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**Atkins et al.**

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(54) **LOCATION-AND DIRECTION-ENHANCED  
AUTOMATIC REMINDERS OF  
APPOINTMENTS**

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340/539.26; 340/994; 340/988; 701/201;  
701/202; 701/203; 701/207; 701/208; 701/213

(58) **Field of Classification Search** ..... 340/539.13,  
340/539.11, 539.26, 309.16, 995, 988, 994;  
701/207, 213, 201, 202, 208, 203

See application file for complete search history.

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(57) **ABSTRACT**

An automatic appointment reminder system uses location and/or direction of travel of the reminder recipient relative to appointments to affect the time of sending of appointment reminders to the user, and thus enhances the user's ability to be on-time for appointments.

**8 Claims, 3 Drawing Sheets**

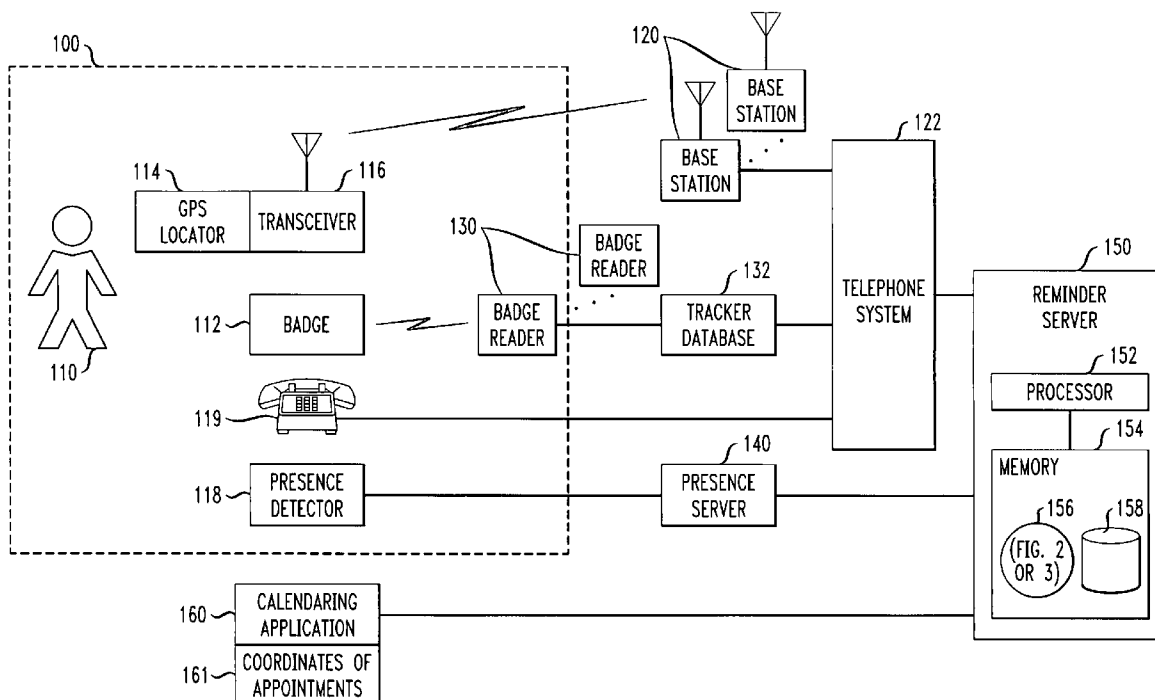


FIG. 1

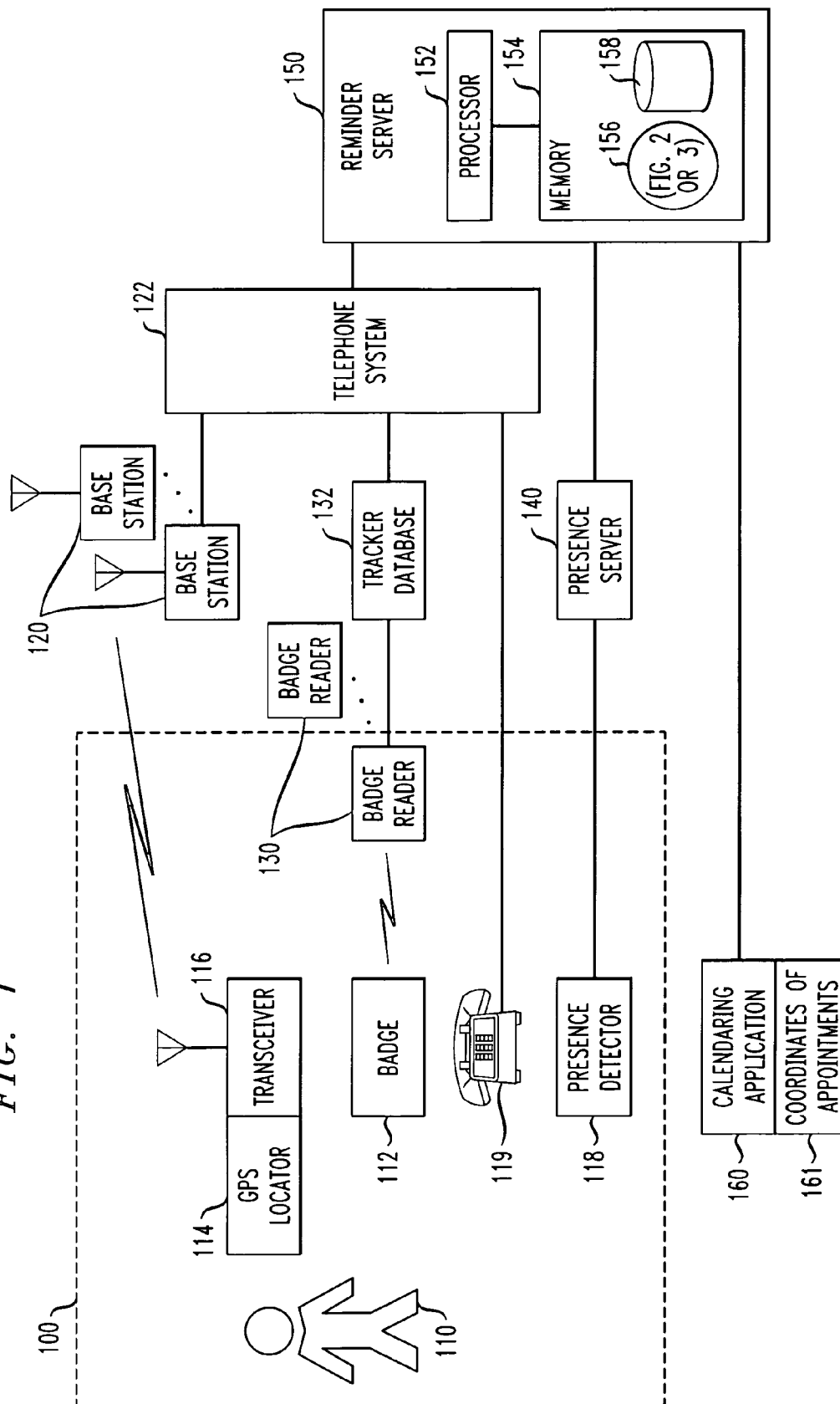


FIG. 2

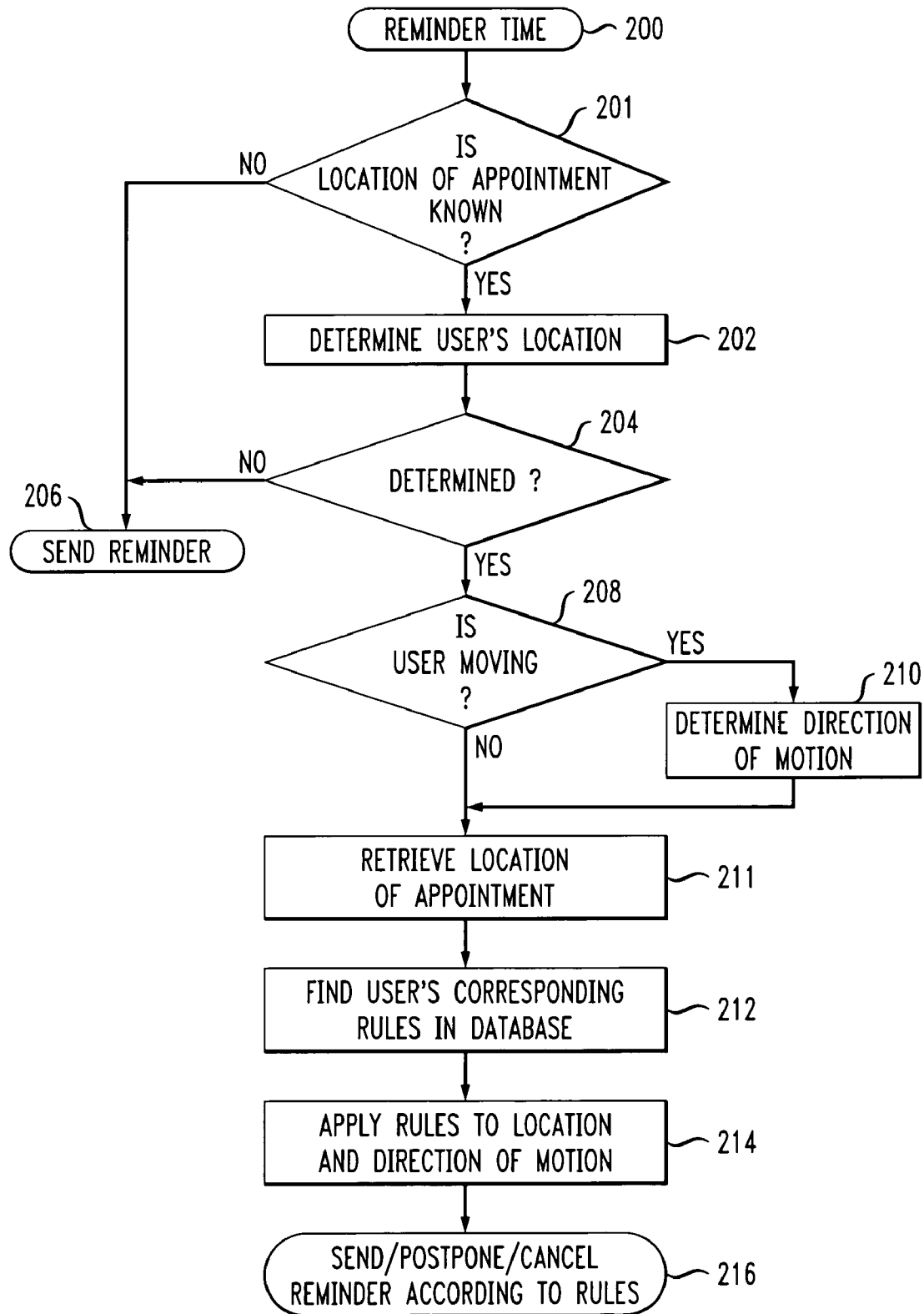
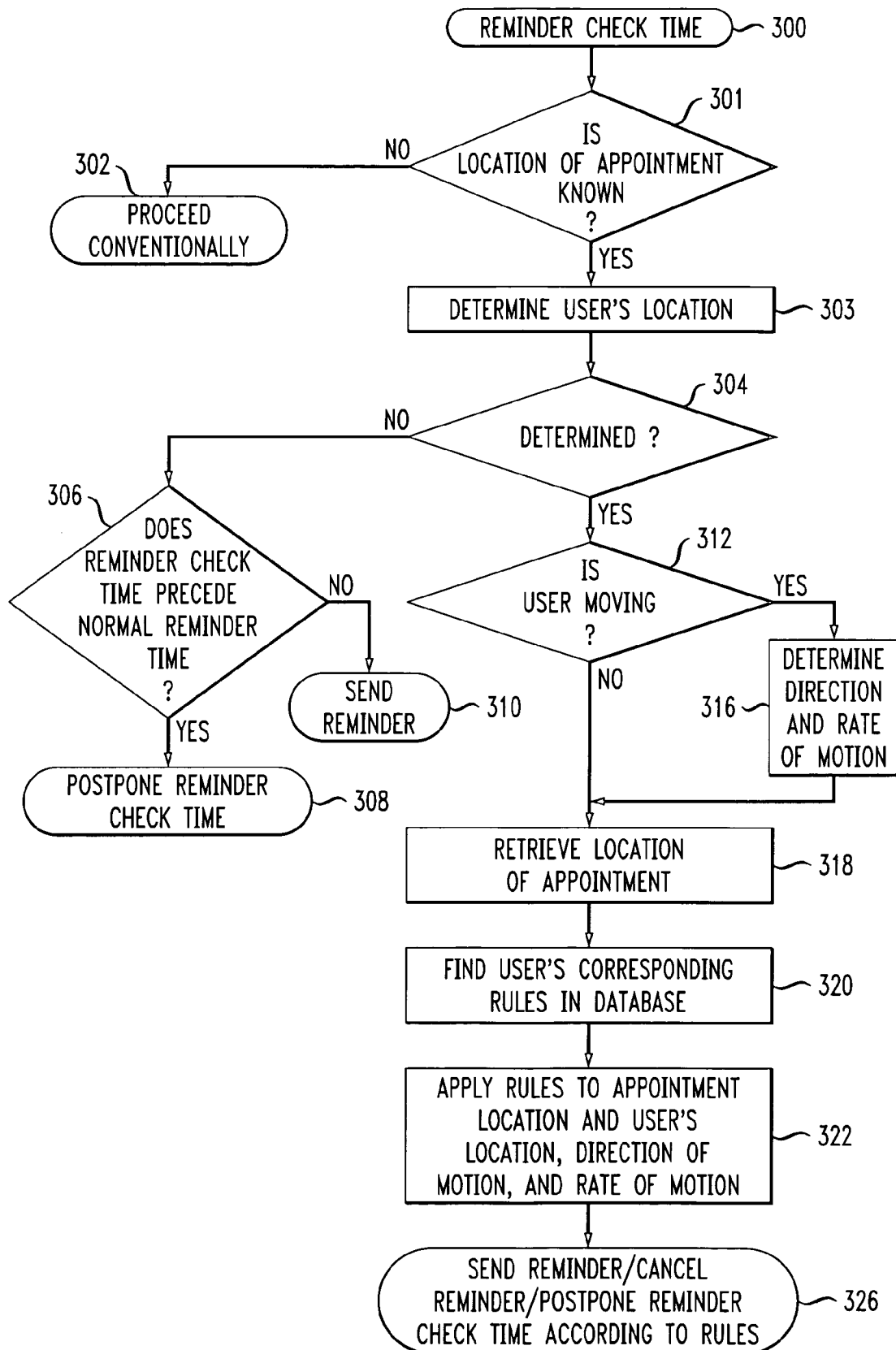


FIG. 3



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# LOCATION-AND DIRECTION-ENHANCED AUTOMATIC REMINDERS OF APPOINTMENTS

## TECHNICAL FIELD

This invention relates to the field of automated reminder arrangements.

## BACKGROUND OF THE INVENTION

Calendar-based automatic reminding applications are well known in the art. They integrate a calendaring application, such as Microsoft Outlook Calendar, with a messaging application, such as Microsoft Exchange, to send electronic messages to a user informing him or her of a calendar entry (referred to herein as an appointment) at some selected period of time before the time of the appointment. An example thereof is MobiSMS from MobiMarketing, which synchronizes with Outlook Calendar to send short Message Service (SMS) calendar-entry reminders to communication devices of specified persons. The known applications send the reminders irrespective of other factors that may influence whether or not sending of the reminder is appropriate, such as the user's present activity, location, or direction of travel.

Location-based services, which assist people in their decision-making during performance of tasks in space and time, are also known. They support spatial queries, such as "the shortest route from here to there" and "nearest restaurant from here," where "here" is the location of the user, specified either by the user or by any location-detecting system (e.g., Global Positioning Satellites, triangulation, etc.). Examples thereof are described in U.S. Pat. Nos. 5,963,861 and 6,177,905, and in M. Raubal and C. Rinner, "Multi-Criteria Decision Analysis for Location Based Services," *Proc. 12<sup>th</sup> Int. Conf. on Geoinformatics* (Geoinformatics 2004) (Gavle, Sweden, 7-9 Jun. 2004), pp. 47-53. Another example is car or palmtop navigation tools that deliver a constant stream of instructions to the user based on the user's current location to help the user follow a route and arrive at a desired destination. Examples thereof are the CoPilot product of ALK Technologies Inc., the Destinator product of Homeland Security Technology Corporation, and a cell phone equipped with the Nokia Xpress-on GPS shell from Nokia Corporation.

## SUMMARY OF THE INVENTION

We have recognized that advantages are to be gained by integrating the principles of calendar-reminder applications with location-based services to condition sending of calendar reminders on location and/or direction of travel of the reminder recipient relative to the appointment. For example, if the intended recipient of an e-mail reminder is not at their desk at the time of sending of the reminder, the reminder may be useless and it would be preferable to send a page or a voice reminder instead. Or, if the intended recipient is occupied in certain activities (e.g., in the washroom, or in an executive conference room) at the time of sending of the reminder, it may be inappropriate to interrupt the recipient and preferable to delay the reminder. Or, if the intended recipient is already on the way to or at the location that is the subject of the reminder, a reminder may not be needed. Or, if the intended recipient is far away from the place of the appointment, a reminder sent at a predetermined standard time interval before the appointment may be too late to be of any use.

According to an embodiment of the invention, therefore, there is provided a machine-implemented method of remind-

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ing a person of appointments, which involves determining a location and a time of an appointment, determining a location of the person, and using the determined locations and the determined time to schedule a reminder of the appointment.

5 The reminder is then sent to the person at the scheduled time. The invention thus improves the ability of a person who uses an automatic appointment reminder system to be on-time for the appointments.

While the invention has been characterized in terms of method, it also encompasses apparatus that performs the method. The apparatus preferably includes an effector—any entity that effects the corresponding step, unlike a means—for each step. The invention further encompasses any computer-readable medium containing instructions which, when executed in a computer, cause the computer to perform the method steps.

## BRIEF DESCRIPTION OF THE DRAWING

20 These and other features and advantages of the invention will become more apparent from a description of an illustrative embodiment of the invention when considered together with the drawing, in which:

FIG. 1 is a block diagram of an appointment-reminder system that includes illustrative embodiments of the invention.

FIG. 2 is a functional flow diagram of operations of a reminder server of the system of FIG. 1 according to one embodiment of the invention; and

FIG. 3 is a functional flow diagram of operations of the reminder server of the system of FIG. 1 according to another embodiment of the invention.

## DETAILED DESCRIPTION

FIG. 1 shows a system that includes an illustrative embodiment of the invention. The system includes the present physical location 100 of a user 110. That location may be, for example, the user's car or some other transportation vehicle, a building, a conference room, or the user's office. Location 100 includes various means 112-119 for remotely determining the user's location, such as the user's office desktop telephone 119, a presence detector 118 such as an instant-messaging application running on the user's office desktop computer, a wireless transceiver 116 integrated with a global positioning system (GPS) locator 114, such as a GPS-equipped portable wireless phone, a car phone, or a personal digital assistant (PDA), or an RFID-equipped badge 112 of a user plus a badge reader 130 located in the user's office, conference room, building hallway, etc. These are just some examples of possible means for determining the user's location; the list is not exhaustive, and any other desired means for determining the user's location may be used as well.

Desk telephone 119 is connected to a telephone system 122, which can determine whether phone 119 is in use or idle. While system 122 is illustratively a telephone system, it may be any kind of communications system. Wireless telephone or PDA 114-116 is connected via a base station 120 to telephone system 122, which can interrogate GPS 114 through transceiver 116. Badge reader 130 is connected to a tracking database 132 that stores readings reported by badge reader 130 and which can in turn be interrogated through telephone system 122 for the name of the person's location (e.g., "Conference Room B," or "Hallway A at aisle F," or "Point X"). And presence detector 118 is connected to a presence server 140 to which it reports presence information on user 110.

A reminder server **150** is connected to a calendaring application **160** of user **110**, such as the user's Outlook Calendar. Reminder server **150** is a stored-program controlled apparatus comprising a memory **154** for storing data and programs needed for operation of server **150**, and a processor **152** that uses the data and executes the programs from memory **154**. Server **150** illustratively includes a Microsoft Exchange server, and also includes the functionality of conventional calendar-based automatic reminding applications. According to the invention, however, server **150** further includes a database **158** of rules and a program **156** that uses those rules to condition the conventional reminder functionality by the location of user **110**. Server **150** may serve reminders to one user **110** only, but in most applications server **150** serves a plurality of users and consequently has access to, a plurality of users' calendaring applications **160**. Database **158** may store a set of rules that apply to all users served by server **150**, or each user may have his or her own set of rules in database **158**. In order to make information on the locations of users **110** available to server **150**, server **150** is connected to presence server **140** and to telephone system **122**.

Rules defining any desirable behavior of reminder server **150** may be used to populate database **158**. The rules may be formulated in any desired form—for example, they may take the form of “if, then” statements, or they may be given an order of precedence. Illustrative rules include:

If user **110** is already at the appointment's location, then do not send a reminder.

If user **110** is already on the conference bridge of the appointment, then do not send a reminder.

If user **110** has left the appointment's location, and either has been gone for a period of time greater than x, or the appointment will commence within a period of time less than x, then send a reminder.

If user **110** is located in a “do not disturb zone” (administratively defined), then do not send a reminder.

If user **110** has left the “do not disturb zone” and the appointment has not yet taken place, then send a reminder.

If user **110** is heading toward the appointment's location, do not send a reminder.

If user **110** is heading away from the appointment's location, then send a reminder.

If user **110** is not at the appointment's location and is stationary, then send a reminder.

In order to be able to employ these rules, server **150** must know or be able to determine the locations (physical, or virtual such as a conference bridge) of appointments. For this purpose, calendaring application **160** includes not only the conventional appointment times and descriptions, but also includes for each appointment a location **161** for the appointment, such as its geographical coordinates. Alternatively, location **161** of appointments may be derived by server **150** by matching keywords of appointment descriptions (such as “headquarters building,” or “meeting room B,” or “my office,” or the address of the appointment, for example) against a database whose entries correlate the keywords with coordinates.

The aspects of one embodiment of operation of server **150** that are unconventional are shown in FIG. 2. Server **150** monitors calendaring application **160** for appointments, in a conventional manner, and determines how far ahead of each appointment to send a reminder, also in a conventional manner. Server **150** also keeps track of postponed (rescheduled), reminders. When it determines that it is time to send an appointment reminder, at step **200**, server **150** first checks whether the location coordinates of the appointment are avail-

able, at step **201**. If not, server **150** proceeds conventionally and sends the reminder to user **110** whose calendar entry this appointment represents, at step **206**. If so, server **150** tries to determine the location of user **110**, at step **202**. Server **150** does this by querying presence server **140**, telephone system **122**, tracker database **132**, and the user's portable wireless communications device **114-116**. If it finds, at step **204**, that it cannot determine the user's location, server **150** proceeds to send the reminder to user **110** in the conventional manner, at step **206**. If it finds at step **204** that it was able to determine the user's location at step **202**, server **206** determines if user **110** is moving, at step **208**. For example, if it determines that user **110** is presently using their desktop telephone **119** or computer **118**, it assumes that user **110** is not moving. If it determines that user **110** is using their car phone, it assumes that user **110** is moving. If it determines the user's presence from a badge reader **130** or the user's portable wireless device **114-116**, it assumes that user **110** may be moving. If user **110** is or may be moving, reminder server **150** tries to determine the direction of the user's motion, at step **210**. For example, it does so by querying again portable wireless communications device **114-116** and tracker database **132** for a change in the user's location. If it determines that user **110** is not moving at step **208**, or after determining the direction of the user's motion at step **210**, server **150** retrieves from calendar application **116** or from a database the coordinates of the appointment, at step **211**. Server **150** also retrieves from database **158** the reminder rules that are applicable to this user **110**, at step **212**, and applies these rules to the user's determined location and direction of motion, at step **214**, to determine what to do with the scheduled reminder that triggered this process at step **200**. Server **150** then either sends the reminder conventionally, postpones it until a later time, or cancels it, at step **216**, as dictated by the rules.

Unlike in the embodiment of FIG. 2, server **150** in the embodiment of FIG. 3 starts processing appointments some period of time before the normal (a user-specified or a system-specified) time for sending a reminder. For example, if the normal reminder time is 15 minutes before the appointment, server **150** will start processing the appointment x hours before the appointment time. This earlier time is referred to herein as a “reminder check time.” At reminder check time of an appointment in calendaring application **160** of a user **110**, determined at step **300** of FIG. 3, server **150** first checks whether the location coordinates of the appointment are available, at step **301**. If not, server **150** proceeds conventionally, at step **302**, and will send the appointment reminder at the normal reminder time. If so, server **150** tries to determine the location of user **110**, at step **303**, in the manner described for step **202** of FIG. 2. If it finds, at step **304**, that it cannot determine the user's location, server **150** checks if the reminder check time is earlier than the normal reminder time, at step **306**. If the reminder check time precedes the normal reminder time, server **150** reschedules the reminder check time for a later time—15 minutes later, for example—at step **308**. If it finds at step **306** that the reminder time does not precede the normal reminder time, server **150** sends the reminder to user **110**, in the conventional manner, at step **310**.

If server **150** finds at step **304** that it was able to determine the user's location, server **150** determines if user **110** is moving, at step **312**, in the manner described for step **208** of FIG. 2, and also tries to determine the user's direction of motion, at step **314**, in the manner described for step **210** of FIG. 2. Or, change-in-location information including the direction-of-motion information may come from sources **120**, **132**, or **140**. Also at step **314**, server **150** determines the rate of motion of user **110**, for example by determining the time interval

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between queries of the user's location and the change in the coordinates of the user's location between those queries. If it determines that user 110 is not moving at step 312, or after determining the user's direction and/or rate of motion at step 316, server 150 retrieves from calendaring application 116 or from a database the coordinates of the appointment, at step 318. Server 150 also retrieves from database 158 the reminder rules that are applicable to this user 110, at step 320, and applies these rules to the appointment coordinates and the user's location and direction and rate of motion, at step 322, to determine what action to take. Server 150 then either sends the reminder at this time, or cancels the reminder, or postpones the reminder check time, at step 326, as dictated by the rules.

The reminder rules that are used include those described for the embodiment of FIG. 2, but additionally may include rules such as

If the calculated reminder time occurs before the reminder check time, either cancel the reminder for user 110 or send a "can't make meeting on time" message.

If the calculated reminder time falls after the reminder check time and before the appointment time, schedule the reminder for user 110 and update the reminder based on periodic checks of tracker database 132.

If the calculated reminder time falls after the appointment time, either cancel the reminder for user 110 or send a "can't make meeting on time" message.

If user 110 is determined to be outside of a predetermined location range  $y$ , then do not engage the reminder time check mechanism (example: user 110 is in Los Angeles, but the face-to-face appointment location is Canberra)

If the time for a second meeting away from the office of user 110 is "close" to the time for a first away meeting (i.e., user 110 is unlikely to return to the office in between the meetings) remind user 110 of both meetings at the earliest calculated reminder time of the two meetings.

Of course, various changes and modifications to the illustrative embodiment described above will be apparent to those skilled in the art. For example, the reminder server, and even the calendaring application and coordinates of appointments, may be implemented on the user's portable communications device. Or, real-time traffic and road construction information can be brought in as additional inputs to the time-to-travel algorithm. This would likely provide more accurate meeting reminders. One can also tap into existing GPS routing services to allow the user to access best-route information to their scheduled meeting. Furthermore, users may be given the option of sharing their location and time-to-travel information with other meeting participants. That way if a person was running late for a meeting, the other people attending the meeting could access that person's information in the Outlook calendar and see that person's arrival progress. If it looked like the person was only a couple of minutes away, the meeting could be delayed until they arrived. However, if that person was still some distance away and was going to be significantly late, the other participants could either start the meeting without that person or reschedule for another time when all participants were available. Also, the idea of time-to-travel-based reminders can be extended into other areas, such as a public transportation application to notify a person when they have to be at the bus stop or train station in order to arrive at a desired destination on time. The application would access public transportation timetables and replace a scheduled appointment location with the location of the public transportation station that the person must be at in order to make the flight, train, bus, etc. Also, the application can

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postpone the start time of a meeting based on the location of other attendees (and their consequent expected arrival times) and postpone the appointment reminders accordingly. These changes and modifications can be made without departing from the spirit and the scope of the invention and without diminishing its attendant advantages. It is therefore intended that such changes and modifications be covered by the following claims except insofar as limited by the prior art.

What is claimed is:

1. A machine-implemented method of reminding a person of appointments, comprising:

determining a location and a time of an appointment;  
determining a location of the person;  
using the determined locations and the determined time to schedule a time for a reminder of the appointment;  
at the scheduled time, determining a current location of the person;  
in response to the current location being a predetermined location, forbearing from issuing the reminder of the appointment at the scheduled time; and  
in response to at least the current location not being the predetermined location, issuing the reminder of the appointment at the scheduled time.

2. An apparatus for reminding a person of appointments, comprising:

means for determining a location and a time of an appointment;  
means for determining a location of the person;  
means for using the determined locations and the determined time to schedule a time for a reminder of the appointment;  
means for determining a current location of the person at the scheduled time; and  
means responsive to the current location being a predetermined location, for forbearing from issuing the reminder of the appointment at the scheduled time, and responsive at least to the current location not being the predetermined location, for issuing the reminder of the appointment at the scheduled time.

3. An apparatus for reminding a person of appointments, comprising:

means for determining a location and a time of an appointment;  
means for determining a location and a direction of motion of the person; and  
means for using the determined locations, direction of motion, and time to schedule a time for a reminder of the appointment.

4. The apparatus of claim 3 wherein:

the means for determining a location and a direction of motion of the person comprise  
means for determining a current direction of motion of the person at the scheduled time; and  
the means for using the determined locations, direction of motion, and time comprise  
means responsive to the current direction being a predetermined direction, for forbearing from sending the scheduled reminder to the person at the scheduled time, and responsive at least to the current direction not being the predetermined direction, for sending the scheduled reminder to the person at the scheduled time.

5. The apparatus of claim 3 wherein:

the means for determining a location and a direction of motion of the person comprise  
means for determining a rate of motion of the person; and  
the means for using the determined locations, direction of motion, and time comprise

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means for using the determined locations, direction of motion, rate of motion, and time to schedule the time for the reminder of the appointment.

6. An apparatus for reminding a person of appointments, comprising:

a query mechanism that obtains a location and a time of an appointment from a source that specifies the location and the time of the appointment;

a query mechanism that obtains a location of the person from at least one source that determines the location of the person;

a rules engine that applies a database of rules to the obtained locations and the obtained time to determine a time for sending the reminder of the appointment; and

a scheduler that sends the reminder at the determined time for sending; wherein

the rules engine is adapted to respond to a current location of the person at the scheduled time being a predetermined location, by causing the scheduler to forbear from sending the reminder of the appointment at the scheduled time, and is adapted to respond at least to the current location of the person at the scheduled time not being the predetermined location, by causing the scheduler to send the reminder of the appointment at the scheduled time.

7. An apparatus for reminding a person of appointments, comprising

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a query mechanism that obtains a location and a time of an appointment from a source that specifies the location and the time of the appointment;

a query mechanism that obtains a location and a direction of motion of the person from at least one source of location of the person;

a rules engine that applies a database of rules to the obtained locations, direction of motion, and time to determine a time for sending the reminder of the appointment; and

a scheduler that sends the reminder at the determined time for sending.

8. The apparatus of claim 7 wherein:

the query mechanism for obtaining a location and a direction of motion of the person is further adapted to determine a current direction of motion of the person at the determined time; and the rules engine is further adapted to apply the database of rules to the direction of motion of the person at the determined time, for causing the scheduler to forbear from sending the reminder to the person at the determined time in response to the direction at the determined time being a predetermined direction, and for causing the scheduler to send the reminder to the person at the determined time at least in response to the direction at the determined time not being the predetermined direction.

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