuated, cause notifications to be provided to various users. These triggers may be established by users manually, *e.g.*, using reminder application 116, or they may be established automatically, *e.g.*, based on various signals from other components such as schedule engine 122. A spatial trigger is actuated when it is determined, *e.g.*, based on a signal received from GPS component 112 or based on a schedule event, that a user is at or near a particular location (*e.g.*, in a city, at a particular store or restaurant, in a particular

airport, etc.). A temporal trigger is actuated at a particular moment, e.g., some predetermined time interval prior to or after some event or appointment, or at the scheduled time.

[0016] Suppose every time a user visits a particular city she eats at a particular restaurant. Perhaps the user has even rated the restaurant highly, *e.g.*, using social media. Trigger establishment engine 126 may determine from these signals that the user should be provided with one or more notifications pertinent to that restaurant (*e.g.*, restaurant closed for renovations) when it is determined that the user is in the city. Accordingly, trigger establishment engine 126 may establish a spatial trigger that is actuated when the user is in the city. Additionally or alternatively, if the restaurant is one that requires advanced booking, a temporal trigger may be established to be actuated well ahead of the user's next visit to the city (*e.g.*, as ascertained from information in index 124) in order to provide the user with a reminder to make a reservation in a timely manner. More examples of spatial and temporal triggers will be described below.

[0017] Notification engine 130 may generate one or more notifications to be provided to one or more users in response to actuation of a temporal or spatial trigger. These notifications may take numerous forms, including but not limited to one or more of text messages, emails, lock screen notifications, pop up notifications, audio reminders (*e.g.*, beeps), haptic feedback (*e.g.*, vibration), advertisements, and so forth. Notification engine 130 may maintain an index 132 of information pertaining to types of notifications that are available for particular users, *e.g.*, based on capabilities of those users' client devices 106.

[0018] Additionally or alternatively, notification engine 130 may maintain in index 132 user preferences as to how users prefer to receive notifications. These preferences may be determined manually, *e.g.*, by user's providing explicit preferences ahead of time. Additionally or alternatively, these preferences may be determined automatically, based on explicit or implicit feedback from particular users or users in general. For example, suppose a particular notification sent in response to actuation of a particular type of trigger is explicitly rated by multiple users as "not well received," and/or multiple users provide implicit feedback by ignoring the notification or not acting in response to it. Notification engine 130 may modify

information in index 132 to indicate that users did not respond well to that particular notification, and may act accordingly in the future.

[0019] Trigger monitoring engine 134 may monitor for various signals to determine when a temporal or spatial trigger has been actuated. Temporal triggers may be actuated in response to trigger monitoring engine 134 continuously and/or periodically comparing a current time to one or more temporal triggers. Spatial triggers may be actuated in response to trigger monitoring engine 134 determining that a user has arrived at, or will arrive at, some location. For example, trigger monitoring engine 134 may determine that a user has arrived at a destination by examining a GPS location provided by client device 106, by comparing a scheduled destination indicated in a schedule calendar entry to a current time, and so forth.

[0020] Myriad temporal and/or spatial triggers may be established, *e.g.*, by trigger establishment engine 126, based on various signals from various sources (*e.g.*, schedule engine 122, applications 110-116, etc.). A notification provided in response to actuation of a trigger may remind a user that when the user travels to location X, the user should be notified of Y. For example, the next time a user arrives in a particular city (*e.g.*, as a final destination or as a layover), she could be reminded to visit a particular point of interest (*e.g.*, a restaurant) or to call a particular person (*e.g.*, a friend in the area).

[0021] Some triggers may include both spatial and temporal components. For example, a trigger may be actuated temporally some time prior to a user's being scheduled to arrive at a particular destination. For example, a trigger may be actuated some time (*e.g.*, two days, two weeks) before a user's flight to a particular city. Various tasks may be associated with the trigger, such as reaching out to one or more contacts in the city to schedule a rendezvous, making a reservation at a popular restaurant, and so forth. Other triggers may be actuated some time prior to a user's departure from a location (e.g., "don't forget to buy souvenirs")

[0022] In some instances, in addition to or instead of providing a notification to a user on actuation of one or more triggers, a notification may be provided to a third party. For example, on arrival to an airport or train station of a particular city, a friend of the user could be "paged" (*e.g.*, using a text message) that the user has arrived. The page may include other information as well, such as a current location of the user (*e.g.*, determined using GPS), a trajectory of the

user (*e.g.*, headed towards baggage claim), and so forth. Additionally or alternatively, the user may be notified on the friend's location (*e.g.*, waiting out front of a particular terminal) so that the user may meet the friend at that location. Pertinent third parties may be identified explicitly by a user, or implicitly by one or more components of knowledge system 102 or client device 106 based on one or more signals. For example, schedule engine 122 or another component may determine that a user has a sibling that lives in a particular city, *e.g.*, using the user's contact list and/or one or more social networks.

[0023] In some instances, a notification may be sent out to an abstracted third party. Suppose a user scheduled to fly to a particular city and has a contact that lives near the city named "Geno Davis." Upon the user's arrival (or, for instance, sometime interval prior to or after) at the city, a page to pick the user up at the airport may be presented on a client device 106 of any user that is (i) within a predetermined distance of the arrival airport, (ii) is named "Geno Davis," and/or (iii) has opted in to receive such communications (*e.g.*, via reminder application 116). The Geno Davis that knows the user may be reminded to pick up the user. Others nearby named Geno Davis may simply ignore the page.

[0024] In some instances where it cannot be determined with a particular level of confidence that a particular person is a contact of a user, that person may be conditionally notified. Suppose a first person named Geno Davis has been at the airport for a particularly long period of time (and the user's flight is not delayed). The first Geno Davis may not be notified because it may be assumed he works at the airport, and does not intend to pick up the user. However, if a second person named Geno Davis has only recently arrived at the airport, it may be assumed that this second Geno Davis is there to pick up the user, and thus he may receive a notification.

[0025] Sometimes, a notification may be provided to a user or a third party when a trigger is not actuated or when a negative trigger is actuated. For example, suppose a user is scheduled to arrive in a particular city at a particular time, and a friend is supposed to pick up the user at the airport. Suppose further, however, that the user's flight is delayed or cancelled. When trigger monitoring engine 134 determines that the user did not arrive (or will not arrive)

as scheduled, it may cause a notification to be sent to the friend saying something like "user's flight delayed or cancelled," so that the friend does not go to the airport to pick up the user.

[0026] Some triggers may be actuated upon satisfaction of multiple spatial and/or temporal conditions. For example, a trigger may be actuated upon (i) a determination that a user is scheduled to be in a particular city at a particular date, and (ii) a determination that that visit will last for at least a predetermined amount of time. Thus, if a user schedules a visit to that particular city that will last for several days, the user may be notified in advance to arrange a meeting with a contact in that city. By contrast, if the user is only scheduled to visit the city for a brief period of time (*e.g.*, a layover), the user may not be notified ahead of time to contact the contact. Of course, if the user's stay in the city is extended for some reason, *e.g.*, by a cancelled flight, weather, etc., then the trigger may end up being actuated after all. As another example, a trigger may be actuated after (i) a user lands at an airport and (ii) leaves the airport using a mode of transportation other than plane (*e.g.*, determined by the user's rate of speed based on change to a GPS signal).

[0027] In some instances, actuation of a trigger may be impacted by and/or conditioned on occurrence or non-occurrence of other events. For example, suppose a trigger is established, *e.g.*, based on a calendar entry, that causes a notification to be provided to a user when the user is scheduled to be at a location. If no conflicting signals are detected, the user will be provided with the notification at the scheduled time. However, suppose at the scheduled time, the user's GPS reveals that he or she is elsewhere. That may cause the trigger to be overridden, so that the user is not provided with any notification. This may avoid provision of a notification intended to be consumed after landing where a flight or trip is cancelled.

[0028] In some instances, triggers may cause one of multiple notifications to be provided to a user, depending on the circumstances. For instance, a trigger may be established to detect whether a user arrives at a destination at a scheduled time. If the user does arrive (*e.g.*, as indicated by GPS), then a first notification reminding the user to attend some appointment at a later time may be provided. However, if the user does not arrive at the schedule time, *e.g.*, because her flight is cancelled, a second notification may be provided reminding the user to cancel the appointment.

[0029] Some triggers may take into account a user's travel history, browsing history, interests, search engine query history, and so forth, to determine the user's interest. For example, it may be determined (*e.g.*, using reminder engine 116 or via analysis of the user's search history or via manual entry) that a user is interested in visiting a landmark in a particular city. The next time the user is in that city, it may be determined that the user will be too busy to visit the landmark. Either no notification may be provided, or a notification may be providing asking the user if she'd like to alter her travel plans to make time to visit the landmark.

[0030] Triggers that are actuated to cause advertisements to be presented to users may also take into account user interest. For example, suppose a user has just arrived in San Diego, and has a general interest (*e.g.*, determined from her browsing history) in World War II. A spatial trigger may be actuated upon her arrival, and may cause an advertisement to be presented to her for visiting the USS Midway in San Diego harbor. Or, if the user's location history indicates she already visited the Midway, the same spatial trigger may cause another advertisement related to another point of interest (*e.g.*, the San Diego Zoo) to be presented to the user. Current events may be considered in such scenarios. For example, if a museum in San Diego is currently offering a temporary exhibit related to World War II, the user may be notified of that in an advertisement.

[0031] In situations in which the systems described herein collect personal information about users, or may make use of personal information, the users may be provided with an opportunity to control whether programs or features collect user information (*e.g.*, information about a user's social network, social actions or activities, profession, a user's preferences, or a user's current geographic location), or to control whether and/or how to receive content from the content server that may be more relevant to the user. Also, certain data may be treated in one or more ways before it is stored or used, so that personal identifiable information is removed. For example, a user's identity may be treated so that no personal identifiable information can be determined for the user, or a user's geographic location may be generalized where geographic location information is obtained (such as to a city, ZIP code, or state level), so that a particular geographic location of a user cannot be determined. Thus, the user may have control over how information is collected about the user and/or used.

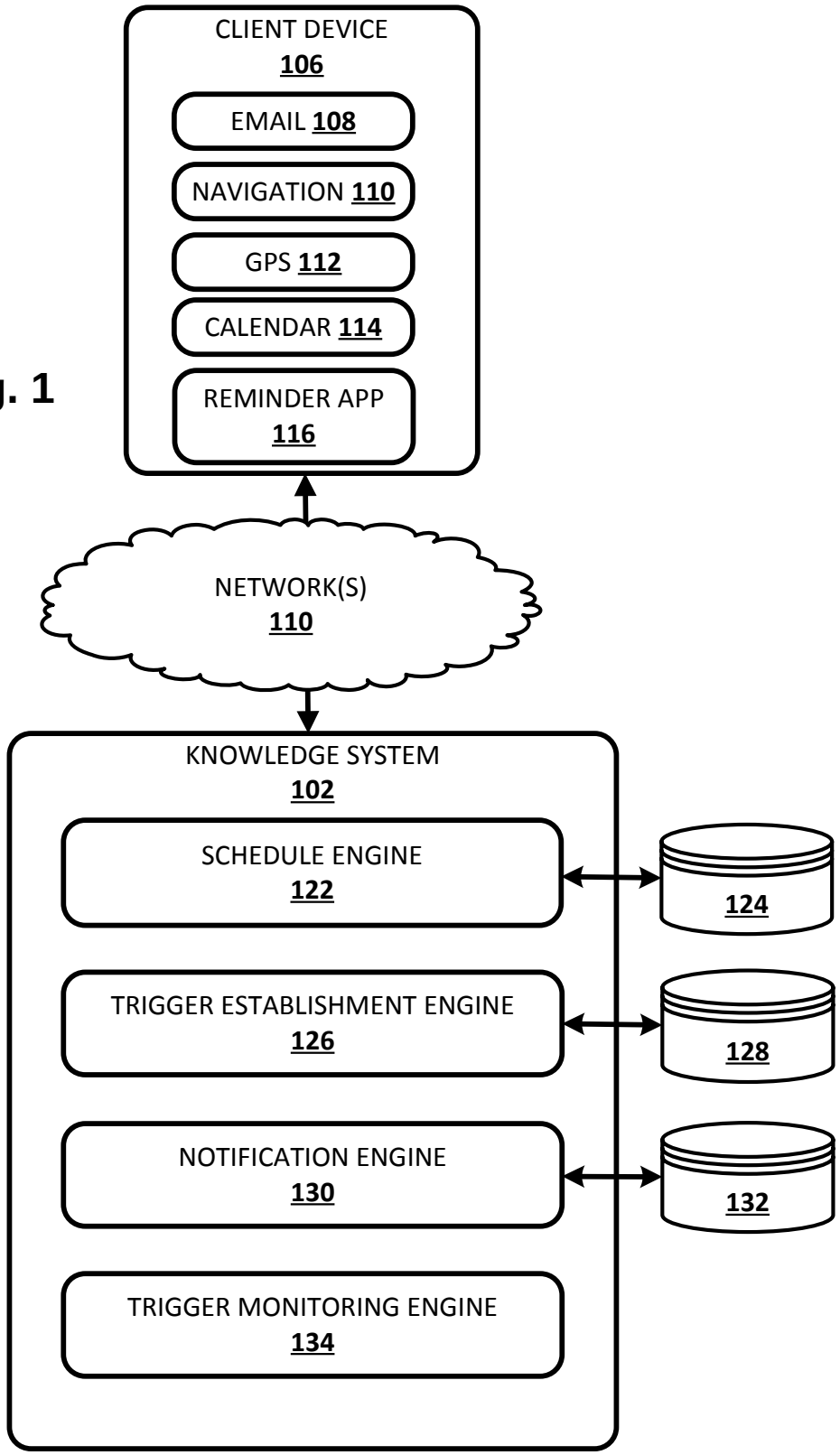
CLIENT DEVICE
106
EMAIL 108
NAVIGATION 110
GPS 112
CALENDAR 114
REMINDER APP
116
NETWORK(S)
110
KNOWLEDGE SYSTEM
102
SCHEDULE ENGINE
122
124
TRIGGER ESTABLISHMENT ENGINE
126
128
NOTIFICATION ENGINE
130
132
TRIGGER MONITORING ENGINE
134

Fig. 1