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(71) Applicant: **SKY MOTION RESEARCH, ULC** [—/CA]; 1410 Stanley, Suite 1020, Montreal, Québec H3A 1P8 (CA).

(72) Inventor: **LEBLANC, Andre**; 338 Ave. Berwick, Montreal, Québec H3R 1Z6 (CA).

(74) Agent: **BENOIT & CÔTÉ, INC.**; 800-1550 Metcalfe, Montreal, Québec H3A 1X6 (CA).

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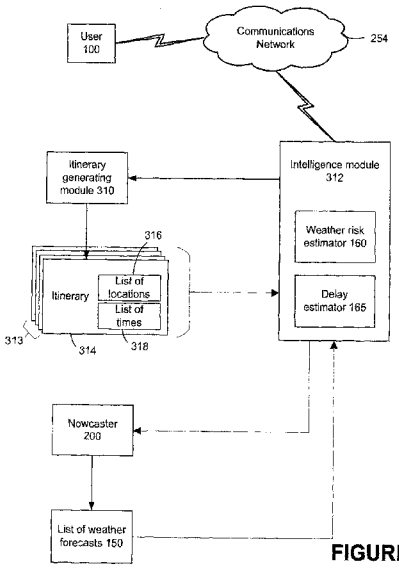

FIGURE 1

(57) Abstract: Provided are methods, devices, and non-transitory computer-readable storage mediums to generate an itinerary with a weather forecast. The itinerary may comprise a departure location, a destination location and a first time. Based on the itinerary, an intermediary location and an intermediary time associated with the intermediary location may be identified. A weather forecast associated with the identified intermediary location and the intermediary time may be predicted. A weather risk associated with the identified route may be assessed and based on the assessed risk, an alternative route may be additionally identified.

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METHOD AND SYSTEM FOR COMBINING LOCALIZED WEATHER FORECASTING AND ITINERARY PLANNING

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority of co-owned and co-invented U.S. Patent Application No. 13/856,923 filed on April 4, 2013, U.S. Patent Application No. 13/922,800, filed on June 20, 2013, U.S. Patent Application No. 13/947,331, filed on July 22, 2013, U.S. Provisional Application No. 61/839,675, filed on June 26, 2013, U.S. Provisional Application No. 61/835,626, filed on June 16, 2013, and U.S. Provisional Application No. 61/836,713, filed on June 19, 2013, the entire disclosures of which are hereby incorporated by reference.

BACKGROUND

(a) Field

[0002] The subject matter disclosed generally relates to methods for producing weather forecasts. More specifically, the subject matter relates to software applications for producing weather forecasts.

(b) Related Prior Art

[0003] Conventional weather forecasting systems provide weather predictions 12 hours to a few days from the present time. If one needs a short-term forecast or a forecast with a fine time scale, the best information available usually is an hourly forecast for the day.

[0004] Conventional weather forecasts are average forecasts for the area for which they are generated. Thus, a forecast may be inaccurate for a precise location within this area, and even the present weather displayed for an area may differ from the actual weather for a precise location within this area.

[0005] Moreover, conventional weather forecasts are displayed at a time scale that is too coarse to allow a user to know when a weather event takes place in a precise location and time. Even for hourly conventional weather forecasts, it is impossible for the user to know if the forecasted weather event will last one hour or one minute and, for the latter, at what time it will take place exactly within the hour.

[0006] For a user who stays at the same place during a part of a day, conventional weather forecasts may provide a reliable weather forecast. However, for a moving user, conventional weather forecasts that are communicated to the public lack the necessary temporal and spatial resolution to provide the moving user with a reliable weather forecast along the itinerary of the user. Furthermore, no conventional weather forecasts or itinerary planning tools estimate the delays caused by weather on a route, although there is a need for tools comprising that function.

[0007] Therefore, there is a need in the market for the generation and display of short-term weather forecasts for various locations and times, and there is further a need in the market for a system and method which allow for estimating the weather along the route between the departure location and the destination location so that the user may attempt to take alternative routes to avoid extreme weather conditions.

SUMMARY

[0008] There may be provided a computer implemented method for generating itineraries comprising: identifying a departure location, a destination location and a first time, identifying an intermediary location between the departure location and the destination location, identifying an intermediary time associated with the intermediary location, identifying a weather forecast associated with the intermediary location and the intermediary time, and identifying an itinerary based at least on the weather forecast.

[0009] In some embodiments, the method may comprise estimating a travel time between locations based on the weather forecast.

[0010] In some embodiments, the method may comprise identifying at least one of a modified intermediary time based on the weather forecast, and identifying a modified weather forecast associated with the intermediary location and the modified intermediary time.

[0011] In some embodiments, the method may comprise identifying a weather severity level associated with the weather forecast of the intermediary location and the intermediary time. The itinerary may be identified based on the weather severity level.

[0012] In some embodiments, the method may comprise: identifying an alternative intermediary location based on the weather severity level, identifying a second intermediary time associated with the alternative location, and identifying a second weather forecast associated with the alternative intermediary location and the second intermediary time, wherein the itinerary is identified based at least on the second weather forecast.

[0013] In some embodiments, the weather forecast may comprise information indicating a probability of a specific type of precipitation at a specific rate.

[0014] In some embodiments, the departure location, the destination location and the first time may be received from a remote device (e.g. GPS, a user-operable device, etc.). At least one of the departure location and the destination location may be associated with a current location of the remote device, and the first time may be associated with a current time.

[0015] In some embodiments, the method may comprise: identifying multiple intermediary locations, identifying multiple intermediary times associated with the multiple intermediary locations, and identifying multiple weather forecasts associated with the multiple intermediary locations and the multiple intermediary times, wherein the itinerary is identified based at least on the multiple weather forecasts.

[0016] In some embodiments, the method may comprise: identifying a first set of intermediary locations and a second set of intermediary locations, identifying a third set of intermediary times associated with the first set of intermediary locations,

identifying a fourth set of intermediary times associated with the second set of intermediary locations, identifying a fifth set of weather forecasts associated with the first set of intermediary locations and the third set of intermediary times, identifying a sixth set of weather forecasts associated with the second set of intermediary locations and the fourth set of intermediary times, and comparing a weather severity level associated with the fifth set of weather forecasts with a weather severity level associated with the sixth set of weather forecasts, wherein, based on the comparison, the identified itinerary comprises the first set of intermediary locations or the second set of intermediary locations.

[0017] In other embodiments, there may be provided a computer implemented method for generating itineraries comprising: receiving an itinerary request including a departure location, a destination location and a given time, in response to receiving the itinerary request, obtaining a list of locations and a list of times corresponding to the locations, obtaining a weather forecast for each location of the list of locations for the time corresponding to each location, resulting in a list of weather forecasts, and outputting the list of weather forecasts for corresponding locations. The method may comprise estimating a delay in a displacement due to the weather forecasts. The delay in the displacement may be used to modify the times corresponding to the locations.

[0018] In some embodiments, there may be a device comprising one or more processors, a memory storing computer instructions that can be executed by the one or more processors such that the device is caused to perform any one or more of the methods described above, when the instructions are executed. Further, there may be a non-transitory computer-readable medium storing such instructions.

[0019] Further, there may be a device that comprises one or more processors, a memory storing instructions for the one or more processors, a communication module to connect to a remote server over a communication network, and a display. When the instructions are executed, the device may be caused to: receive, from the remote server, an itinerary comprising a departure location, a destination location and an intermediary location, the itinerary generated based at least on a weather forecast

associated with the intermediary location and an intermediary time, the intermediary time representing the time at which the device is expected to arrive at the intermediary location, and cause, on the display, a display of at least a part of the itinerary received from the remote server. The device may be a mobile device such as, non-exclusively, a handheld device, a cellphone, a vehicle, etc.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Further features and advantages of the present disclosure will become apparent from the following detailed description, taken in combination with the appended drawings, in which:

[0021] Figure 1 shows an example of a block diagram of a system for combining localized weather forecasting and itinerary planning;

[0022] Figure 2A shows an example of a block diagram of a suitable nowcaster for implementing one or more embodiments;

[0023] Figure 2B is one example of a more detailed block diagram of a suitable nowcaster for implementing one or more embodiments;

[0024] Figure 2C is another example of a more detailed block diagram of a suitable nowcaster for implementing one or more embodiments;

[0025] Figure 3 is a screenshot illustrating an example of an itinerary returned by an itinerary generating module;

[0026] Figure 4A is an example of a network environment in which the embodiments may be practiced;

[0027] Figure 4B is an example of another network environment in which the embodiments may be practiced; and

[0028] Figure 5 is an exemplary diagram illustrating a suitable computing operating environment in which embodiments of the claimed subject matter may be practiced.

[0029] It will be noted that, throughout the appended drawings, like features are identified by like reference numerals.

DETAILED DESCRIPTION

[0030] The embodiments will now be described more fully hereinafter with reference to the accompanying drawings, which form a part hereof, and which show, by way of illustration, specific embodiments by which the embodiments may be practiced. The embodiments are also described so that the disclosure conveys the scope of the claimed subject matter to those skilled in the art. The embodiments may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein.

[0031] Among other things, the present embodiments may be embodied as methods or devices. Accordingly, the embodiments may take the form of an entirely hardware embodiment, an entirely software embodiment, an embodiment combining software and hardware aspects, etc. Furthermore, although the embodiments are described with reference to a portable or handheld device, they may also be implemented on desktops, laptop computers, tablet devices, or any computing device having sufficient computing resources to implement the embodiments.

[0032] Definitions

[0033] In the present specification, the following terms are meant to be defined as indicated below:

[0034] Nowcasting: The term *nowcasting* is a contraction of "now" and "forecasting"; it refers to the sets of techniques devised to make short-term forecasts, typically in the 0- to 12-hour range.

[0035] A nowcaster is a weather forecasting device which prepares very short-term (e.g., 1 minute, 5 minutes, 15 minutes, 30 minutes, etc.) forecasts for a very small region on Earth (5 meters, 10 meters, 50 meters, 100 meters, 500 meters, 1,000 meters, etc.).

[0036] A weather value is a weather-related quantity or attribute of any sort such as temperature, pressure, visibility, precipitation type and intensity, accumulation, cloud cover, wind, etc.

[0037] A forecasted weather value is a weather value that is predicted by the nowcaster.

[0038] A weather-related event is an event that can affect a weather value or a forecasted weather value, which include, for example, at least one of hail, a wind gust, lightning, a temperature change, etc.

[0039] Precipitation type (PType): indicates the type of precipitation. Examples of precipitation types include, but are not limited to, rain, snow, hail, freezing rain, ice pellets, or ice crystals.

[0040] Precipitation rate (PRate): indicates the precipitation intensity. Examples of precipitation rate values include, but are not limited to, no (i.e., none), light, moderate, heavy, extreme. In an embodiment, the precipitation rate can also be expressed as a range of values such as: none to light, light to moderate, moderate to heavy, or any combination of the above.

[0041] Precipitation probability: indicates the probability that precipitation might occur. Examples of precipitation probability values include, but are not limited to, no, unlikely, slight chance of, chance of, likely, very likely, or certain.

[0042] In an embodiment, the precipitation probability can also be expressed as a range of values such as: none to light, light to moderate, or moderate to heavy. Precipitation probability may also be expressed in terms of percentages; e.g., 0%, 25%, 50%, 75%, 100%; or ranges of percentages; e.g., 0% to 25%, 25% to 50%, 50% to 75%, 75% to 100%. In an embodiment, the precipitation probability may be taken from a probability distribution.

[0043] Precipitation type and precipitation rate categories (PTypeRate): a PTypeRate category is combination of precipitation type and precipitation rate to which may be associated a probability of occurrence for a given period to indicate the possibility of receiving a certain type of precipitation at a certain rate.

[0044] A weather forecast is a set of one or more forecasted weather values that are displayable to users.

[0045] A user is a person to whom or machine to which a weather forecast is forwarded.

[0046] An itinerary is a list of locations or directions guiding a user from point A to point B. Optionally, the itinerary may comprise times corresponding to a location or time intervals between locations. A key point is a location that meets a criterion which may be a user's preference.

[0047] Briefly stated, the present embodiments describe a method and system for combining localized weather forecasting and itinerary planning. The weather forecast is generated by a short-term weather forecaster known as a system for generating nowcasts or a nowcaster.

[0048] Now referring to Figure 1, there is described a system for combining localized weather forecasting and itinerary planning. The system comprises an intelligence module **312**, an itinerary generating module **310** and a nowcaster **200**. The intelligence module **312** further comprises a weather risk estimator **160** and a delay estimator **165**. These components will be further described below.

[0049] Itinerary Generation Module

[0050] The itinerary generating module **310** may be a web-based module and/or a GPS-based module for generating routes and directions.

[0051] An example of such web-based modules may include MapQuest™, Yahoo™ Maps, Google™ Maps, and so on. In these types of modules, the data relating to the generation or routes is stored on a remote server that is accessible via a telecommunications network such as the Internet. Using these modules, the user may request directions from a first location A to a second location B, whereby the module may return a list of directions for the displacement from A to B as shown in Figure 3.

[0052] As shown in Figure 1, the itinerary generating module **310** generates an itinerary **314**, which comprises a list of locations **316** and a list of times **318**, where the times correspond to the locations.

[0053] In an embodiment, the itinerary generating module **310** may provide one or more choices of itineraries for the user to choose. Then, the module generates a list **313** of itineraries.

[0054] In another embodiment, the data may be downloaded and/or pushed from the server to the computing device on which the embodiments are practiced, whereby the route may be displayed without accessing the remote server.

[0055] In an embodiment, the itinerary generating module **310** may also include a GPS device which determines the current location of the user using a satellite connection. The GPS unit may be embedded in a portable device such as an iPhone™ or the like. In another example, the GPS device may be embedded in a handheld GPS navigation device such as the series of devices manufactured by Garmin™ or Magellan™ etc.

[0056] Intelligence Module

[0057] As shown in Figure 1, the intelligence module **312** links the user **100**, the itinerary generating module **310**, and the nowcaster **310** by sending appropriate queries to and receiving information from these elements. More precisely, the intelligence module **312** may receive information from a user **100** through a communication network **254**. In an embodiment, the intelligence module **312** may be linked to a user interface for receiving the user's entries such that the identification of the locations A and B, departure time, and the user preferences regarding the locations for which the nowcasts are needed. The intelligence module **312** may use this information received from user **100** to query the itinerary generating module **310**, for example, by sending the geographic locations of points A and B characterizing the beginning and the end of the itinerary. The intelligence module **312** may also send to the itinerary generating module **310** information about the beginning time of the itinerary or about the user's preferences. For example, the user may choose to obtain the nowcasts for key points such as major cities along the route, or by increments of, for example, 30 km, etc.

[0058] According to an embodiment, the intelligence module **312** sends a first time or a current time and a time interval to the itinerary generating module **310**.

[0059] Depending on the embodiment, the intelligence module **312** or the itinerary generating module **310** may estimate a time of arrival for each key point which represents the estimated time at which the user is expected to arrive at a certain key point. Estimation of the arrival time may depend on several factors including: the departure time (which, unless specified by the user, is taken as the present time), the distance between the departure point and the respective key point, traffic information received from the itinerary generating module **310** (or another source), weather information, current speed, and speed limit associated with each segment of the route between the current location and the respective key point.

[0060] The itinerary generating module **310** generates an itinerary **314** or a list **313** of itineraries as described hereinabove. According to an embodiment, each itinerary comprises a list of locations **316** and a list of times **318**. This information is sent back to the intelligence module **312**.

[0061] According to an embodiment, the intelligence module may select locations (such as the key points specified in the user's preferences) and their corresponding times and sends them to the nowcaster **200**.

[0062] In an embodiment, the intelligence module **312** may send the location information of each location or key point along with the current time whereby the user may see the current weather conditions in the different locations along the route.

[0063] Depending on the embodiment, the intelligence module **312** may send all the list in just one call to the server on which the nowcaster **200** is implemented, or, on the contrary, divide the list into more than one part when the call is sent to the nowcaster **200**.

[0064] For each location and time, the nowcaster **200** outputs a weather forecast. Therefore, the nowcaster **200** generates a list of weather forecasts **150** corresponding to each itinerary **314**.

[0065] As discussed above, the itinerary generating module **310** may provide different choices of routes comprising weather conditions along different locations or key points. In an embodiment, when more than one itinerary is provided, a weather risk estimator **160** within the intelligence module **312** may compute the risk associated with each list of weather forecasts **150** corresponding to an itinerary, thus sorting the lists of weather forecasts **150** and their corresponding itinerary according to the weather risk. The weather risk estimator **160** may assign each itinerary a category or a grade depending on the gravity of the weather events happening on the itinerary (strong winds, heavy rain, etc.) or the probability that these events will take place. Sorting itineraries adds information (the estimated risk) to the lists of weather forecasts **150**. According to an embodiment, if the itinerary is displayed (textually or graphically), the parts of the itineraries that have a higher or lower risk may be displayed with a distinctive color.

[0066] According to an embodiment, if the weather risk is estimated for various itineraries, the method may route traffic to the least risky itinerary.

[0067] When the intelligence module has received locations, times, weather forecasts, and other information (such as weather risk) of an itinerary, this information is sent to the user **100** using the communication network **254**.

[0068] According to an embodiment, the weather forecast for each location and time in an itinerary may be provided on a single web page.

[0069] According to an embodiment, the intelligence module **312** may comprise a delay estimator **165**. The delay estimator **165** uses the list of weather forecasts to determine the delay on a part of an itinerary due to the weather conditions, such as rain, fog, strong wind, etc., that can slow down the traffic. The delay estimator **165** may use a database comprising statistics about the delays due to weather conditions. If the delay estimator **165** is used, the list of times **318** corresponding to the list of locations **316** is not relevant anymore because delays change the times in the itinerary. Therefore, the intelligence module queries again the itinerary generating module **310** by taking into account the delays, producing a more accurate list of times **318**. The

intelligence module **312** receives this updated list of times **318** and sends it to the nowcaster **200** for an update of the list of weather forecasts **150**. Therefore, when the delay estimator is used, an iterative process takes place. This iterative process may be programmed to cease after a given number of iterations or after equilibrium is reached in the results. When the iterative process is done, the intelligence module outputs the list **313** of itineraries along with the most accurate list of weather forecasts **150**.

[0070] Nowcaster

[0071] Figures 2A-2C are block diagrams of a nowcaster according to one or more embodiments of the subject matter described in the specification.

[0072] As shown in Figures 2A-2C, the nowcaster **200** receives weather observations from different sources **201** such as weather observation sources including but not limited to: point observations **201-2** (e.g., feedback provided by users and automated stations), weather radars **201-3**, satellites **201-4** and other types of weather observations **201-1**, and weather forecast sources such as numerical weather prediction (NWP) model output **201-5** and weather forecasts and advisories **201-6**.

[0073] The nowcaster **200** comprises a memory **220** and a processor **210**. The memory **220** comprises the instructions for the method and also stores data from the weather sources, intermediate results, and weather forecasts. The processor **210** allows the nowcaster **200** to perform calculations.

[0074] The nowcaster **200** can receive information **230** from a user through a communication network **254**.

[0075] The nowcaster **200** outputs a weather forecast, or a succession of weather forecasts.

[0076] Figure 2B is one embodiment of the nowcaster 200. In this embodiment, the nowcaster **200** comprises a PType distribution forecaster **202** and a PRate distribution forecaster **204**. The PType forecaster **202** receives the weather observations from the different sources **201** and outputs a probability distribution of

precipitation type over an interval of time, for a given latitude and longitude (and/or location). For example:

a. Snow: 10%

b. Rain: 30%

c. Freezing Rain: 60%

d. Hail: 0%

e. Ice Pellets: 0%

[0077] Similarly, the PRate distribution forecaster **204** receives the weather observations for a given latitude and longitude from the different sources **201** and outputs a probability distribution forecast of a precipitation rate (PRate) in a representation that expresses the uncertainty. For example, the PRate may be output as a probability distribution of precipitation rates or a range of rates over an interval of time, for a given latitude and longitude. For example:

f. No Precip.: 30%

g. Light: 40%

h. Moderate: 20%

i. Heavy: 10%

[0078] The PRate and PType values output by the PRate distribution forecaster **204** and the PType forecaster **202** are sent to a forecast combiner **206** to combine these values into a single value PTypeRate which represents the precipitation outcomes. For example, if the value of PType is "Snow," and the value of "PRate" is heavy, the combined value of PTypeRate may be "heavy snow."

[0079] For a given latitude and longitude, the system outputs forecasted PTypeRate Distributions for predefined time intervals, either fixed (ex: 1 minute) or variable (ex: 1 minute, then 5 minutes, then 10 minutes, etc.). The system can either pre-calculate and store forecasted PTypeRate Distributions in a sequence of time intervals, or calculate it in real time. A PTypeRate Distribution represents, for each time interval, the certainty or uncertainty that a PTypeRate will occur.

[0080] With reference to Figure 2B, the forecast combiner **206** receives the final PRate distribution from the PType forecaster **202** and the final PRate distribution from the PRate distribution forecaster **204** to combine them into a group of PTypeRate distribution values each representing the probability of receiving a certain type of precipitation at a certain rate. An example is provided below.

[0081] Assuming that the PType distribution is as follows: Snow: 50%, Rain: 0%, Freezing rain: 30%, Hail: 0%, Ice pellets: 20%, and the PRate distribution is as follows: None: 0%, Light: 10%, Moderate: 20%, Heavy: 30%, Very Heavy: 40%, the PTypeRate distributions may be as follows:

Table 1: An Example of PTypeRate Distribution Table

PType / PRate	Snow 50%	Rain 0%	Freez. Rain 30%	Hail 0%	Ice Pellets 20%
None 0%	No precipitation	No precipitation	No precipitation	No precipitation	No precipitation
Light 10%	5% light snow	No precipitation	3% light freezing rain	No precipitation	2% light ice pellets
Moderate 20%	10% moderate snow	No precipitation	6% moderate freezing rain	No precipitation	4% moderate ice pellets
Heavy 30%	15% heavy snow	No precipitation	9% heavy freezing rain	No precipitation	6% heavy ice pellets
Very Heavy 40%	20% heavy snow	No precipitation	12% very heavy freezing rain	No precipitation	8% very heavy ice pellets

[0082] Accordingly, the forecast combiner **206** multiplies the probability of each type of precipitation by the probability of each rate of precipitation to obtain a probability of receiving a certain type of precipitation at a certain rate, for example, 20% chance of heavy snow, or 12% chance of very heavy freezing rain. In an embodiment, it is possible to associate probability ranges with textual information for displaying the textual information to the user instead of the probabilities in numbers. For example, probabilities that are between 5% and 15% may be associated with the

text: "low chance," while probabilities that are between 40% and 70% may be associated with the text "high chance," or "very likely," etc., whereby, instead of displaying: 60% chance of heavy snow, it is possible to display: "high chance of heavy snow."

[0083] In another embodiment, it is possible to combine two or more different PTypeRates along one or more dimensions (the dimensions including: the rate, type, or probability). For example, results of such combination may include: Likely light to moderate rain, Likely light to moderate rain or heavy snow; Likely moderate rain or snow; Likely rain or snow; Chance of light to moderate rain or heavy snow or light hail; Chance of moderate rain, snow or hail; Chance of rain, snow or hail, etc.

[0084] Accordingly, the nowcaster **200** receives the location for which the nowcasts are needed and the time and/or time interval for which the nowcasts are needed and outputs the PTypeRate distribution for the given location and for the specific time.

[0085] Figure 2C illustrates another embodiment of the nowcaster **200**. In this embodiment, the nowcaster **200** comprises a PType selector/receiver **202-C** and a PRate distribution forecaster **204**.

[0086] Similar to the embodiment shown in Figure 2B, the PRate distribution forecaster **204** receives the weather observations for a given latitude and longitude from the different sources **201** and outputs a probability distribution forecast of a precipitation rate (PRate) in a representation that expresses the uncertainty. For example, the PRate may be output as a probability distribution of precipitation rates or a range of rates over an interval of time, for a given latitude and longitude. For example:

f. No Precip.: 30%

g. Light: 40%

h. Moderate: 20%

i. Heavy: 10%

[0087] However, the PType selector/receiver **202-C** does not output a probability distribution associated with different types of precipitation. Instead, the PType selector/receiver **202-C** receives weather observations for a given latitude and longitude from the different sources **201** to select one precipitation type from a list of different precipitation types. For example, based on the inputs received from the sources **201**, the PType selector/receiver **202-C** selects a single precipitation type that is most likely to occur in the given latitude and the longitude (and/or location) from the following list of precipitation types:

a. Snow

b. Rain

c. Freezing Rain

d. Hail

e. Ice Pellets

f. Mix (e.g., a+c, a+d, b+c, a+e, c+e, d+e, etc.)

[0088] From the list of precipitation types such as the one above, only one precipitation type is selected for a given location. For example, a mix of snow and freezing rain can be selected as the most likely precipitation type for a give location at a given time. The precipitation type is not associated with a probability value. In fact, since only one precipitation type is selected for any given location and time corresponding to the location, the selected precipitation type will have an effective probability value of 100%.

[0089] The list of precipitation types that are available for selection of one type may include a mix type that represent a mix of two different precipitation types (e.g., snow and freezing rain, hail and ice pellets, etc). A mix type is considered as a distinct precipitation type available for selection, and as shown above in (f) of the list, there can be many different mix types representing the mix of different pairs of various precipitation types.

[0090] In another embodiment, the precipitation type is not selected by the PType selector/receiver **202-C** but instead is received from a source outside the

nowcaster **200**. In other words, the nowcaster 200 may request to a remote source (e.g., a third-party weather service) identification of the precipitation type that is most likely to occur for a given location at a given time and receive a response from the source identifying the most likely precipitation type. In this case, selection of the precipitation type is not performed by the nowcaster **200**. The nowcaster **200** merely is inputted with the already-selected precipitation type and thereby can save computational power of the nowcaster **200** that would otherwise have been needed to perform the selection.

[0091] The selected precipitation type and the PRate values respectively output by the PType selector/receiver **202-C** and the PRate distribution forecaster **204** are combined. For example, if the selected precipitation type is snow, and the PRate values are as described above, the combined information would indicate:

a. No Snow: 30%

b. Light Snow: 40%

c. Moderate Snow: 20%

d. Heavy Snow: 10%.

[0092] As only one precipitation type is concerned, only a minimal amount of computational power is needed to perform the combining to output the final weather forecast data. Since the PType selector/receiver **202-C** will output one (1) precipitation type for a given location and time, if the PRate distribution forecaster **204** outputs a number m of probability distribution, the final weather forecast data will comprise only a number m (m*1) of weather forecast distribution.

[0093] In outputting the final weather forecast data, it is possible to associate probability ranges with textual information for displaying the textual information to the user instead of the probabilities in numbers, similar to the embodiment shown in Figure 2B. For example, probabilities that are between 5% and 15% may be associated with the text: "low chance," while probabilities that are between 40% and 70% may be associated with the text "high chance," or "very likely," etc., whereby,

instead of displaying: "60% chance of heavy snow," it is possible to display: "high chance of heavy snow."

[0094] Accordingly, the nowcaster **200** receives the location for which the nowcasts are needed and the time and/or time interval for which the nowcasts are needed and outputs the selected PType and PRate distribution for the given location and for the specific time.

[0095] The nowcaster according to the embodiment shown in Figure 2C may be advantageous over the embodiment shown in Figure 2B in certain circumstances in which efficiency is desired. The embodiment of Figure 2C can be implemented using much less processing power than the embodiment of Figure 2B. However, the embodiment of Figure 2B may be more suitable than the embodiment of Figure 2C in providing a more detailed and accurate snapshot of weather forecast data for any given location and time.

[0096] Figure 4A is an example of a network environment in which the embodiments may be practiced. The nowcaster **300** may be implemented on a server/computer **250** which is accessible by a plurality of client computers **252** over a communication network **254**. The client computers may include but are not limited to: laptops, desktops, portable computing devices, tablets, and the like. Using a client computer **252**, each user may enter the directions between two locations and preferably the time of departure (otherwise the current time is used to replace this). The information is sent to the remote server **250** over a telecommunications network. The server **250** returns a list of locations on the route from locations A to B along with nowcasts at these locations on the route. The server accesses weather source **201** over a telecommunications network as discussed in connection with Figure 2A. The server **250** may have geographic data stored thereon and may also access itinerary sources **320** provided by a third entity.

[0097] Preferably, the computing device **252** is GPS-enabled, in which case, the computing device may provide updates to the server **250** for updating the nowcasts along the route, as discussed above.

[0098] Figure 4B is an example of another network environment in which the embodiments may be practiced. In this embodiment, the user enters the destination and views the itinerary on a GPS navigation device. The GPS navigation device takes the departure location as the present location. The present location and the end destination along with the route chosen by the satellite may be sent to the server **250** via the satellite **332**. The intelligence module implemented in the server **250** may return the nowcasts for key points along the route, and send the nowcasts and an identification of the key points to the GPS device **330** for adding to the itinerary given by the GPS device **330**.

[0099] In an embodiment, if the user is generating an itinerary using a GPS and/or web-enabled computing device, the nowcasts may be updated on the map based on the advancement of the user on the route and the changes in weather conditions.

[00100] In an embodiment, the nowcasts may be provided on the map along with the time/time interval associated with each nowcast. In an embodiment, the time shown on the map is the estimated time of arrival which is estimated by the intelligence module **312** based on the current location, speed, and weather and traffic conditions.

[00101] Hardware and Operating Environment

[00102] Figure 5 illustrates an exemplary diagram of a suitable computing operating environment in which embodiments of the claimed subject matter may be practiced. The following description is associated with Figure 5 and is intended to provide a brief, general description of suitable computer hardware and a suitable computing environment in conjunction with which the embodiments may be implemented. Not all the components are required to practice the embodiments, and variations in the arrangement and type of the components may be made without departing from the spirit or scope of the embodiments.

[00103] Although not required, the embodiments are described in the general context of computer-executable instructions, such as program modules, being

executed by a computer, such as a personal computer, a hand-held or palm-size computer, smartphone, or an embedded system such as a computer in a consumer device or specialized industrial controller. Generally, program modules include routines, programs, objects, components, data structures, etc., that perform particular tasks or implement particular abstract data types.

[00104] Moreover, those skilled in the art will appreciate that the embodiments may be practiced with other computer system configurations, including hand-held devices, multiprocessor systems, microprocessor-based or programmable consumer electronics, network PCS, minicomputers, mainframe computers, cellular telephones, smartphones, display pagers, radio frequency (RF) devices, infrared (IR) devices, Personal Digital Assistants (PDAs), laptop computers, wearable computers, tablet computers, a device of the iPod or iPad family of devices, integrated devices combining one or more of the preceding devices, or any other computing device capable of performing the methods and systems described herein. The embodiments may also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

[00105] The exemplary hardware and operating environment of Figure 5 includes a general-purpose computing device in the form of a computer **720**, including a processing unit **721**, a system memory **722**, and a system bus **723** that operatively couples various system components including the system memory to the processing unit **721**. There may be only one or there may be more than one processing unit **721**, such that the processor of computer **720** comprises a single central-processing unit (CPU), or a plurality of processing units, commonly referred to as a parallel processing environment. The computer **720** may be a conventional computer, a distributed computer, or any other type of computer; the embodiments are not so limited.

[00106] The system bus **723** may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. The system memory may also be referred to as simply the "memory," and includes read-only memory (ROM) **724** and random access memory (RAM) **725**. A basic input/output system (BIOS) **726**, containing the basic routines that help to transfer information between elements within the computer **720**, such as during start-up, is stored in ROM **724**. In one embodiment of the claimed subject matter, the computer **720** further includes a hard disk drive **727** for reading from and writing to a hard disk, not shown, a magnetic disk drive **728** for reading from or writing to a removable magnetic disk **729**, and an optical disk drive **730** for reading from or writing to a removable optical disk **731**, such as a CD ROM or other optical media. In alternative embodiments of the claimed subject matter, the functionality provided by the hard disk drive **727**, magnetic disk **729** and optical disk drive **730** is emulated using volatile or non-volatile RAM in order to conserve power and reduce the size of the system. In these alternative embodiments, the RAM may be fixed in the computer system, or it may be a removable RAM device, such as a Compact Flash memory card.

[00107] In an embodiment of the claimed subject matter, the hard disk drive **727**, magnetic disk drive **728**, and optical disk drive **730** are connected to the system bus **723** by a hard disk drive interface **732**, a magnetic disk drive interface **733**, and an optical disk drive interface **734**, respectively. The drives and their associated computer-readable media provide non-volatile storage of computer readable instructions, data structures, program modules, and other data for the computer **720**. It should be appreciated by those skilled in the art that any type of computer-readable media that can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, RAMs, ROMs, and the like, may be used in the exemplary operating environment.

[00108] A number of program modules may be stored on the hard disk, magnetic disk **729**, optical disk **731**, ROM **724**, or RAM **725**, including an operating system

735, one or more application programs 736, other program modules 737, and program data 738. A user may enter commands and information into the personal computer 720 through input devices such as a keyboard 740 and pointing device 742. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, touch-sensitive pad, or the like. These and other input devices are often connected to the processing unit 721 through a serial port interface 746 that is coupled to the system bus, but may be connected by other interfaces, such as a parallel port, game port, or a universal serial bus (USB). In addition, input to the system may be provided by a microphone to receive audio input.

[00109] A monitor 747 or other type of display device is also connected to the system bus 723 via an interface, such as a video adapter 748. In one embodiment of the claimed subject matter, the monitor comprises a Liquid Crystal Display (LCD). In addition to the monitor, computers typically include other peripheral output devices (not shown), such as speakers and printers. The monitor may include a touch-sensitive surface which allows the user to interface with the computer by pressing on or touching the surface.

[00110] The computer 720 may operate in a networked environment using logical connections to one or more remote computers, such as a remote computer 749. These logical connections are achieved by a communication device coupled to or a part of the computer 720; the embodiment is not limited to a particular type of communications device. The remote computer 749 may be another computer, a server, a router, a network PC, a client, a peer device, or other common network node, and typically includes many or all of the elements described above relative to the computer 720, although only a memory storage device 750 has been illustrated in Figure 6. The logical connections depicted in Figure 6 include a local-area network (LAN) 751 and a wide-area network (WAN) 752. Such networking environments are commonplace in offices, enterprise-wide computer networks, intranets, and the Internet.

[00111] When used in a LAN-networking environment, the computer **720** is connected to the local network **751** through a network interface or adapter **753**, which is one type of communications device. When used in a WAN-networking environment, the computer **720** typically includes a modem **754**, a type of communications device, or any other type of communications device for establishing communications over the WAN **752**, such as the Internet. The modem **754**, which may be internal or external, is connected to the system bus **723** via the serial port interface **746**. In a networked environment, program modules depicted relative to the personal computer **720**, or portions thereof, may be stored in the remote memory storage device. It is appreciated that the network connections shown are exemplary and other means of establishing a communications link between the computers may be used.

[00112] The hardware and operating environment in conjunction with which embodiments of the claimed subject matter may be practiced has been described. The computer in conjunction with which embodiments of the claimed subject matter may be practiced may be a conventional computer, a hand-held or palm-size computer, a computer in an embedded system, a distributed computer, or any other type of computer; the claimed subject matter is not so limited. Such a computer typically includes one or more processing units as its processor, and a computer-readable medium such as a memory. The computer may also include a communications device, such as a network adapter or a modem, so that it is able to communicatively couple other computers.

[00113] While preferred embodiments have been described above and illustrated in the accompanying drawings, it will be evident to those skilled in the art that modifications may be made without departing from this disclosure. Such modifications are considered as possible variants comprised in the scope of the disclosure.

CLAIMS:

1. A computer implemented method for generating itineraries comprising:

identifying a departure location, a destination location and a first time,

identifying an intermediary location between the departure location and the destination location,

identifying an intermediary time associated with the intermediary location,

identifying a weather forecast associated with the intermediary location and the intermediary time, and

identifying an itinerary based at least on the weather forecast.

2. The method of claim 1, comprising estimating a travel time between locations based on the weather forecast.

3. The method of any of claims 1-2, comprising:

identifying at least one of a modified intermediary time based on the weather forecast, and

identifying a modified weather forecast associated with the intermediary location and the modified intermediary time.

4. The method of any of claims 1-3, comprising: identifying a characteristic associated with the weather forecast of the intermediary location and the intermediary time, wherein the itinerary is identified based on the characteristic.

5. The method of claim 4, wherein the characteristic comprises a weather severity level associated with the weather forecast of the intermediary location and the intermediary time, and a user preference.

6. The method of claim 4, comprising:

identifying an alternative intermediary location based on the characteristic,

identifying a second intermediary time associated with the alternative location, and

identifying a second weather forecast associated with the alternative intermediary location and the second intermediary time,

wherein the itinerary is identified based at least on the second weather forecast.

7. The method of any of claims 1-6, wherein the weather forecast comprises information indicating a probability of a specific type of precipitation at a specific rate.

8. The method of any of claims 1-7, wherein:

the departure location, the destination location and the first time are received from a remote device,

at least one of the departure location and the destination location is associated with a current location of the remote device, and

the first time is associated with a current time.

9. The method any of claims 1-8, comprising:

identifying multiple intermediary locations,

identifying multiple intermediary times associated with the multiple intermediary locations, and

identifying multiple weather forecasts associated with the multiple intermediary locations and the multiple intermediary times,

wherein the itinerary is identified based at least on the multiple weather forecasts.

10. The method of any of claims 1-9, comprising:

identifying a first set of intermediary locations and a second set of intermediary locations,

identifying a third set of intermediary times associated with the first set of intermediary locations,

identifying a fourth set of intermediary times associated with the second set of intermediary locations,

identifying a fifth set of weather forecasts associated with the first set of intermediary locations and the third set of intermediary times,

identifying a sixth set of weather forecasts associated with the second set of intermediary locations and the fourth set of intermediary times, and

comparing a characteristic associated with the fifth set of weather forecasts with a characteristic associated with the sixth set of weather forecasts,

wherein, based on the comparison, the identified itinerary comprises the first set of intermediary locations or the second set of intermediary locations.

11. A device for generating itineraries comprising:

one or more processors,

a memory storing instructions for the one or more processors, and

a communication module to connect to a remote device over a communication network,

wherein when the one or more processors execute the instructions stored in the memory, the device is caused to:

identify a departure location, a destination location and a first time,

identify an intermediary location between the departure location and the destination location,

identify an intermediary time associated with the intermediary location,

identify a weather forecast associated with the intermediary location and the intermediary time, and

identify an itinerary based at least on the weather forecast.

12. The device of claim 11, wherein the device is caused to estimate a travel time between locations based on the weather forecast.

13. The device of claim 11 or 12, wherein the device is caused to:

identify at least one of a modified intermediary time based on the weather forecast, and

identify a modified weather forecast associated with the intermediary location and the modified intermediary time.

14. The device of any of claims 11-13, wherein the device is caused to identify a characteristic associated with the weather forecast of the intermediary location and the intermediary time, and a user preference parameter,

wherein the itinerary is identified based on the characteristic and the user preference parameter.

15. The device of claim 14, wherein the device is caused to:

identify an alternative intermediary location based on the characteristic,

identify a second intermediary time associated with the alternative location, and

identify a second weather forecast associated with the alternative intermediary location and the second intermediary time,

wherein the itinerary is identified based at least on the second weather forecast.

16. The device of any of claims 11-15, wherein the weather forecast comprises information indicating a probability of a specific type of precipitation at a specific rate.

17. The device of any of claims 11-16, wherein:

the communication module receives the departure location, the destination location and the first time from the remote device,

at least one of the departure location and the destination location is associated with a current location of the remote device, and

the first time is associated with a current time.

18. The device of any of claims 11-17, wherein the device is caused to:

identify multiple intermediary locations,

identify multiple intermediary times associated with the multiple intermediary locations, and

identify multiple weather forecasts associated with the multiple intermediary locations and the multiple intermediary times,

wherein the itinerary is identified based at least on the multiple weather forecasts.

19. The device of any of claims 11-18, wherein the device is caused to:

identify a first set of intermediary locations and a second set of intermediary locations,

identify a third set of intermediary times associated with the first set of intermediary locations,

identify a fourth set of intermediary times associated with the second set of intermediary locations,

identify a fifth set of weather forecasts associated with the first set of intermediary locations and the third set of intermediary times,

identify a sixth set of weather forecasts associated with the second set of intermediary locations and the fourth set of intermediary times, and

compare a characteristic associated with the fifth set of weather forecasts with a

characteristic associated with the sixth set of weather forecasts,

wherein, based on the comparison, the identified itinerary comprises the first set of intermediary locations or the second set of intermediary locations.

20. A system comprising a server and a remote device that is connected to the server over a communication network, wherein:

the server comprises a computer and a non-transitory computer-readable medium storing a program causing the computer to execute an itinerary generation process, the itinerary generation process comprising:

identifying an itinerary comprising a departure location, a destination location and a first time,

identifying a departure location, a destination location and a first time,

identifying an intermediary location between the departure location and the destination location,

identifying an intermediary time associated with the intermediary location,

identifying a weather forecast associated with the intermediary location and the intermediary time, and

identifying an itinerary based at least on the weather forecast, and

the remote device comprises one or more processors, a display and a memory storing instructions for the one or more processors to:

obtain the itinerary from the server over the communication network,

cause, on the display, a display of at least part of the itinerary.

21. The system of claim 20, wherein the itinerary generation process comprises:

identifying a characteristic associated with the weather forecast of the intermediary location and the intermediary time,

identifying a second intermediary location based on the characteristic,

identifying a second intermediary time associated with the second

intermediary location, and

identifying a second weather forecast associated with the second intermediary location and the second intermediary time,

wherein the itinerary is identified based at least on the second weather forecast.

22. A computer implemented method for generating itineraries comprising:

receiving an itinerary request including a departure location, a destination location and a given time,

in response to receiving the itinerary request, obtaining a list of locations and a list of times corresponding to the locations,

obtaining a weather forecast for each location of the list of locations for the time corresponding to each location, resulting in a list of weather forecasts, and

outputting at least one of an itinerary or the list of weather forecasts for corresponding locations.

23. The method of claim 22, comprising estimating a delay in a displacement due to the weather forecasts.

24. The method of claim 23, wherein the delay in the displacement is used to modify the times corresponding to the locations.

25. A mobile device, comprising:

one or more processors,

a memory storing instructions for the one or more processors,

a communication module to connect to a remote server over a communication network, and a display,

wherein when the instructions are executed by the one or more processors, the device is caused to:

receive, from the remote server, an itinerary comprising a departure location, a destination location and an intermediary location, the itinerary generated based at least on a weather forecast associated with the intermediary location and an intermediary time, the intermediary time representing the time at which the mobile device is expected to arrive at the intermediary location, and cause, on the display, a display of at least a part of the itinerary received from the remote server.

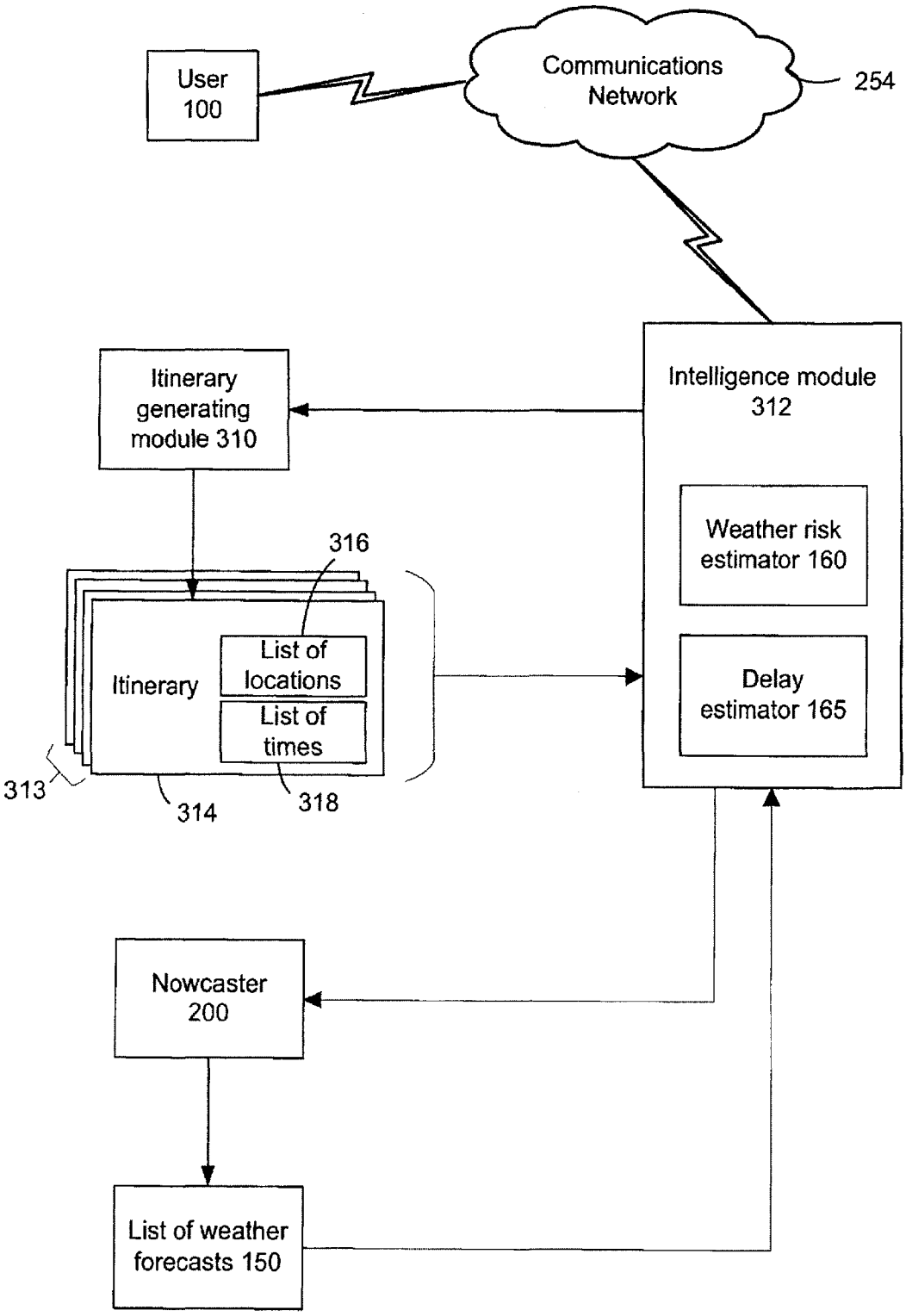
User
100
Communications
Network
254
Itinerary
generating
module 310
Intelligence module
312
Weather risk
estimator 160
Delay
estimator 165
316
Itinerary
List of
locations
List of
times
313
314
318
Nowcaster
200
List of weather
forecasts 150

FIGURE 1

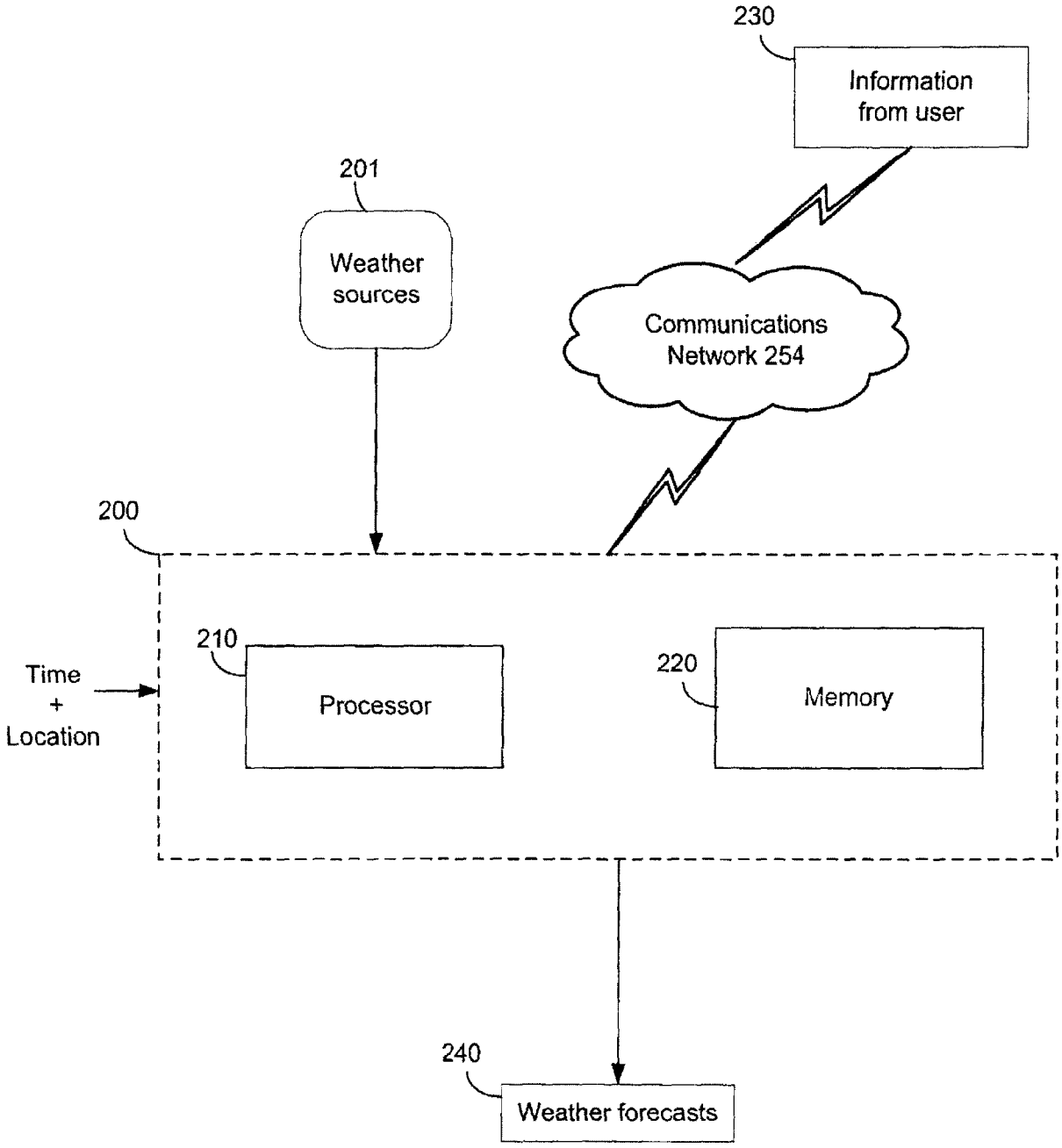
230
Information from user
201
Weather sources
Communications Network 254
200
210
Processor
220
Memory
Time + Location
240
Weather forecasts

FIGURE 2A

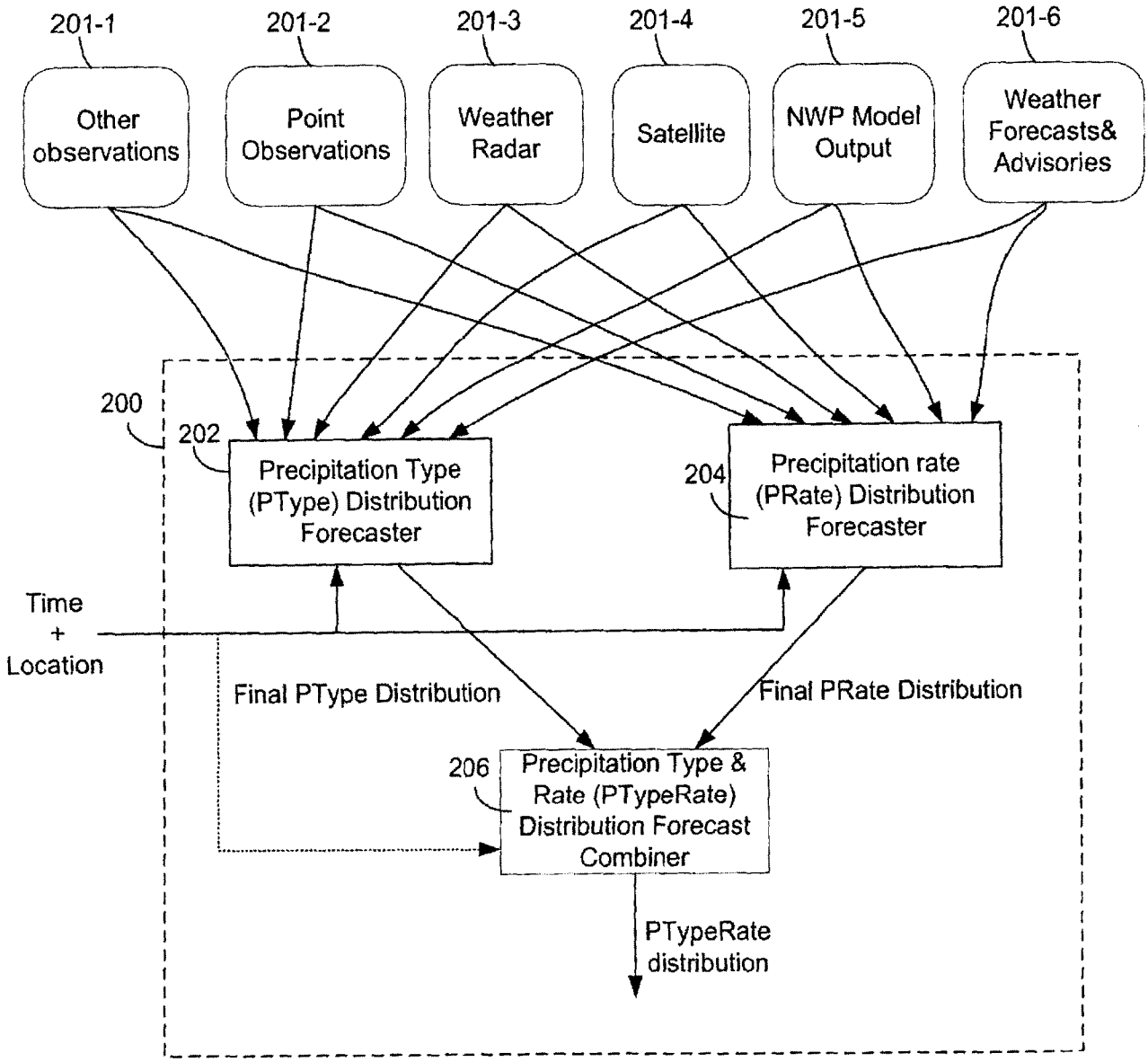
201-1
201-2
201-3
201-4
201-5
201-6
Other observations
Point Observations
Weather Radar
Satellite
NWP Model Output
Weather Forecasts& Advisories
200
202
Precipitation Type (PType) Distribution Forecaster
204
Precipitation rate (PRate) Distribution Forecaster
Time + Location
Final PType Distribution
Final PRate Distribution
206
Precipitation Type & Rate (PTypeRate) Distribution Forecast Combiner
PTypeRate distribution

FIGURE 2B

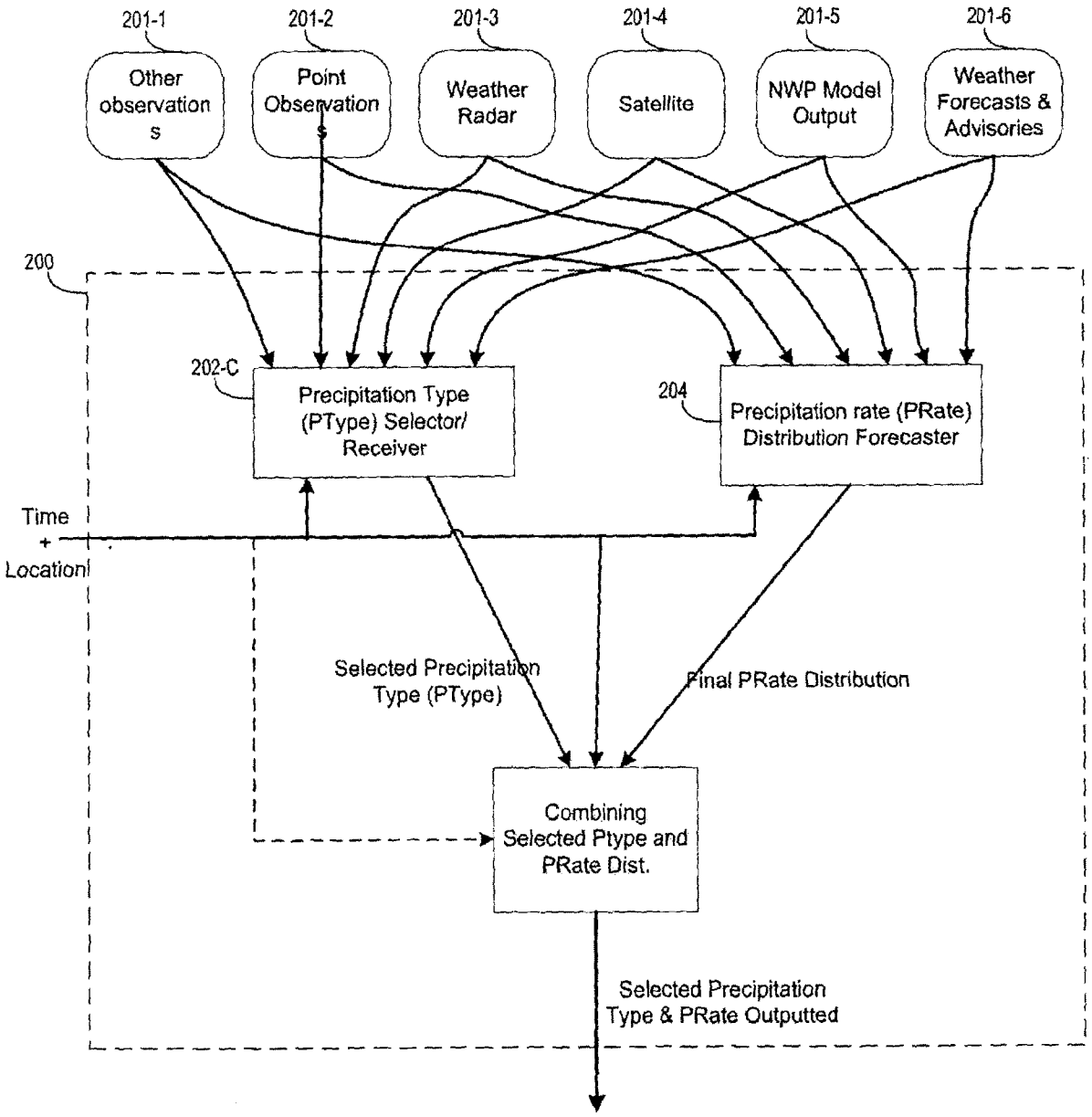
201-1
Other observation s
201-2
Point Observation s
201-3
Weather Radar
201-4
Satellite
201-5
NWP Model Output
201-6
Weather Forecasts & Advisories
200
202-C
Precipitation Type (PType) Selector/ Receiver
204
Precipitation rate (PRate) Distribution Forecaster
Time + Location
Selected Precipitation Type (PType)
Final PRate Distribution
Combining Selected Ptype and PRate Dist.
Selected Precipitation Type & PRate Outputted

FIGURE 2C

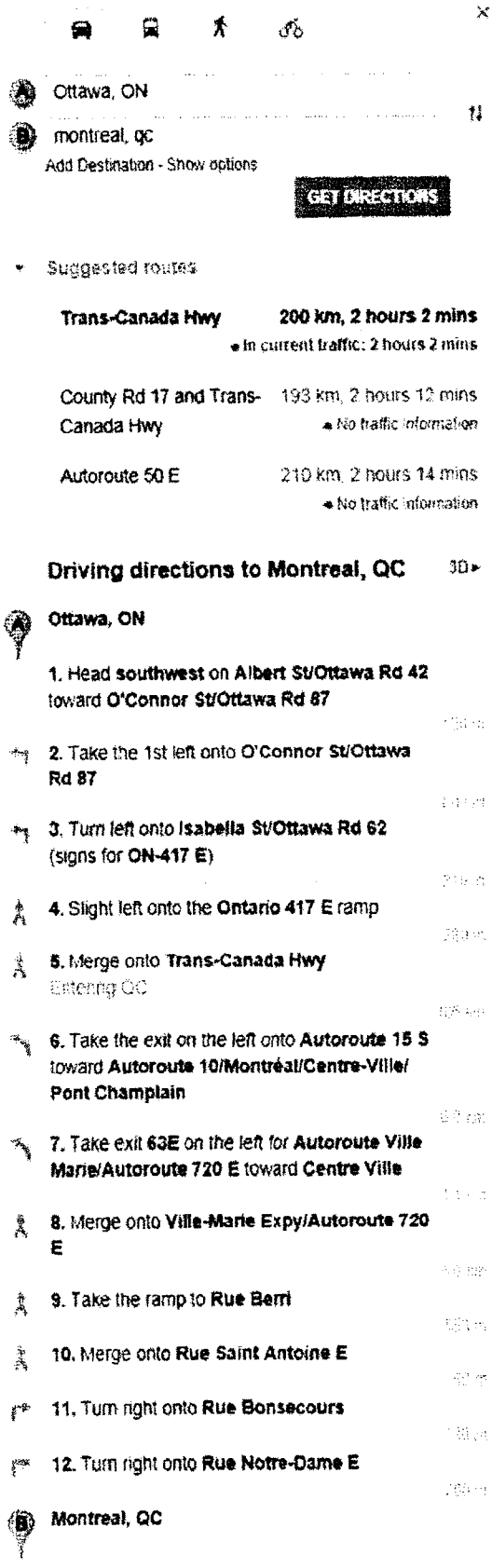
Ottawa, ON
montreal, qc
Add Destination - Show options
GET DIRECTIONS
Suggested routes
Trans-Canada Hwy 200 km, 2 hours 2 mins
In current traffic: 2 hours 2 mins
County Rd 17 and Trans-Canada Hwy 193 km, 2 hours 12 mins
No traffic information
Autoroute 50 E 210 km, 2 hours 14 mins
No traffic information
Driving directions to Montreal, QC
Ottawa, ON
1. Head southwest on Albert St/Ottawa Rd 42 toward O'Connor St/Ottawa Rd 87
2. Take the 1st left onto O'Connor St/Ottawa Rd 87
3. Turn left onto Isabella St/Ottawa Rd 62 (signs for ON-417 E)
4. Slight left onto the Ontario 417 E ramp
5. Merge onto Trans-Canada Hwy
Entering QC
6. Take the exit on the left onto Autoroute 15 S toward Autoroute 10/Montréal/Centre-Ville/ Pont Champlain
7. Take exit 63E on the left for Autoroute Ville Marie/Autoroute 720 E toward Centre Ville
8. Merge onto Ville-Marie Expy/Autoroute 720 E
9. Take the ramp to Rue Berri
10. Merge onto Rue Saint Antoine E
11. Turn right onto Rue Bonsecours
12. Turn right onto Rue Notre-Dame E
Montreal, QC

FIGURE 3

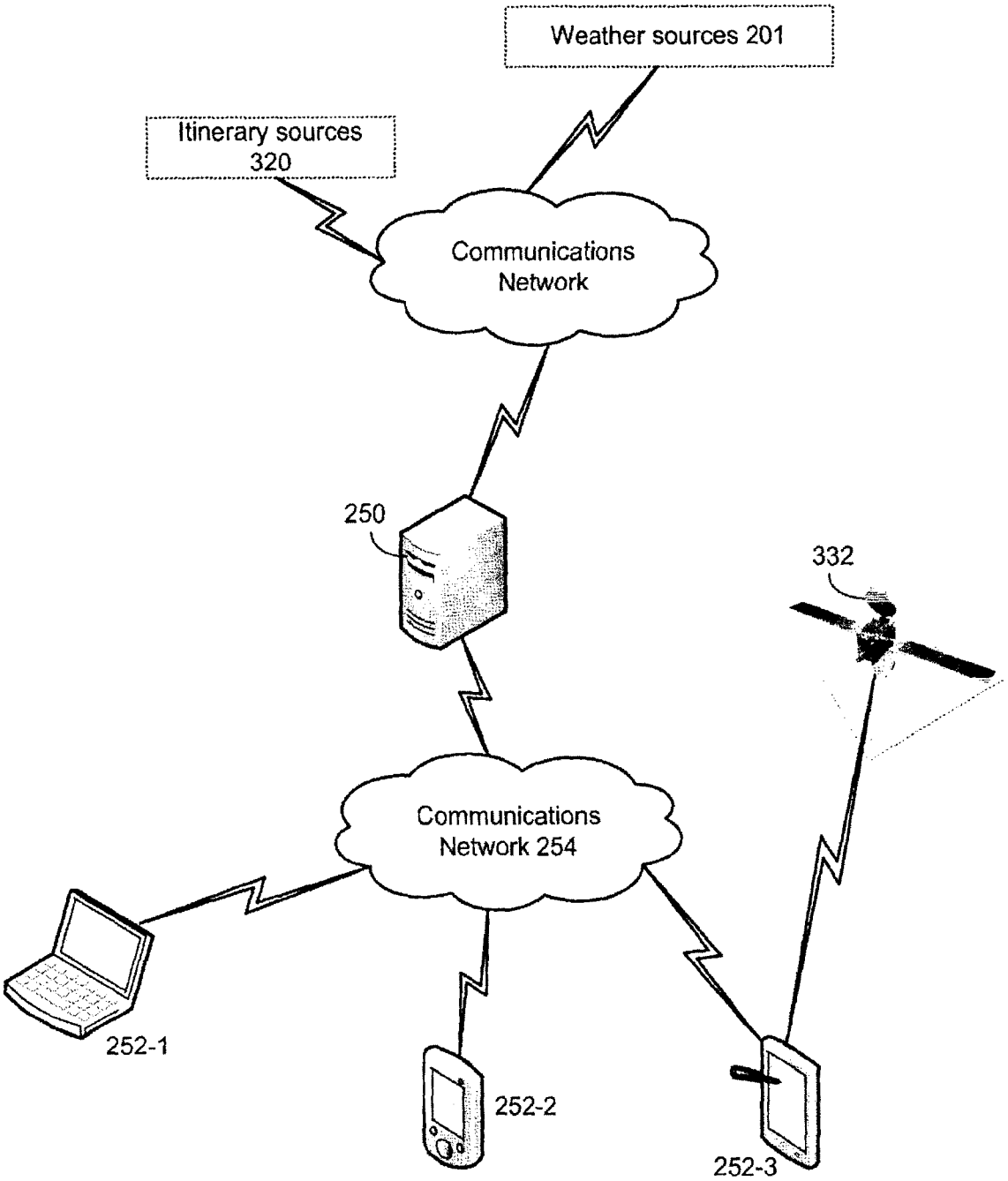
Weather sources 201
Itinerary sources 320
Communications Network
250
332
Communications Network 254
252-1
252-2
252-3

FIGURE 4A

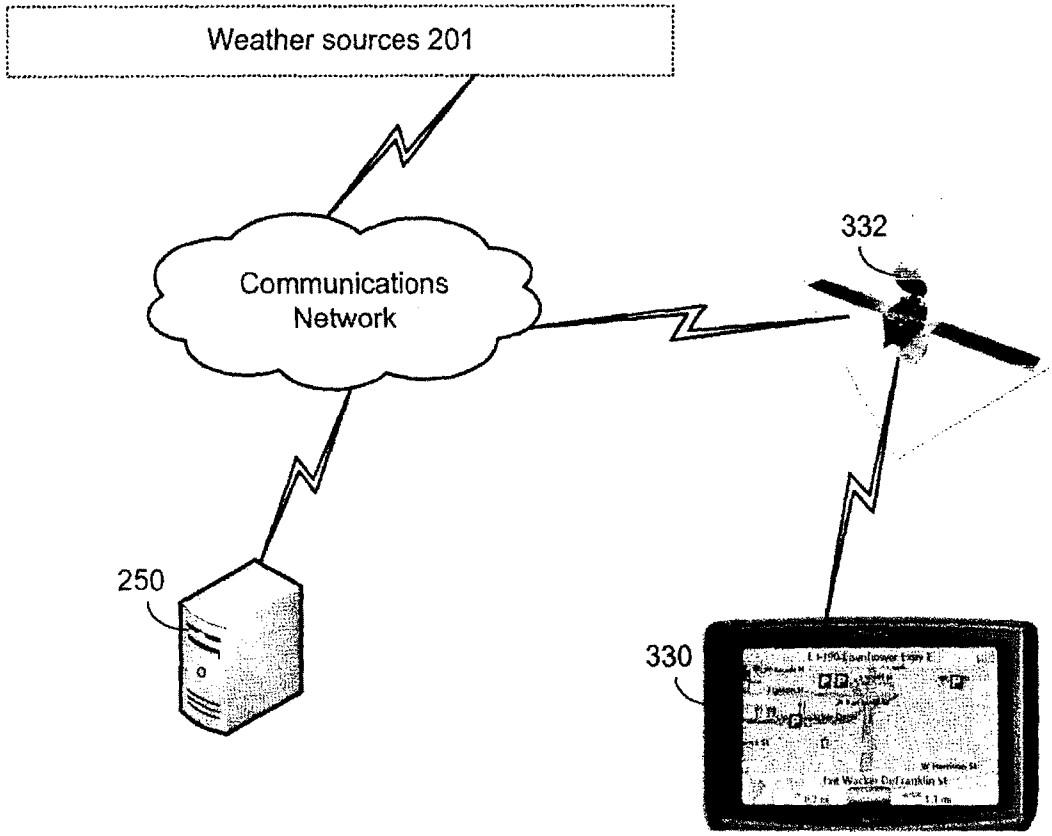

FIGURE 4B

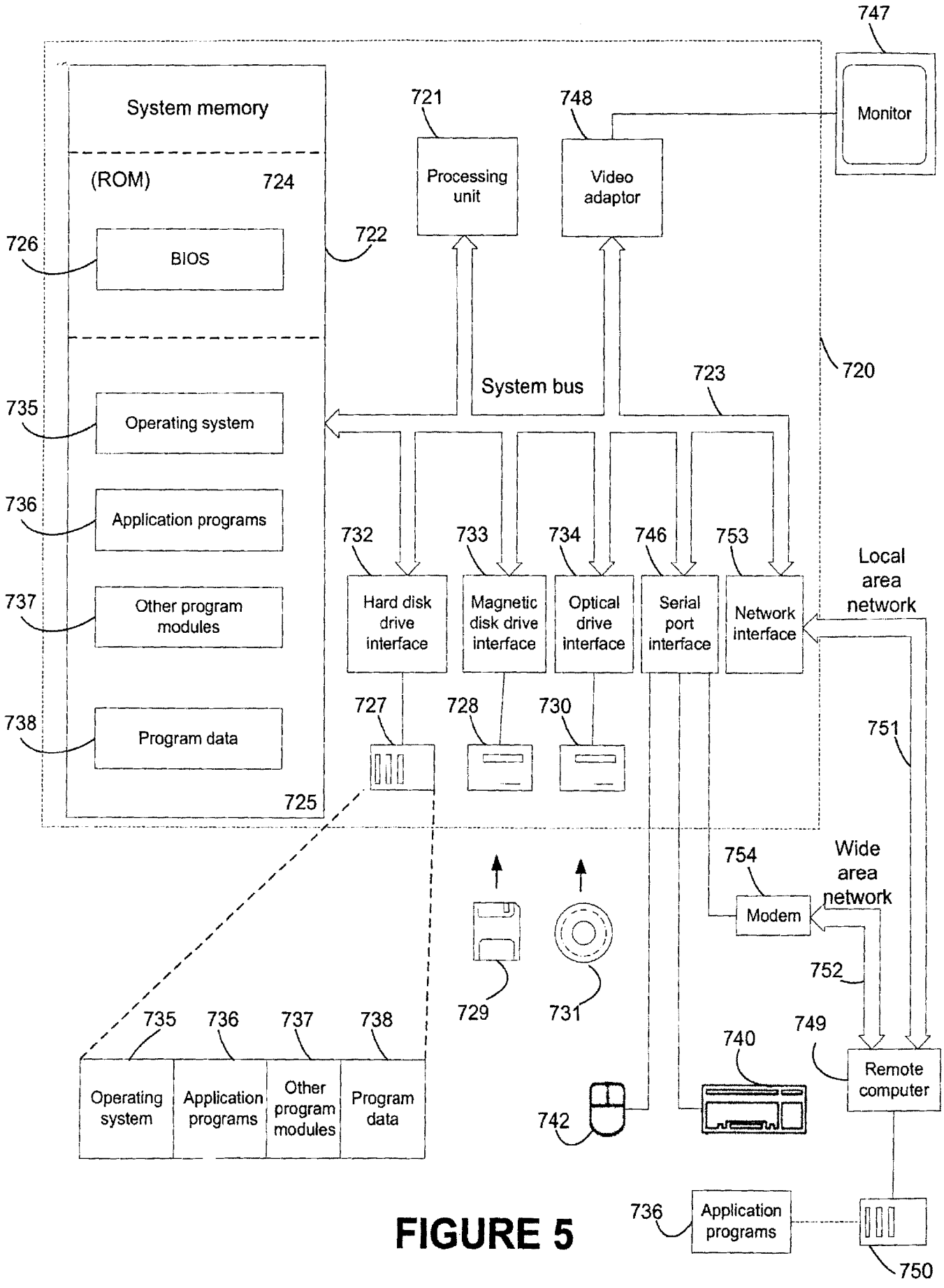
747
Monitor
721
Processing unit
748
Video adaptor
System memory
(ROM) 724
726
BIOS
722
720
System bus
723
735
Operating system
736
Application programs
737
Other program modules
738
Program data
725
732
733
734
746
753
Hard disk drive interface
Magnetic disk drive interface
Optical drive interface
Serial port interface
Network interface
Local area network
727
728
730
751
754
Modem
Wide area network
752
729
731
735
736
737
738
Operating system
Application programs
Other program modules
Program data
740
749
Remote computer
742
736
Application programs
750

FIGURE 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2014/000315

A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***G01C 21/00*** (2006.01), *G01W 1/10* (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: ***G01C 21/00*** (2006.01), *G01W 1/10* (2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
(Canadian Patent Database, Questel Intellectual Property Portal: itinerary, gps, weather forecast, intermediary location, intermediary time, navigation)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,317,686 (Ran) 13 November 2001 (2001-11-13) (abstract, Fig. 3,6, column 6, lines 6-14)	1-25
X	US 2011/0307168 (Kieff) 15 December 2011 (2011-12-15) (see whole document)	1-25
X	US 2009/0088965 (Burckart et al.) 2 April 2009 (2009-04-02) (see whole document)	1-25

☐ Further documents are listed in the continuation of Box C.

☑ See patent family annex.

*	Special categories of cited documents:
"A"	document defining the general state of the art which is not considered to be of particular relevance
"E"	earlier application or patent but published on or after the international filing date
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O"	document referring to an oral disclosure, use, exhibition or other means
"P"	document published prior to the international filing date but later than the priority date claimed
"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&"	document member of the same patent family

Date of the actual completion of the international search 15 July 2014 (15-07-2014)	Date of mailing of the international search report 17 July 2014 (17-07-2014)
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(71)申请人 天气变化研究无限责任公司
地址 加拿大魁北克

(72)发明人 A·莱伯兰克

(74)专利代理机构 中国国际贸易促进委员会专利商标事务所 11038
代理人 李玲

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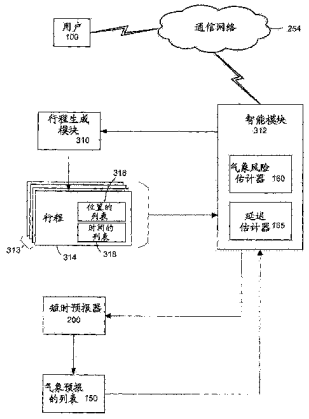
将局部气象预报与行程规划进行组合的方法与系统

(57)摘要

提供了一种用于生成带气象预报的行程的方法、设备和非临时性计算机可读存储介质。所述行程可以包括出发位置、目的位置和第一时间。基于所述行程，可以识别中间位置和与中间位置相关联的中间时间。可以预测与识别的中间位置和中间时间相关联的气象预报。可以评估与识别的路线相关联的气象风险，并基于评估的风险，可以另外识别供替换的路线。



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1. 一种用于生成行程的计算机实现的方法，包括：

识别出发位置、目的位置和第一时间，

识别所述出发位置与所述目的位置之间的中间位置，

识别与所述中间位置相关联的中间时间，

识别与所述中间位置和所述中间时间相关联的气象预报，以及

至少基于所述气象预报识别行程。

2. 根据权利要求 1 所述的方法，包括基于所述气象预报估计位置之间的行进时间。

3. 根据权利要求 1-2 中任一项所述的方法，包括：

基于所述气象预报识别至少一个修改的中间时间，以及

识别与所述中间位置和所述修改的中间时间相关联的修改的气象预报。

4. 根据权利要求 1-3 中任一项所述的方法，包括：识别与所述中间位置和所述中间时间的气象预报相关联的特性，其中基于所述特性识别所述行程。

5. 根据权利要求 4 所述的方法，其中所述特性包括与所述中间位置和所述中间时间的气象预报相关联的气象严重级别，和用户偏好。

6. 根据权利要求 4 所述的方法，包括：

基于所述特性识别供替换的中间位置，

识别与所述供替换的位置相关联的第二中间时间，以及

识别与所述供替换的中间位置和所述第二中间时间相关联的第二气象预报，

其中至少基于所述第二气象预报识别所述行程。

7. 根据权利要求 1-6 中任一项所述的方法，其中所述气象预报包括指示以特定速率的特定类型降水的概率的信息。

8. 根据权利要求 1-7 中任一项所述的方法，其中：

从远程设备接收所述出发位置、所述目的位置和所述第一时间，

所述出发位置和所述目的位置中的至少一者与所述远程设备的当前位置相关联，以及

所述第一时间与当前时间相关联。

9. 根据权利要求 1-8 中任一项所述的方法，包括：

识别多个中间位置，

识别与所述多个中间位置相关联的多个中间时间，以及

识别与所述多个中间位置和所述多个中间时间相关联的多个气象预报，

其中至少基于所述多个气象预报识别所述行程。

10. 根据权利要求 1-9 中任一项所述的方法，包括：

识别第一组中间位置和第二组中间位置，

识别与所述第一组中间位置相关联的第三组中间时间，

识别与所述第二组中间位置相关联的第四组中间时间，

识别与所述第一组中间位置和所述第三组中间时间相关联的第五组气象预报，

识别与所述第二组中间位置和所述第四组中间时间相关联的第六组气象预报，以及

将与所述第五组气象预报相关联的特性和与所述第六组气象预报相关联的特性进行比较，

其中，基于所述比较，识别的行程包括所述第一组中间位置或所述第二组中间位置。

11. 一种用于生成行程的设备，包括：

一个或多个处理器，

存储用于所述一个或多个处理器的指令的存储器，以及

通过通信网络连接到远程设备的通信模块，

其中当所述一个或多个处理器执行存储在所述存储器中的指令时，使得所述设备：

识别出发位置、目的位置和第一时间，

识别所述出发位置与所述目的位置之间的中间位置，

识别与所述中间位置相关联的中间时间，

识别与所述中间位置和所述中间时间相关联的气象预报，以及

至少基于所述气象预报识别行程。

12. 根据权利要求 11 所述的设备，其中使得所述设备基于所述气象预报估计位置之间的行进时间。

13. 根据权利要求 11 或 12 所述的设备，其中使得所述设备：

基于所述气象预报识别至少一个修改的中间时间，以及

识别与所述中间位置和所述修改的中间时间相关联的修改的气象预报。

14. 根据权利要求 11-13 中任一项所述的设备，其中使得所述设备识别与所述中间位置和所述中间时间的气象预报相关联的特性，和用户偏好参数，

其中基于所述特性和所述用户偏好参数识别所述行程。

15. 根据权利要求 14 所述的设备，其中使得所述设备：

基于所述特性识别供替换的中间位置，

识别与供替换的位置相关联的第二中间时间，以及

识别与所述供替换的中间位置和所述第二中间时间相关联的第二气象预报，

其中至少基于所述第二气象预报识别所述行程。

16. 根据权利要求 11-15 中任一项所述的设备，其中所述气象预报包括指示以特定速率的特定类型降水的概率的信息。

17. 根据权利要求 11-16 中任一项所述的设备，其中：

所述通信模块从所述远程设备接收所述出发位置、所述目的位置和所述第一时间，

所述出发位置和所述目的位置中的至少一者与所述远程设备的当前位置相关联，以及

所述第一时间与当前时间相关联。

18. 根据权利要求 11-17 中任一项所述的设备，其中使得所述设备：

识别多个中间位置，

识别与所述多个中间位置相关联的多个中间时间，以及

识别与所述多个中间位置和所述多个中间时间相关联的多个气象预报，

其中至少基于所述多个气象预报识别所述行程。

19. 根据权利要求 11-18 中任一项所述的设备，其中使得所述设备：

识别第一组中间位置和第二组中间位置，

识别与所述第一组中间位置相关联的第三组中间时间，

识别与所述第二组中间位置相关联的第四组中间时间，

识别与所述第一组中间位置和所述第三组中间时间相关联的第五组气象预报，

识别与所述第二组中间位置和所述第四组中间时间相关联的第六组气象预报，以及

将与所述第五组气象预报相关联的特性和与所述第六组气象预报相关联的特性进行比较，

其中，基于所述比较，识别的行程包括所述第一组中间位置或所述第二组中间位置。

20. 一种包括服务器和通过通信网络连接到所述服务器的远程设备的系统，其中：

所述服务器包括计算机和非临时性计算机可读介质，所述非临时性计算机可读介质存储使得所述计算机执行行程生成处理的程序，所述行程生成处理包括：

识别包括出发位置、目的位置和第一时间的行程，

识别出发位置、目的位置和第一时间，

识别所述出发位置与所述目的位置之间的中间位置，

识别与所述中间位置相关联的中间时间，

识别与所述中间位置和所述中间时间相关联的气象预报，以及

至少基于所述气象预报识别行程，以及

所述远程设备包括一个或多个处理器、显示器和存储用于所述一个或多个处理器执行以下操作的指令的存储器：

通过所述通信网络从所述服务器获得所述行程，

使得在所述显示器上显示所述行程的至少部分。

21. 根据权利要求 20 所述的系统，其中所述行程生成处理包括：

识别与所述中间位置和所述中间时间的气象预报相关联的特性，

基于所述特性识别第二中间位置，

识别与所述第二中间位置相关联的第二中间时间，以及

识别与所述第二中间位置和所述第二中间时间相关联的第二气象预报，

其中至少基于所述第二气象预报识别所述行程。

22. 一种用于生成行程的计算机实现的方法，包括：

接收包括出发位置、目的位置和给定时间的行程请求，

响应于接收到所述行程请求，获得位置的列表和对应于所述位置的时间的列表，

获得针对位置的列表中的每个位置的、针对对应于每个位置的时间的气象预报，产生气象预报的列表，以及

输出行程或针对对应的位置的气象预报的列表中的至少一者。

23. 根据权利要求 22 所述的方法，包括估计由于所述气象预报造成的位移的延迟。

24. 根据权利要求 23 所述的方法，其中所述位移的延迟被用于修改对应于所述位置的时间。

25. 一种移动设备，包括：

一个或多个处理器，

存储用于所述一个或多个处理器的指令的存储器，

通过通信网络连接到远程服务器的通信模块，和显示器，

其中当由所述一个或多个处理器执行所述指令时，使得所述设备：

从所述远程服务器接收包括出发位置、目的位置和中间位置的行程，所述行程至少基于与所述中间位置和中间时间相关联的气象预报被生成，所述中间时间表示所述移动设备

预计到达所述中间位置的时间；以及使得在所述显示器上显示从所述远程服务器接收的所述行程的至少部分。

将局部气象预报与行程规划进行组合的方法与系统

[0001] 相关申请的交叉引用

[0002] 本申请要求2013年4月4日提交的共同拥有和共同发明的美国专利申请No.13/856,923、2013年6月20日提交的美国专利申请No.13/922,800、2013年7月22日提交的美国专利申请No.13/947,331、2013年6月26日提交的美国临时专利申请No.61/839,675、2013年6月16日提交的美国临时专利申请No.61/835,626、和2013年6月19日提交的美国临时专利申请No.61/836,713的优先权，其全部内容作为参考被合并于此。

技术领域

[0003] 所公开的主题总的来说涉及一种用于生成气象预报的系统。更具体地，本主题涉及用于生成气象预报的软件应用。

背景技术

[0004] 传统的气象预报系统提供距目前时间12小时到几天的气象预测。如果有人需要短期预报或时间尺度非常精细的预报，则对于一天来说通常可获得的最佳信息是按小时的预报。

[0005] 传统的气象预报是对生成气象预报的区域的平均预报。从而，对于该区域内的精确位置预报可能是不精确的，甚至对区域所显示的当前气象可能与该区域内的精确位置的实际气象是不同的。

[0006] 而且，传统的按时间尺度来显示的气象预报太粗略，不能允许用户知道在精确的位置和时间什么时候发生气象事件。即使对于按小时的传统气象预报，用户也不能知道预报的气象事件是持续一个小时还是一分钟，以及对于持续一分钟的情况，气象事件到底发生在一个小时内的什么时候。

[0007] 对于在一天之中的一段时间呆在同一位置的用户，传统的气象预报可以提供可靠的气象预报。然而，对于移动的用户，被传达给公众的传统气象预报缺乏必要的时间和空间分辨率，以向移动用户提供沿着用户的行程的可靠的气象预报。而且，传统的气象预报或路线规划工作不能估算路线上由气象造成的延迟，虽然需要具有该功能的工具。

[0008] 所以，市场上有生成和显示对各个位置和时间的短期气象预报的需求，以及市场上还需要一种允许估计沿出发位置与目的位置之间的路线的气象的系统和方法，从而用户可以尝试采取替代路线来避免极端气象条件。

发明内容

[0009] 可以提供一种用于生成行程的计算机实现的方法，包括：识别出发位置、目的位置和第一时间，识别出发位置与目的位置之间的中间位置，识别与中间位置相关联的中间时间，识别与中间位置和中间时间相关联的气象预报，以及至少基于所述气象预报识别行程。

[0010] 在一些实施方式中，方法可以包括基于气象预报估计位置之间的行程时间。

[0011] 在一些实施方式中，方法可以包括基于气象预报识别至少一个修改的中间时间，以及识别与中间位置和修改的中间时间相关联的修改的气象预报。

[0012] 在一些实施方式中，方法可以包括识别与中间位置和中间时间的气象预报相关联的气象严重级别。可以基于气象严重级别识别行程。

[0013] 在一些实施方式中，方法可以包括：基于气象严重级别识别供替换的中间位置，识别与供替换的位置相关联的第二中间时间，以及识别与供替换的中间位置和第二中间时间相关联的第二气象预报，其中至少基于第二气象预报识别行程。

[0014] 在一些实施方式中，气象预报可以包括指示以特定速率的特定类型降水的概率的信息。

[0015] 在一些实施方式中，可以从远程设备（例如，GPS、用户可操作设备等等）接收出发位置、目的位置和第一时间。出发位置和目的位置中的至少一者可以与远程设备的当前位置相关联，以及第一时间可以与当前时间相关联。

[0016] 在一些实施方式中，该方法可以包括：识别多个中间位置，识别与多个中间位置相关联的多个中间时间，以及识别与多个中间位置和多个中间时间相关联的多个气象预报，其中至少基于所述多个气象预报识别行程。

[0017] 在一些实施方式中，该方法可以包括：识别第一组中间位置和第二组中间位置，识别与第一组中间位置相关联的第三组中间时间，识别与第二组中间位置相关联的第四组中间时间，识别与第一组中间位置和第三组中间时间相关联的第五组气象预报，识别与第二组中间位置和第四组中间时间相关联的第六组气象预报，以及将与第五组气象预报相关联的气象严重级别和与第六组气象预报相关联的气象严重级别进行比较，其中，基于该比较，识别的行程包括第一组中间位置或第二组中间位置。

[0018] 在其他实施方式中，可以提供一种用于生成行程的计算机实现的方法，包括：接收包括出发位置、目的位置和给定时间的行程请求，响应于接收到所述行程请求，获得位置的列表和对应于所述位置的时间的列表，获得针对位置的列表中的每个位置的、针对对应于每个位置的时间的气象预报，得到气象预报的列表，并输出针对对应的位置的气象预报的列表。方法可以包括估计由于气象预报造成的位移的延迟。位移的延迟可以被用于修改对应于所述位置的时间。

[0019] 在一些实施方式中，可以有一种设备，该设备包括一个或多个处理器、存储计算机指令的存储器，可以由一个或多个处理器执行所述计算机指令，从而使得当执行所述指令时设备执行上述方法中的任意一个或多个方法。而且，可以有一种存储所述指令的非临时性计算机可读介质。

[0020] 而且，可以有一种设备，该设备包括一个或多个处理器、存储用于所述一个或多个处理器的指令的存储器、通过通信网络连接到远程服务器的通信模块、和显示器。当执行指令时，可以使设备：从远程服务器接收包括出发位置、目的位置和中间位置的行程，所述行程至少基于与中间位置和中间时间相关联的气象预报被生成，所述中间时间表示预计设备到达所述中间位置的时间；以及使得显示器显示至少部分从远程服务器接收的所述行程。设备可以为移动设备，诸如非排他地是手持设备、移动电话、车辆等等。

附图说明

[0021] 结合附图，根据下面的详细描述，本公开的进一步的特征和优点将会变得明显，在所述附图中：

[0022] 图 1 示出了用于将局部气象预报和行程规划组合起来的系统的框图的示例；

[0023] 图 2A 示出了用于实施一个或多个实施方式的合适的短时预报器的框图的示例；

[0024] 图 2B 是用于实施一个或多个实施方式的合适的短时预报器的更详细的框图的一个示例；

[0025] 图 2C 是用于实施一个或多个实施方式的合适的短时预报器的更详细的框图的另一个示例；

[0026] 图 3 是示出了行程生成模块返回的行程的示例的截屏图；

[0027] 图 4A 是其中可以实现实施方式的一个网络环境的示例；

[0028] 图 4B 是其中可以实现实施方式的另一个网络环境的示例；

[0029] 图 5 是示出了其中可以实现所要求保护的主题的实施方式的合适的计算操作环境的示例图。

[0030] 要注意的是，在附图中，相似的特征由相似的参考标记来标识。

具体实施方式

[0031] 现在将参考附图在下面更充分地描述实施方式，所述附图构成实施方式的一部分并通过说明的方式显示了可用来实现实施方式的特定实施方式。描述实施方式还为了使得本公开可以向本领域的技术人员表达要求保护的主题的范围。然而，实施方式可以以不同的形式实现，而不应该解释为限于在此提出的实施方式。

[0032] 此外，这些实施方式可以被实施为方法或设备。因此，实施方式可以采用整体硬件实施方式、整体软件实施方式、软件与硬件方面结合的实施方式等的形式。而且，虽然参考便携式或手持式设备描述了实施方式，但是也可以在台式机、笔记本电脑、平板电脑或有足够的计算资源来实现实施方式的任何计算设备上实现实施方式。

[0033] 定义

[0034] 在本说明书中，下面的术语旨在定义为如下：

[0035] 短时预报：术语短时预报是“短时”和“预报”的缩写词，其指的是被设计成进行短期（通常是 0 到 12 小时范围内）的预报的技术的集合。

[0036] 短时预报器是针对地球上非常小的区域（5 米、10 米、50 米、100 米、500 米、1000 米等）准备非常短期（例如，1 分钟、5 分钟、15 分钟、30 分钟等）的预报的气象预报设备。

[0037] 气象值是任何种类的与气象有关的量或属性，诸如温度、气压、能见度、降水类型和强度、积聚、云量、风等等。

[0038] 预报的气象值是由短时预报器预测的气象值。

[0039] 气象有关的事件是可以影响气象值或预测的气象值的事件，所述气象有关的事件包括例如以下至少一者：冰雹、阵风、雷电、温度变化等等。

[0040] 降水类型（P 类型）：表示降水的类型。降水类型的示例包括但不限于，降雨、降雪、冰雹、冻雨、冰粒、或冰晶等等。

[0041] 降水速率（P 速率）：表示降水的强度。降水速率值的示例包括但不限于，无降水（即，不降水）、轻度降水、中度降水、重度降水、严重降水。在一个实施方式中，降水速率也

可以表示为诸如以下值的范围：无到轻度降水、轻到中度降水、中到重度降水，或上述的任意组合。

[0042] 降水概率：表示降水可能发生的概率。降水概率值的示例包括但不限于，无、不太可能、微小几率、偶有、可能、很可能、或确定。

[0043] 在一个实施方式中，降水概率还可以表示为诸如以下值的范围：无到轻度降水、轻到中度降水、或中到重度降水。降水概率也可以表示为百分比的形式，例如0％、25％、50％、75％、100％；或者百分比的范围，例如0％到25％、25％到50％、50％到75％、75％到100％。在一个实施方式中，如下所述可以从概率分布中得到降水概率。

[0044] 降水类型和降水速率类别（P类型速率）：P类型速率类别是降水类型与降水速率的组合，针对给定期间发生的概率可以与该P类型速率类别相关联，用于表示以特定速率接收特定类型的降水的概率。

[0045] 气象预报是可显示给用户一个或多个预报的气象值的集合。

[0046] 用户是气象预报所转发到的人或机器。

[0047] 行程是引导用户从点A到点B的位置或方向的列表。可选择地，行程可以包括对应于位置的时间或位置之间的时间间隔。关键点是符合标准的位置，所述标准可以为用户的偏好。

[0048] 简单地讲，本实施方式描述了一种用于将局部气象预报与行程规划组合起来的方法和系统。通过已知为用于生成短时预报的系统或短时预报器的短期气象预报器来生成气象预报。

[0049] 现在参考图1，描述了一种用于将局部气象预报与行程规划组合起来的系统。所述系统包括智能模块312、行程生成模块310和短时预报器200。智能模块312还包括气象风险估计器160和延迟估计器165。下面将进一步描述这些组件。

[0050] 行程生成模块

[0051] 行程生成模块310可以为用于生成路线和方向的基于网络的模块和/或基于GPS的模块。

[0052] 该基于网络的模块的示例可以包括地图查询（Mapquest™）、雅虎地图（Yahoo™ Maps）、谷歌地图（Google™ Maps）等等。在这些类型的模块中，与生成或路线相关联的数据存储在远程服务器上，可以经由电信网络（例如互联网）访问该远程服务器。使用这些模块，用户可以请求从第一位置A到第二位置B的方向，从而模块可以返回如图3所示的从A到B的位移的方向的列表。

[0053] 如图1所示，行程生成模块310生成行程314，该行程314包括位置316的列表和时间318的列表，其中时间与位置相对应。

[0054] 在一个实施方式中，行程生成模块310可以提供一个或多个行程选项以供用户选择。然后，模块生成行程的列表313。

[0055] 在另一个实施方式中，可以从服务器下载和/或推送数据到可以实现实施方式的计算设备，由此可以在不访问远程服务器的情况下显示所述路线。

[0056] 在一个实施方式中，行程生成模块310还可以包括GPS设备，所述GPS设备使用卫星连接来确定用户的当前位置。GPS单元可以嵌入便携式设备中，诸如iPhone™等等。在另一个实施方式中，GPS设备可以嵌入手持式GPS导航设备中，诸如Garmin™或Magellan™

等制造的系列设备。

[0057] 智能模块

[0058] 如图 1 所示，智能模块 312 通过发送合适的查询到用户 100、行程生成模块 310 和短时预报器 310 并从这些元件接收信息，来链接用户 100、行程生成模块 310、和短时预报器 310。更确切来说，智能模块 312 可以通过通信网络 254 从用户 100 接收信息。在一个实施方式中，智能模块 312 可以链接到用于接收用户输入的用户接口，从而识别诸如位置 A 和 B、出发时间和关于需要短时预报的位置的用户偏好。例如，通过发送表征行程的开始和结束的点 A 和 B 的地理位置，智能模块 312 可以使用从用户 100 接收的该信息来查询行程生成模块 310。智能模块 312 还可以向行程生成模块 310 发送关于行程的开始时间或关于用户的偏好的信息。例如，用户可以选择获得对诸如沿着路线的主要城市的关键点的短时预报，或以例如 30km 等的增量获得短时预报。

[0059] 根据一个实施方式，智能模块 312 发送第一时间或当前时间和时间间隔到行程生成模块 310。

[0060] 根据实施方式，智能模块 312 或行程生成模块 310 可以估计针对每个关键点的到达时间，该到达时间表示用户预计达到特定关键点的估计时间。对到达时间的估计可以取决于多个因素，包括：出发时间（除非由用户指定，否则该出发时间就为当前时间）、出发点与相应的关键点之间的距离、从行程生成模块 310（或其他源）接收的交通信息、气象信息、当前速度、和与当前位置与相应的关键点之间的每段路线相关的限速。

[0061] 如上所述，行程生成模块 310 生成行程 314 或行程的列表 313。根据一个实施方式，每个行程包括位置 316 的列表和时间 318 的列表。该信息被发送回到智能模块 312。

[0062] 根据一个实施方式，智能模块可以选择位置（诸如用户偏好中指定的关键点）及其对应的时间，并将该位置和时间发送到短时预报器 200。

[0063] 在一个实施方式中，智能模块 312 可以将每个位置或关键点的位置信息与当前时间一起发送，由此用户可以看到沿着路线的不同位置处的当前气象条件。

[0064] 基于该实施方式，智能模块 312 可以就在一次呼叫中向实施短时预报器 200 的服务器发送所有列表，或反之，当向短时预报器 200 发送呼叫时将列表分成多个部分。

[0065] 针对每个位置和时间，短时预报器 200 输出气象预报。所以，短时预报器 200 生成对应于每个行程 314 的气象预报 150 的列表。

[0066] 如上所述，行程生成模块 310 可以提供不同的包括沿着不同的位置或关键点的气象条件的路线选项。在一个实施方式中，当提供多个行程时，智能模块 312 内的气象风险估计器 160 可以计算与对应于路线的气象预报 150 的每个列表相关的风险，从而根据气象风险对气象预报 150 的列表及其对应的行程进行分类 (sorting)。气象风险估计器 160 可以根据在行程上发生的气象事件的严重性（强风，大雨等）或这些事件将会发生的概率，给每个行程分配类别或等级。对行程分类会向气象预报 150 的列表添加信息（估计的风险）。根据一个实施方式，如果（以文本或图形方式）显示行程，则可以用不同的颜色显示有较高或较低风险的行程部分。

[0067] 根据一个实施方式，如果对各个行程估计气象风险，则方法可以将交通的路线规划为危险最小的行程。

[0068] 当智能模块接收了位置、时间、气象预报、和其他行程信息（诸如气象风险）时，则

使用通信网络 254 向用户 100 发送该信息。

[0069] 根据一个实施方式，可以在单个网页上提供对行程中每个位置和时间的气象预报。

[0070] 根据一个实施方式，智能模块 312 可以包括延迟估计器 165。该延迟估计器 165 使用气象预报的列表来确定由于气象条件（诸如，可能使交通减速的降雨、雾、强风等）造成的部分行程上的延迟。延迟估计器 165 可以使用具有关于由气象条件造成的延迟的统计的数据库。如果使用延迟估计器 165，则对应于位置 316 的列表的时间 318 的列表不再相关，因为延迟会改变行程上的时间。所以，智能模块通过考虑延迟再次查询行程生成模块 310，生成更准确的时间 318 的列表。智能模块 312 接收该更新的时间 318 的列表，并将该列表发送到短时预报器 200，以用于更新气象预报 150 的列表。所以，当使用延迟估计器时，发生迭代过程。可以对该迭代过程进行编程使其在最后达到给定次数的迭代或平衡后停止。当完成该迭代过程时，智能模块输出行程的列表 313 以及最准确的气象预报 150 的列表。

[0071] 短时预报器

[0072] 图 2A-2C 是根据说明书中所述的主题的一个或多个实施方式的短时预报器的框图。

[0073] 如图 2A-2C 所示，短时预报器 200 从不同的源 201 接收气象观测，所述源诸如气象观测源和气象预报源，所述气象观测源包括但不限于：点观测 201-2（例如，由用户和自动站提供的反馈）、气象雷达 201-3、卫星 201-4 和其他类型的气象观测 201-1，所述气象预报源诸如数值气象预报 (NWP) 模型输出 201-5 和气象预报和公告 201-6。

[0074] 短时预报器 200 包括存储器 220 和处理器 210。存储器 220 包括用于方法的指令，还存储来自气象源的数据、中间结果和气象预报。处理器 210 允许短时预报器执行计算。

[0075] 短时预报器 200 通过通信网络 254 从用户接收信息 230。

[0076] 短时预报器 200 输出气象预报或一系列气象预报。

[0077] 图 2B 是短时预报器 200 的一个实施方式。在该实施方式中，短时预报器 200 包括 P 类型 (PType) 分布预报器 202 和 P 速率 (PRate) 分布预报器 204。P 类型预报器 202 针对给定的经纬度（和 / 或位置）从不同的源 201 接收气象观测并输出一段时间间隔上的降水类型的概率分布。例如：

[0078] a. 降雪：10％

[0079] b. 降雨：30％

[0080] c. 冻雨：60％

[0081] d. 冰雹：0％

[0082] e. 冰粒：0％

[0083] 类似的，P 速率预报器 204 从不同的源接收针对给定经纬度的气象观测，并以表达不确定性的表示来输出降水速率 (PRate) 的概率分布预报。例如，P 速率可以被输出为针对给定的经纬度的一段时间间隔上的降水速率或速率的范围的概率分布。例如：

[0084] f. 无降水：30％

[0085] g. 轻度降水：40％

[0086] h. 中度降水：20％

[0087] i. 重度降水：10％

[0088] P 速率分布预报器 204 和 P 类型预报器 202 输出的 P 速率和 P 类型值被发送到预报组合器 206，以将这些值组合成单个值 P 类型速率 (PTypeRate)，该 P 类型速率表示降水结果。例如，如果 P 类型的值为“降雪”，“P 速率”的值为重度，则 P 类型速率的组合值可以为“重度降雪”。

[0089] 对于给定的经纬度，系统输出针对预定时间间隔的预报的 P 类型速率分布，所述预定时间间隔可以是固定的（例如 :1 分钟）或可变的（例如 :1 分钟，然后 5 分钟，然后 10 分钟等）。系统可以按照时间间隔序列预计算或存储预报的 P 类型速率分布，或实时计算预报的 P 类型速率分布。P 类型速率分布表示，针对每个时间间隔 P 类型速率会发生的确定性或不确定性。

[0090] 参考图 2B，预报组合器 206 从 P 类型预报器 202 接收最终的 P 类型分布和从 P 速率分布预报器 204 接收最终的 P 速率分布，以将所述 P 类型分布和所述 P 速率分布组合成一组 P 类型速率分布值，每个所述 P 类型速率分布值表示以特定速率接收特定类型的降水的概率。下面提供示例。

[0091] 假设 P 类型分布如下 :降雪 :50％，降雨 :0％，冻雨 :30％，冰雹 :0％，冰粒 :20％，以及 P 速率分布如下 :无降水 :0％，轻度降水 :10％，中度降水 :20％，重度降水 :30％，严重降水 40％，则 P 类型速率分布可以如下 :

[0092] 表 1 :P 类型速率分布表的示例

[0093]

P类型 / P速率	降雪 50%	降雨 0%	冻雨 30%	冰雹 0%	冰粒 20%
无降水 0%	无降水	无降水	无降水	无降水	无降水
轻度降水 10%	5%轻度降雪	无降水	3% 轻度冻雨	无降水	2%轻度冰粒
中度降水 20%	10% 中度降雪	无降水	6% 中度冻雨	无降水	4% 中度冰粒
重度降水 30%	15% 重度降雪	无降水	9% 重度冻雨	无降水	6% 重度冰粒
严重降水 40%	20% 严重降雪	无降水	12% 严重冻雨	无降水	8% 严重冰粒

[0094] 因此，预报组合器 206 将每种类型降水的概率与每个降水速率的概率相乘来获得以特定速率接收特定类型的降水的概率，例如 20％几率的重度降雪，或 12％几率的严重冻雨。在一个实施方式中，能够将概率范围与文本信息关联起来，以用于代替数字式的概率而向用户显示文本信息。例如，5％与 15％之间的概率可以与文本“小几率”关联，而 40％与

70％之间的概率可以与文本“大几率”或“很可能”相关联等等，由此，代替显示 60％几率的重度降雪，可以显示 :“大几率重度降雪”。

[0095] 在另一个实施方式中，能够沿着一个或多个维度（所述维度包括 :速度、类型或概率）将两个或多个不同的 P 类型速率组合起来。例如，所述组合的结果可以包括 :可能有轻到中度降雨，可能有轻到中度降雨或重度降雪 ;可能有中度降雨或降雪 ;可能降雨或降雪 ;偶有轻到中度降雨或重度降雪或轻雹 ;偶有中度降雨、降雪或冰雹 ;偶有降雨、降雪或冰雹等等。

[0096] 因此，短时预报器 200 接收需要短时预报的位置和需要短时预报的时间和 / 或时间间隔，并输出针对给定位置和针对特定时间的 P 类型速率分布。

[0097] 图 2C 示出了短时预报器的另一个实施方式。在该实施方式中，短时预报器 200 包括 P 类型选择器 / 接收器 202-C 和 P 速率分布预报器 204。

[0098] 和图 2B 中所示的实施方式类似，P 速率分布预报器 204 从不同的源 201 接收对给定经纬度的气象观测，并以表达不确定性的表示来输出降水速率 (P 速率）的概率分布预报。例如，P 速率可以被输出为针对给定的经纬度一段时间间隔上的降水速率或速率的范围的概率分布。例如 :

[0099] f. 无降水 :30％

[0100] g. 轻度降水 :40％

[0101] h. 中度降水 :20％

[0102] i. 重度降水 :10％

[0103] 然而，P 类型选择器 / 接收器 202-C 不输出与不同类型的降水相关的概率分布。而是 P 类型选择器 / 接收器 202-C 从不同的源 201 接收针对给定经纬度的气象观测，以从不同降水类型的列表中选择一个降水类型。例如，基于从源 201 接收的输入，P 类型选择器 / 接收器 202-C 从以下降水类型的列表中选择最可能在给定经纬度（和 / 或位置）发生的单个降水类型 :

[0104] a. 降雪

[0105] b. 降雨

[0106] c. 冻雨

[0107] d. 冰雹

[0108] e. 冰粒

[0109] f. 混合（例如，a+c、a+d、b+c、a+e、c+e、d+e 等等）

[0110] 从例如上面列表的降水类型的列表中，对于给定的位置仅选择一个降水类型。例如，可以将降雪和冻雨的混合选择作为对给定位置在给定时间最可能的降水类型。降水类型与概率值不相关。实际上，由于针对任意给定位置和时间仅选择一个与位置相对应的降水类型，所以选择的降水类型将具有 100％的有效概率值。

[0111] 可用于选择一个类型的降水类型的列表可以包括表示两个不同降水类型的混合（例如，降雪和冻雨、冰雹和冰粒等等）的混合类型。混合类型被认为是可用于选择的独特降水类型，如上面列表中 (f) 所示，并可以有许多不同的混合类型，表示不同对的各种降水类型的混合。

[0112] 在另一个实施方式中，降水类型不由 P 类型选择器 / 接收器 202-C 选择而是从短

时预报器 200 外部的源中接收。换句话说，短时预报器 200 可以向远程源（例如，第三方气象服务）请求识别针对给定位置在给定时间最可能发生的降水类型，并从识别最可能的降水类型的源接收响应。在这种情况下，对降水类型的选择不由短时预报器 200 执行。仅向短时预报器 200 输入已经选择的降水类型，从而可以节省短时预报器 200 的计算功率，否则就需要该计算功率来执行选择。

[0113] 将分别由 P 类型选择器 / 接收器 202-C 和 P 速率分布预报器 204 输出的选择的降水类型和 P 速率值组合起来。例如，如果选择的降水类型为降雪，以及 P 速率值如上所述，则组合的信息将指示：

[0114] a. 无雪 :30％

[0115] b. 轻度降雪 :40％

[0116] c. 中度降雪 :20％

[0117] d. 重度降雪 :10％

[0118] 因为只涉及一种降水类型，所以只需要极少量的计算功率来执行组合，以输出最终的气象预报数据。因为 P 类型选择器 / 接收器 202-C 会输出一个（1 个）针对给定位置和时间的降水类型，如果 P 速率分布预报器 204 输出 m 个概率分布，则最终的气象预报数据将仅包括 m 个（m*1 个）气象预报分布。

[0119] 在输出最终的气象预报数据时，能够将概率范围与文本信息关联起来，以用于代替数字式的概率向用户显示文本信息，和图 1 中所示的实施方式类似。例如，5％与 15％之间的概率可以与文本“小几率”关联，而 40％与 70％之间的概率可以与文本“大几率”或“很可能”相关联等等，由此，能够代替显示“60％几率的重度降雪”显示为 :“大几率重度降雪”。

[0120] 因此，短时预报器 200 接收需要短时预报的位置和需要短时预报的时间和 / 或时间间隔，并输出针对给定位置和针对特定时间的所选择的 P 类型和 P 速率分布。

[0121] 根据图 2C 所示的实施方式的短时预报器在需要效率的某些情况下相对于图 2B 中所示的实施方式可能是有利的。可以使用比图 2B 的实施方式小得多的处理功率来执行图 2C 的实施方式。然而，图 2B 的实施方式在提供针对任意给定位置和时间的气象预报数据的更详细和精确的简介（snapshot）上可能比图 2C 的实施方式更合适。

[0122] 图 4A 是其中可以实现实施方式的一个网络环境的示例。可以在多个客户端计算机 252 可以通过通信网络 254 进行访问的服务器 / 计算机 250 上实现短时预报器 300。客户端计算机可以包括但不限于 :笔记本电脑、台式计算机、便携式计算设备、平板电脑等。使用客户端计算机 252，每个用户可以输入两个位置之间的方向和优选输入出发时间（否则使用当前时间作为出发时间）。将信息通过电信网络发送到远程服务器 250。服务器 250 将从位置 A 到 B 的路线上的位置的列表以及路线上这些位置处的短时预报一起返回。如根据图 2A 所述的，服务器通过电信网络访问气象源 201。服务器 250 上可以存储有地理数据，并还可以访问第三方提供的行程源 320。

[0123] 优选地，客户端计算机 252 能够启用 GPS。在这种情况下，计算设备可以提供对服务器 250 的更新，以用于更新如上所述的沿着路线的短时预报。

[0124] 图 4B 是其中可以实现实施方式的另一个网络环境的示例。在该实施方式中，用户在 GPS 导航设备上输入目的地并查看行程。GPS 导航设备将出发位置作为当前位置。当前位置和最终目的地以及由卫星选择的路线可以经由卫星 332 被发送到服务器 250。服务器

250 中实施的智能模块可以返回针对沿着路线的关键点的短时预报，并将短时预报和对关键点的识别发送给 GPS 导航设备 330，以用于添加到 GPS 设备 330 给出的行程上。

[0125] 在一个实施方式中，如果用户使用 GPS 和 / 或有网络功能的计算设备生成行程，则可以基于用户在路线上的前进和气象条件的改变来更新短时预报。

[0126] 在一个实施方式中，可以在地图上提供短时预报和与每个短时预报相关的时间 / 时间间隔。在一个实施方式中，地图上显示的时间是智能模块 312 基于当前位置、速度、以及气象和交通条件所估计的估计的到达时间。

[0127] 硬件和操作环境

[0128] 图 5 示出了合适的计算操作环境的示例图，在所述计算操作环境中可以实现所要求保护的主题的实施方式。下面的描述与图 5 有关，并旨在提供对合适的计算机硬件和合适的计算环境的简要概述，结合该简要概述可以实现实施方式。不必须使用所有的组件来实现实施方式，在不脱离实施方式的实质和范围的情况下可以对组件的布置和类型做出改变。

[0129] 虽然不是必须的，但是以计算机可执行指令（诸如程序模块）的一般情况描述了实施方式，所述计算机可执行指令被计算机执行，诸如个人计算机、手持式或掌上型计算机、智能手机、或者嵌入式系统，例如消费电子设备或专业工业控制器中的计算机。一般而言，程序模块包括执行特定任务或实现特定抽象数据类型的例程、程序、对象、组件、数据结构等等。

[0130] 而且，本领域的技术人员将会理解，可以用其他计算机系统配置来实现实施方式，所述其他计算机系统配置包括手持式设备、多处理器系统、基于微处理器或可编程的消费电子产品、网络 PCS、小型计算机、大型计算机、蜂窝电话、智能电话、显示寻呼机、射频 (RF) 设备、红外 (IR) 设备、个人数字助理 (PDA)、膝上型计算机、可穿戴计算机、平板电脑、ipod 或 ipad 系列设备中的设备、将一个或多个前述设备组合起来的集成设备、或者能够执行这里所述的方法和系统的任何其他计算设备。还可以在其中任务由通过通信网络链接的远程处理设备执行的分布式计算环境中实现实施方式。在分布式计算环境中，程序模块可以位于本地和远程存储器存储设备两者之中。

[0131] 图 5 的示例性硬件和操作环境包括计算机 720 形式的通用计算设备，所述计算机 720 包括处理单元 721、系统存储器 722、和可操作地将各种系统组件（包括系统存储器）耦接到处理单元 721 的系统总线 723。可以只有一个处理单元 721，或者可以有多于一个处理单元 721，从而计算机 720 的处理器可以包括单个中央处理单元 (CPU) 或者多个处理单元（通常称为并行处理环境）。计算机 720 可以是常规计算机、分布式计算机、或者任何其它类型的计算机；该实施方式并不做限制。

[0132] 系统总线 723 可以为多种类型的总线结构中的任何类型的总线结构，所述总线结构包括存储器总线或存储器控制器、外围总线、以及使用各种总线体系结构中的任意总线体系结构的局部总线。系统存储器还可以被简称为存储器，并且包括只读存储器 (ROM)724 和随机存取存储器 (RAM)725。基本输入 / 输出系统 (BIOS)726 存储在 ROM724 中，所述基本输入 / 输出系统 726 包含（例如在启动期间）帮助在计算机 720 内的元件之间传输信息的基本例程。在所要求保护的主题的一个实施方式中，计算机 720 还包括用于读取和写入硬盘（未示出）的硬盘驱动器 727、用于读取和写入可移动磁盘 729 的磁盘驱动器 728、和用

于读取和写入可移动光盘 731（诸如 CD ROM 或其他光介质）的光盘驱动器 730。在所要求保护的主题的可替换的实施方式中，使用易失性或非易失性 RAM 来模仿由硬盘驱动器 727、磁盘 729 和光盘驱动器 730 所提供的功能，以便节省功率并减小系统的尺寸。在这些可替换的实施方式中，RAM 可以固定在计算机系统中，或者 RAM 可以是移动 RAM 设备，诸如紧凑型闪存卡。

[0133] 在所要求保护的主题的实施方式中，硬盘驱动器 727、磁盘驱动器 728 和光盘驱动器 730 分别通过硬盘驱动器接口 732、磁盘驱动器接口 733 和光盘驱动器接口 734 连接到系统总线 723。驱动器及其关联的计算机可读介质提供对计算机可读指令、数据结构、程序模块和用于计算机 720 的其他数据的非易失性存储。本领域的技术人员应该理解，可以存储可由计算机访问的数据的任意类型的计算机可读介质可以用于示例性的操作环境中，所述计算机可读介质诸如磁带、闪存卡、数字影盘、伯努利盒式磁带、RAM、ROM 等等。

[0134] 多个程序模块可以存储在硬盘、磁盘 729、光盘 731、ROM 724、或 RAM 725 中，所述程序模块包括操作系统 735、一个或多个应用程序 736、其他程序模块 737 和程序数据 738。用户可以通过输入设备（诸如键盘 740 和定位设备 742）向个人电脑 720 输入命令和信息。其他输入设备（未示出）可以包括麦克风、操纵杆、游戏垫、圆盘式卫星天线、扫描仪、触摸感应垫等等。这些和其他输入设备通常通过耦接到系统总线的串行端口接口 746 连接到处理单元 721，但也可以通过其他接口（诸如并行端口、游戏端口或通用串行总线 (USB)）连接。另外，可以通过麦克风提供到系统的输入以用于接收音频输入。

[0135] 监视器 747 或其他类型的显示器设备也经由诸如视频适配器 748 的接口连接到系统总线 723。在所要求保护的主题的一个实施方式中，监视器包括液晶显示器 (LCD)。除了监视器，计算机通常包括其他外围输出设备（未示出），诸如扬声器和打印机。监视器可以包括允许用户通过按压或触摸表面与计算机接口的触摸敏感表面。

[0136] 计算机 720 可以使用与一个或多个诸如远程计算机 749 的远程计算机的逻辑连接在网络环境中操作。通过耦接到计算机 720 或者是计算机 720 一部分的通信设备实现这些逻辑连接；实施方式不限于特定类型的通信设备。远程计算机 749 可以是其他计算机、服务器、路由器、网络 PC、客户端、对等设备或其他公共网络节点，并且通常包括许多或所有上面关于计算机 720 所述的元件，虽然图 6 中仅示出了存储器存储设备 750。图 6 中示出的逻辑连接包括局域网 (LAN) 751 和广域网 (WAN) 752。这样的联网环境常见于办公室、企业范围计算机网络、内联网和因特网。

[0137] 当用于 LAN 联网环境中时，计算机 720 通过作为一种通信设备的网络接口或适配器 753 连接到本地网络 751。当用于 WAN 联网环境中时，计算机 720 通常包括作为一种通信设备的调制解调器 754，或任何其他类型的用于通过 WAN752（诸如，因特网）建立通信的通信设备。可以是内部或外部的调制解调器 754 经由串行端口接口 746 连接到系统总线 723。在网络环境中，关于个人计算机 720 描述的或者是个人计算机 720 的一部分的程序模块可以存储在远程存储器存储设备中。可以理解，所示的网络连接是示例性的，可使用用于在计算机之间建立通信链接的其他方式。

[0138] 描述了可用于实现所要求保护的主题的实施方式的硬件和操作环境。可以被结合来实现所要求保护的主题的实施方式的计算机可以为常规计算机、手持或掌上型计算机、嵌入式系统中的计算机、分布式计算机、或任何其他类型的计算机；对此所要求保护的主题

不做限制。所述计算机通常包括一个或多个处理单元作为其处理器，还包括诸如存储器的计算机可读介质。计算机还可以包括诸如网络适配器或调制解调器的通信设备，从而其能够通信耦接到其他计算机。

[0139] 虽然上面描述并在附图中示出了优选的实施方式，但是对本领域的技术人员来说明显的是，在不脱离本公开的情况下可以做出修改。所述修改被认为是包括在本公开的范围内的可能的变换方式。

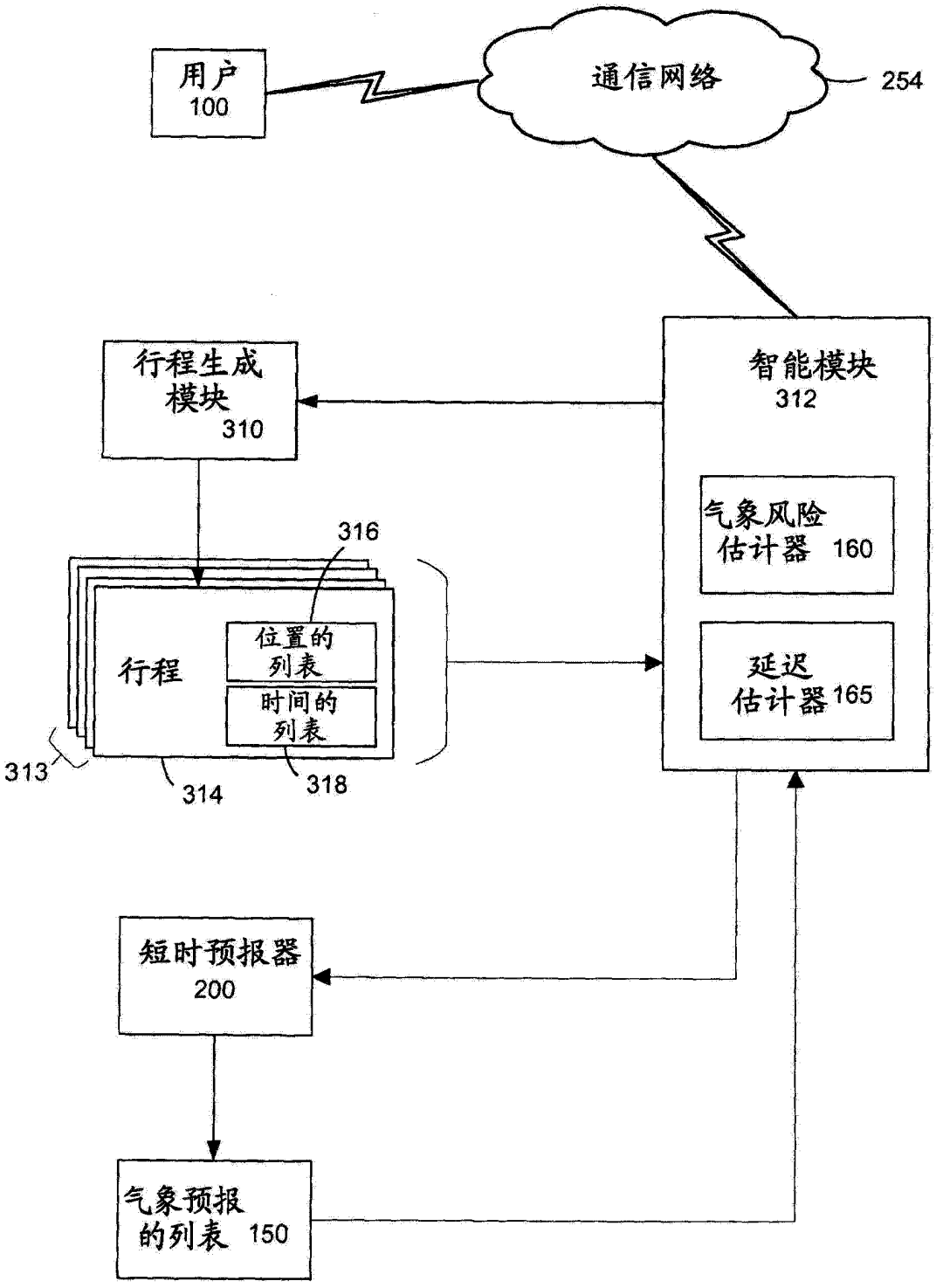

图 1

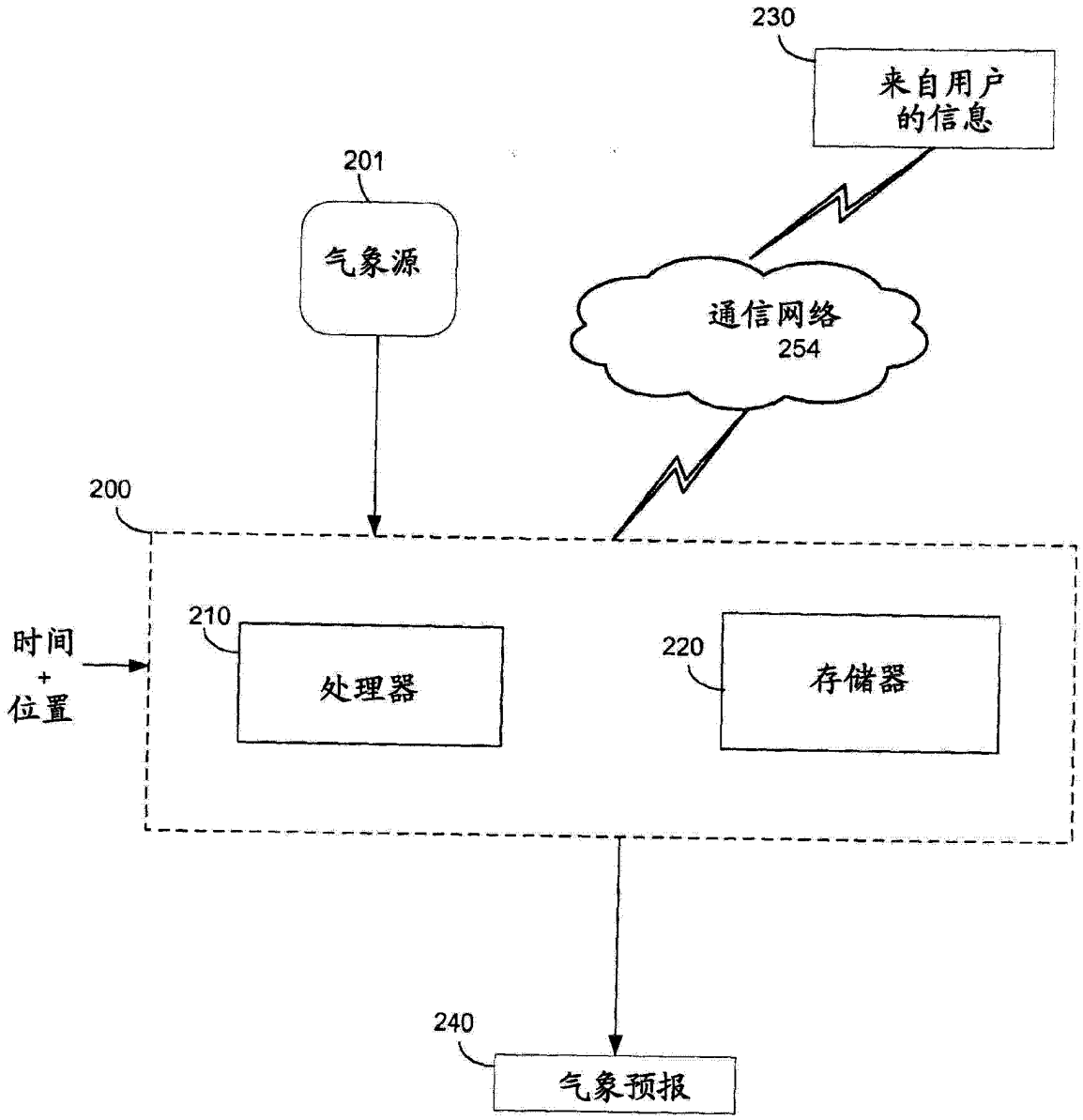

图 2A

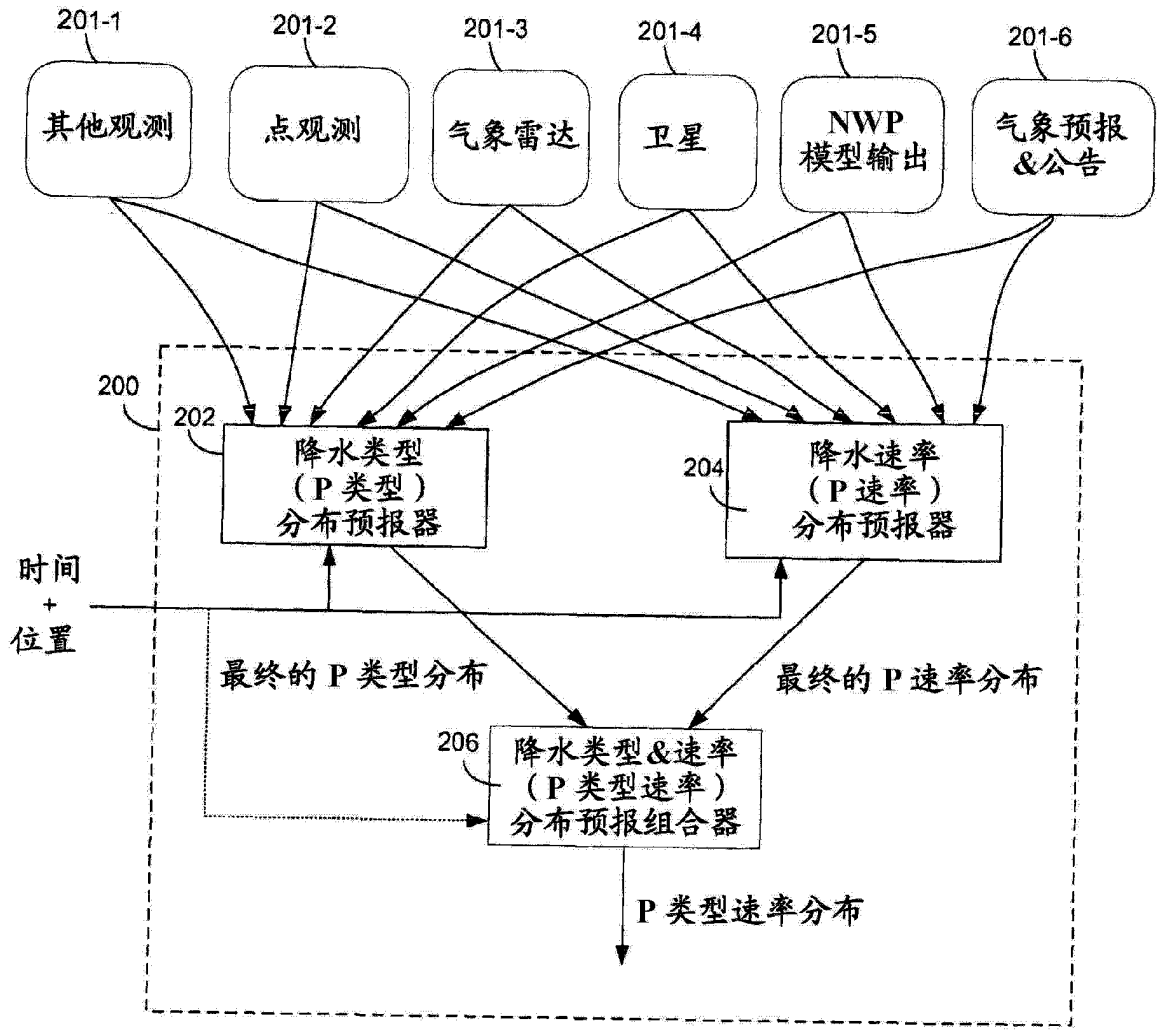

图 2B

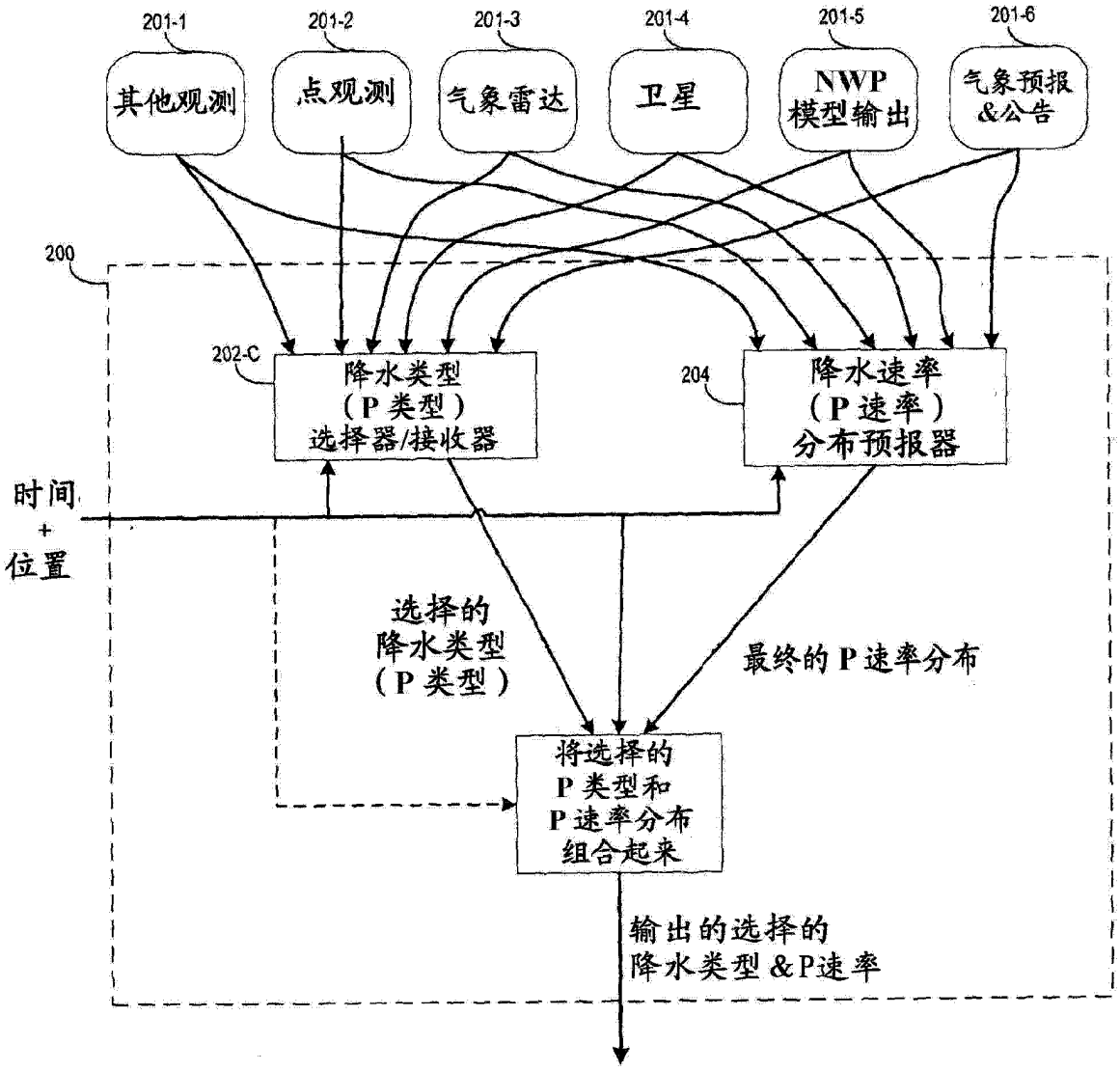

图 2C


Ottawa, ON
montreal, qc
添加目的地-显示选项
获取线路
建议的路线
Trans-Canada Hwy 200 km, 2 hours 2 mins
*当前交通：2 小时 2 分钟
County Rd 17 and Trans-Canada Hwy 193 km, 2 hours 12 mins
*无交通信息
Autoroute 50 E 210 km, 2 hours 14 mins
*无交通信息
到 Montreal, QC 的行车方向
Ottawa, ON
1.在 Albert 大街/Ottawa 42 号上朝西南向 O'Connor 大街/ Ottawa 87 号方向前进
2. 第一次左转进入 O'Connor 大街/ Ottawa 87 号
3. 左转进入 isabella 大街/ Ottawa 62 号（标志为 ON-417E）
4. 向左前方左转进入 Ontario 417 坡道
5. 拐进 Trans-Canada 公路 输入 QC
6. 靠左向 Autoroute 10/Montreal/ Centre Ville/Pont Champlain 方向 从出口出去，进入 Autoroute 15
7. 靠左从 63E 出口出去，向 Centre ville 方向进入 Autoroute Ville Marie/Autoroute 720E
8. 拐进 Ville-Marie Expy/ Autoroute 720E
9. 走坡道进入 Rue Berri
10. 拐进 Rue Saint Autoine E
11. 右转进入 Rue Bonsecours
12. 右转进入 Rue Notre-Dame E
Montreal, QC

图 3

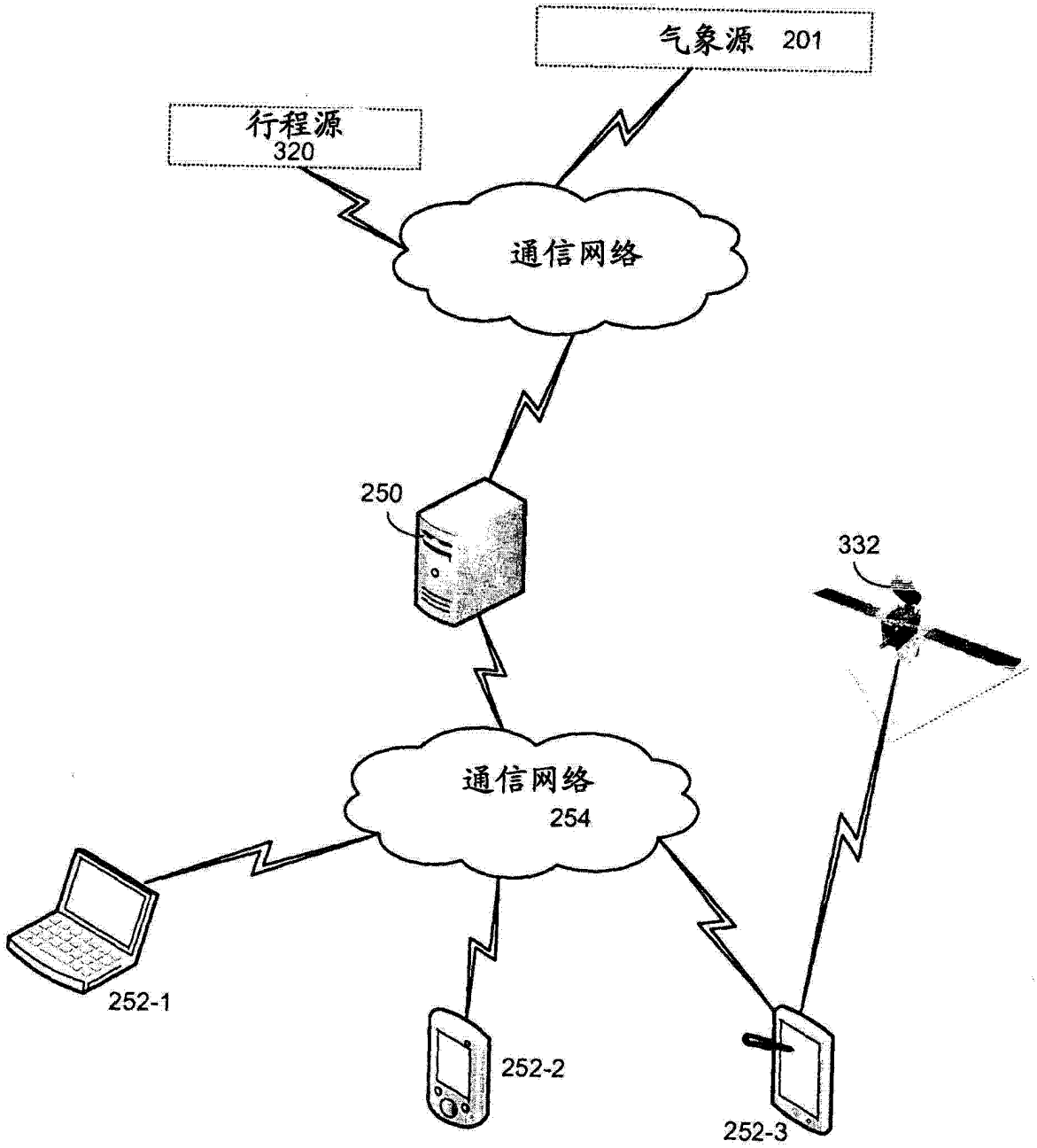

图 4A

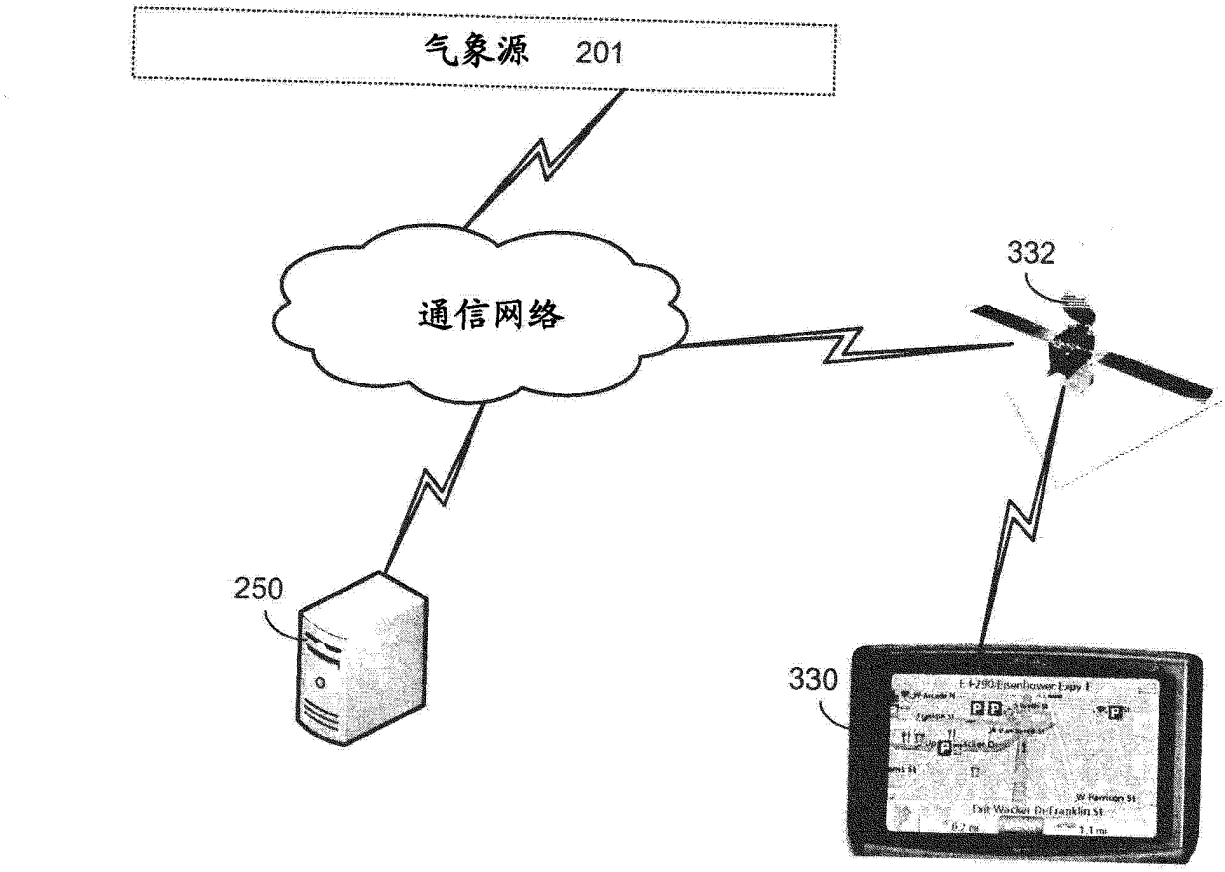

图 4B

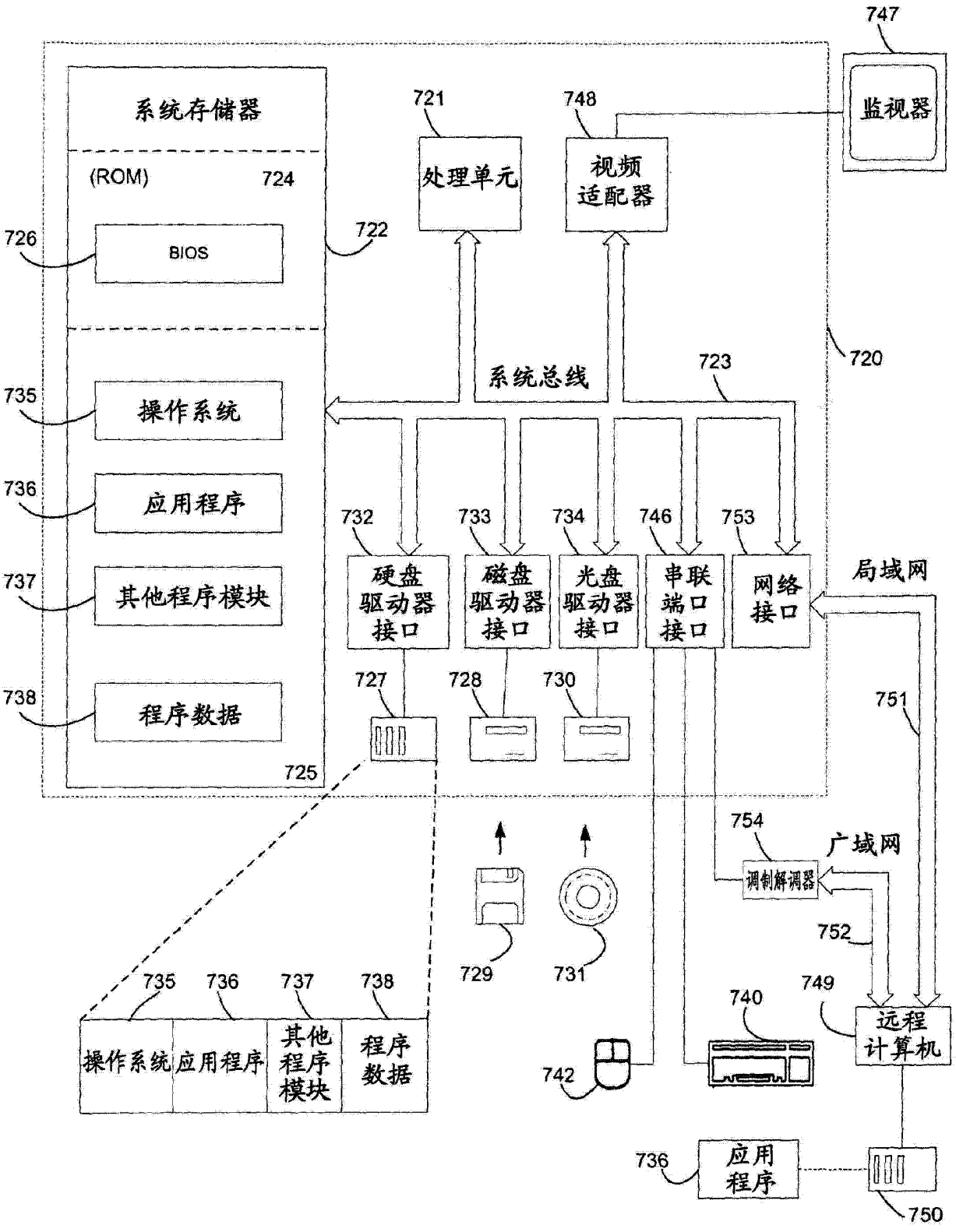

图 5

Abstract

Provided are methods, devices, and non-transitory computer-readable storage mediums to generate an itinerary with a weather forecast. The itinerary may comprise a departure location, a destination location and a first time. Based on the itinerary, an intermediary location and an intermediary time associated with the intermediary location may be identified. A weather forecast associated with the identified intermediary location and the intermediary time may be predicted. A weather risk associated with the identified route may be assessed and based on the assessed risk, an alternative route may be additionally identified.

摘要

提供了壹種用於生成帶氣象預報的行程的方法、設備和非臨時性計算機可讀存儲介質。所述行程可以包括出發位置、目的位置和第壹時間。基於所述行程，可以識別中間位置和與中間位置相關聯的中間時間。可以預測與識別的中間位置和中間時間相關聯的氣象預報。可以評估與識別的路線相關聯的氣象風險，並基於評估的風險，可以另外識別供替換的路線。