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Contextually Aware Navigation System

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ABSTRACT

A contextually aware navigation system equipped in a vehicle can be used to identify that the vehicle is deviating from a predetermined route during navigation guidance. The system determines if the deviation is intentional or unintentional based on a combination of various situational factors. Thereafter, if the system determines that the deviation is intentional, the system can suspend the navigation guidance. On the other hand, if the system determines that the deviation is unintentional the system can continue with the navigation guidance.

PROBLEM STATEMENT

A navigation system provides route guidance to a user and can be implemented for use in a vehicle or the user's electronic device. The navigation systems receives a starting location and a destination location from the user and accordingly provides the user with different route options between the two locations. The user can select one of the available route options and the navigation system guides the user on the selected route by constantly detecting a current location of the user and comparing it with the selected route.

However, in case of a deviation from the planned route, existing navigation systems are not able to determine if the deviation is intentional or unintentional by the user. Therefore, upon detecting any deviation from the planned route, the navigation system immediately provides directions to re-route the user to the initially planned destination, for example by suggesting a u-turn or the shortest route to intersect the initially planned route. However, the user may have

intentionally deviated from the initially planned route to stop for fuel, to use a restroom, to eat, to visit a place of interest, or for another reason. When intentional, the re-routing directions are not useful and may annoy the user. Accordingly, a system is described that differentiates whether a deviation from a planned navigation path is intentional or unintentional and determines how aggressively to re-route the user.

CONTEXTUALLY AWARE NAVIGATION SYSTEM

The systems and techniques described in this disclosure relate to a contextually aware navigation system. The system can be implemented for use via the Internet, an intranet, or another client and server environment. The system can be implemented as program instructions locally on a client device or implemented across a client device and server environment. The system can be implemented for use in a vehicle navigation system or in a user's electronic device.

Fig. 1 illustrates an example method 100 for identifying whether a deviation from a navigation route is intentional or unintentional. The method can be performed by the contextually aware navigation system.

The contextually aware navigation system identifies that a vehicle is deviating from a predetermined route (block 110). A user may wish to travel from location A to location B in the vehicle. The system receives these two locations as inputs from the user. The system accordingly generates a list of routes from location A to location B and presents them to the user. The user may select one of the routes provided by the system. The system constantly monitors a current location of the user as the user moves on this predetermined route. This location measurement

can be performed using global positioning system (GPS) coordinates of the vehicle or the user's electronic device, or can be measured using other known techniques of identifying location, such as cell tower triangulation. The system compares the current location of the user with the predetermined route and identifies when the user has deviated from the predetermined route, e.g., by taking a turn or off-ramp not indicated by the navigation system, or going straight when a turn is suggested.

The system determines if this deviation is intentional or unintentional based on a combination of situational factors (block 120). The situation factors may include the fuel level of the vehicle, the elapsed time since a last stop, historical data of general patterns of travel, new information received by the user during the navigation guidance, and the proximity of locations which might be of interest to the user. The system can use a combination of these situational factors to decide if the deviation made by the vehicle is intentional or unintentional.

For example, the system can receive information from the vehicle indicating the fuel level of the vehicle. From this information, the system can determine if the fuel level of the vehicle is low. If the fuel level is low, the system can then infer that the user is intentionally deviating from the predetermined route in order to refuel the vehicle. The system can increase its confidence that the route deviation is intentional if it identifies the presence of a gas station in the vicinity to where the user deviated from the predetermined route The system can access a centralized database which stores the location of rest stops, including gas stations, restaurants, restrooms, etc.

As a further example, the system can compare the elapsed time since the user last made a stop with the average interval between restroom breaks. If the elapsed time is greater than the

average interval, the system can infer that the user is intentionally deviating from the predetermined route in order to use the restroom. Similar to above, the system can increase its confidence that the route deviation is intentional if it identifies the presence of a restroom in the vicinity to where the user deviated from the predetermined route .

In another example, the system can analyze historical data describing past travel along the same route. The historical data can represent travel by a set of users on the same route. The system can retrieve this information from a database which stores anonymous travel data for vehicles that travelled on the route between location A and location B. From the historical data, the system can analyze past deviations from the route to determine whether the current deviation is intentional or unintentional. For example, if past deviations from the route include stopping at a location (e.g., a restaurant, a gas station, or a rest stop) for more than a threshold amount of time, the system can determine that the current deviation is intentional. As a further example, if past deviations from the route include returning to the planned route (e.g., making a u-turn after accidentally deviating from the route), the system can determine that the current deviation is unintentional.

Alternatively, or additionally, the system can constantly monitor if the user has received any new information since the route navigation began. The system can detect any incoming communication to the user's electronic device, e.g., mobile, laptop, or wearable device. Based on an incoming communication that occurs temporally to a deviation from the planned route, the system can determine whether the deviation is intentional or unintentional. In one example, the user can receive a text message containing an address. In response to the received address, the system determines that a subsequent deviation from the planned route is intentional if, for

example, the vehicle is deviating toward the received address. In another example, a phone call containing common phrases that often result in route changes, e.g.,“hey can you pick me up on the way,” can be detected by the system. In response, the system determines that a subsequent deviation from the planned route is intentional.

Alternatively, or additionally, the system can continuously check for the presence of likely locations that the user may be planning to stop, such as gas stations, charge stations, rest stops, restaurants, or other commonly visited locations such as day cares, gyms, business places, schools, and other locations that the system has detected where many users commonly stop. If any of these locations is in proximity to where the user deviates from the planned route, the system can accordingly determine that the deviation is intentional.

Based on any combination of the situational factors discussed above, the system can determine that the deviation is intentional and can suspend the navigation guidance (block 130). The system can determine that the deviation is intentional from a high confidence that any of the above described situational factors is present. For example, the system can determine a confidence score for each situational factor. The confidence scores can be weighted and combined. The system can determine that the route deviation is intentional if the combined confidence score satisfies a predetermined threshold score. The suspension of the navigation guidance may include muting of the navigation guidance, canceling the navigation guidance completely, or pausing the navigation guidance for a predetermined time. For example, if the system determines that the user has deviated from the route in order to refuel the fuel tank, the system can pause the navigation guidance momentarily, and start the navigation guidance as soon as the vehicle gets back on the predetermined route. While the navigation guidance is

paused, the system can also provide a visual indication to the user that the navigation guidance has been paused.

However, if the system determines that the deviation is unintentional, the system continues to provide navigational guidance to the user (block 140). The system can determine that the deviation is unintentional from a low confidence that any of the above described situational factors is present. The system can determine that the route deviation is unintentional if the combined confidence score, as described above, does not satisfy a predetermined threshold score. Additionally, or alternatively, the system can determine the deviation is unintentional if the vehicle deviates from the predetermined route and keeps on moving along the deviated path for duration more than the threshold duration as set by the system for such a situation. Additionally, or alternatively, the system can determine the deviation is unintentional if the user requests revised directions from the system, e.g., directions to a different destination location. In such a scenario, the system continues to provide navigational guidance to the user.

FIG. 2 is a block diagram of an exemplary environment that shows components of a system for implementing the techniques described in this disclosure. The environment includes client devices 210, servers 230, and network 240. Network 240 connects client devices 210 to servers 230. Client device 210 is an electronic device. Client devices 210 include any devices capable of requesting and receiving data/communications over network 240 that can be used for navigation. Example client devices 210 are navigation systems, in car GPS systems, personal computers (e.g., laptops), mobile communication devices, (e.g. smartphones, tablet computing devices), embedded systems, and other devices 210' that can send and receive data/communications over network 240. Client device 210 may execute an application, such as a

web browser 212 or 214 or a native application 216. Web applications 213 and 215 may be displayed via a web browser 212 or 214. Server 230 may be a web server capable of sending, receiving and storing web pages 232. Web page(s) 232 may be stored on or accessible via server 230. Web page(s) 232 may be associated with web application 213 or 215 and accessed using a web browser, e.g., 212. When accessed, webpage(s) 232 may be transmitted and displayed on a client device, e.g., 210 or 210'. Resources 218 and 218' are resources available to the client device 210 and/or applications thereon, or server(s) 230 and/or web page(s) accessible therefrom, respectively. Resources 218' may be, for example, memory or storage resources; a text, image, video, audio, JavaScript, CSS, or other file or object; or other relevant resources. Network 240 may be any network or combination of networks that can carry data communication.

The subject matter described herein can be implemented in software and/or hardware (for example, computers, circuits, or processors). The subject matter can be implemented on a single device or across multiple devices (for example, a client device and a server device). Devices implementing the subject matter can be connected through a wired and/or wireless network. Such devices can receive inputs from a user (for example, from a mouse, keyboard, or touchscreen) and produce an output to a user (for example, through a display and/or a speaker). Specific examples disclosed are provided for illustrative purposes and do not limit the scope of the disclosure.

DRAWINGS

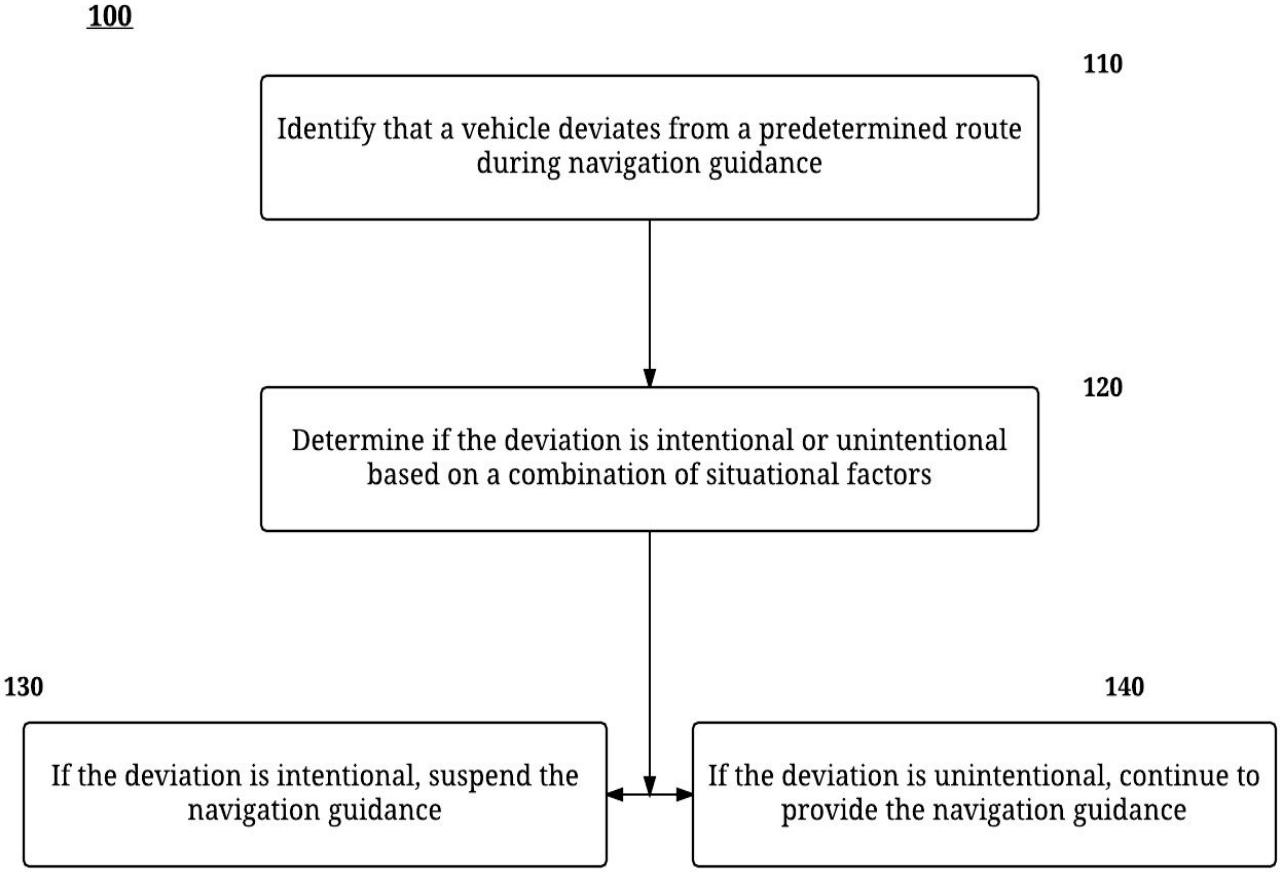

Fig. 1

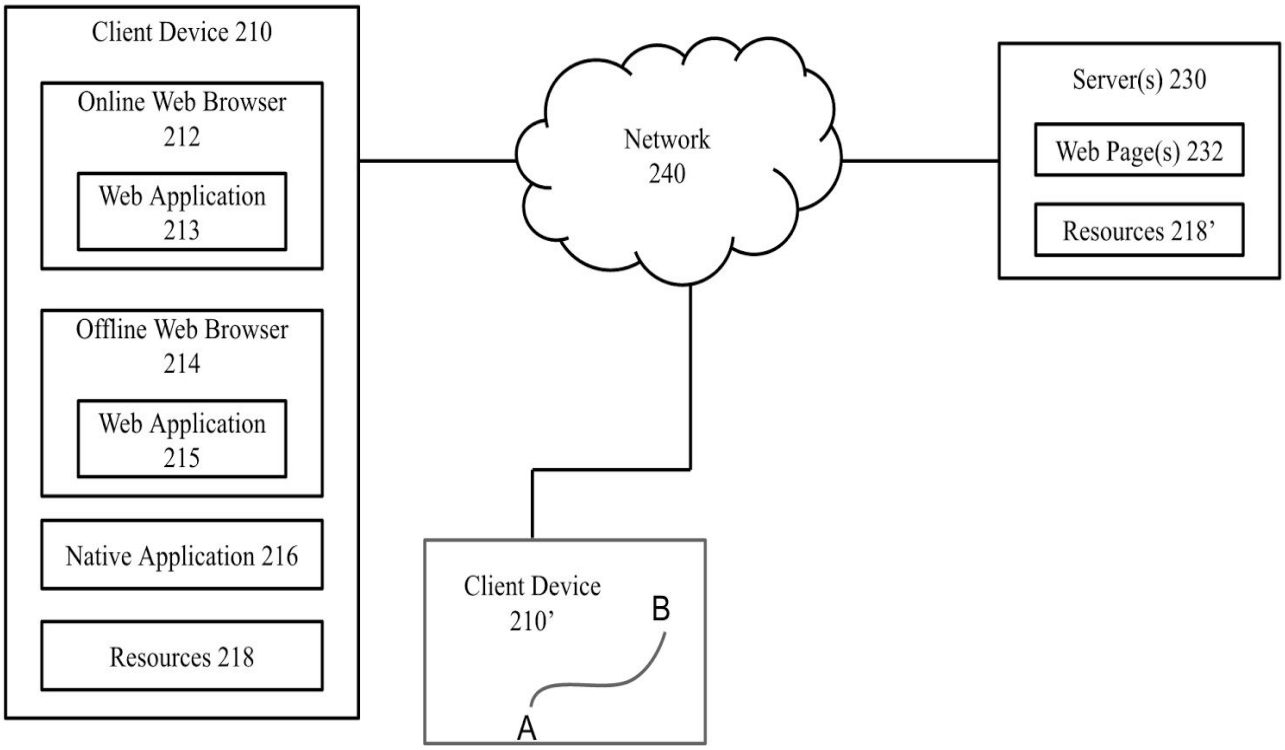
Client Device 210
Online Web Browser 212
Web Application 213
Offline Web Browser 214
Web Application 215
Native Application 216
Resources 218
Network 240
Server(s) 230
Web Page(s) 232
Resources 218'
Client Device 210'
B
A

Fig. 2