TRAFFIC INFORMATION ESTIMATION AND REPORTING SYSTEM

TECHNICAL FIELD

This invention relates to communications systems and more particularly to a method and a system for estimating and delivering road condition information to communications services users.

BACKGROUND OF THE INVENTION

Recent developments in satellite systems technology, such as Low Earth Orbit (LEO) satellites and Very Small Aperture Terminals (VSAT), have provided the impetus for the creation of a wide variety of mobile communications services. These services include personal satellite telephone services and global positioning service (GPS). Prominent among the services provided under the umbrella of global positioning are real-time locator and navigation services for automobile drivers and pedestrians, not to mention security- and military-related applications. The real-time locator service identifies the relative position of a device within a few feet of the real coordinates of the device. By contrast, the navigation service provides directions to an end-user (in the form of digital maps, for example) based on a user's position as well as traffic congestion with respect to that position. Unfortunately, market acceptance of global positioning service has been slower than anticipated by the GPS planners and designers. This is primarily because global positioning service providers have to spread the high cost of procuring and launching (LEO) satellites over a small customer base.

In an attempt to offer similar services at a lower price, systems designers have developed a surface transportation monitoring system called "Intelligent Vehicle Highway System" (IVHS). That system uses video-based detection devices and road sensors to collect real-time traffic data and to deliver warning and alternate route information to users when traffic congestion occurs. The infrastructure for the Intelligent Vehicle Highway System is probably less costly than the infrastructure of the Global Positioning System, which would lead to an expectation of lower cost for IVHS-based service. Sadly, IVHS developers have found out that because IVHS service is limited to congestion detection/management and traffic reporting, the IVHS customer base may even be smaller than the one for GPS. Hence, the smaller IVHS customer base may operate to vitiate any competitive advantage IVHS may enjoy over GPS. This issue is further complicated by the fact that major radio stations broadcast periodic traffic condition reports targeted at drivers on major metropolitan highways. Thus, it is unlikely that radio listeners on the road would pay for a service that is available to them practically free-of-charge, unless the service includes features heretofore unavailable. The radio stations typically receive the traffic report information that they broadcast from sources such as reporters on board strategically located helicopters. Alas, the radio-broadcast traffic information reporting service is delivered primarily during rush hours, and is targeted primarily to listeners on major highways. The delivery time and scope of the radio-broadcast information operate to make that information worthless to drivers who are traveling either during non-rush hours, or on a congested secondary highway or a suburban road. In addition, the radio-broadcast traffic information reporting service does not offer detailed alternate paths to allow targeted drivers/listeners to avoid the congested area. Furthermore, the radio-broadcast traffic information "ages" rapidly (typically, far more rapidly than the radio-broadcast report frequency) as new accidents occur and old ones no longer hamper road traffic. Thus, a problem of the prior art is lack of an "anytime, anywhere" solution that allows delivery of road congestion information to users without deploying a new costly information collection infrastructure.

SUMMARY OF THE INVENTION

The present invention is directed to a system which estimates traffic conditions in the thoroughfares located in one or more radio coverage areas of a wireless communications network based on an analysis of real-time and past traffic information carried on, and collected by, the wireless communications network. The data collection process is performed as part of the registration operation and hand-off procedure carried out by the wireless communications network. Data analyzed may include, for example, actual (current) and expected (past average) number of a) active-busy wireless end-user devices in one or more cells at a particular period of time, and b) active-idle wireless end-user devices registered in a location area of the wireless communications network.

In an embodiment of the principles of the invention, an inference of traffic congestion is made when the number of wireless end-user devices active in a cell or location area exceeds a given threshold. For example, the ratio of actual to expected registered number of wireless devices that are active-busy in a cell and/or active- idle in a location area may be indicative of a bottleneck in one or more major roads located in that cell or in that location area. Furthermore, the same ratio in adjacent cells or location areas provides orientation information regarding bottlenecks on that road. For example, when a cell A and its adjacent cell B to the north are experiencing higher than expected communications traffic while adjacent cell C that is located to the south of A is experiencing communications traffic level equal to or lower than an expected level, an inference is made that a bottleneck is present in the northbound section of the highway or the major road located in cell A. The inference of road traffic congestion based on higher than expected traffic level in particular coverage areas of a wireless network is supported by empirical studies which tend to indicate a direct correlation between traffic jams on a road and increased wireless network traffic in a cell where the congested section of that road is located. The expected traffic level for a cell is derived from past historical data collected by a wireless communications network. The expected traffic level also takes into consideration time-dependent factors, such as time-of-day, day-of-week, day-of-year. Other variables factored in the determination of the threshold level include scheduled events, such as parades and road repairs.

In another embodiment of the invention, an inference of traffic congestion on a road within the coverage area of a cell or location area is made when a significant number of wireless devices spend higher than expected amount of time to traverse that cell or location area. The expected amount of time for a wireless device to traverse a cell is based on past historical data which factors therein time-dependent parameters, such as time-of-day, day-of-week and day-of-year.

According to one aspect of the invention, a user may subscribe to the on-demand traffic reporting service which allows the user to be alerted of possible congestion on any road of an itinerary provided by the user. The itinerary may list, for example, different cells in which the subscriber is expected to travel within particular time intervals.