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(54) **VEHICLE NAVIGATION AND SAFETY SYSTEMS**

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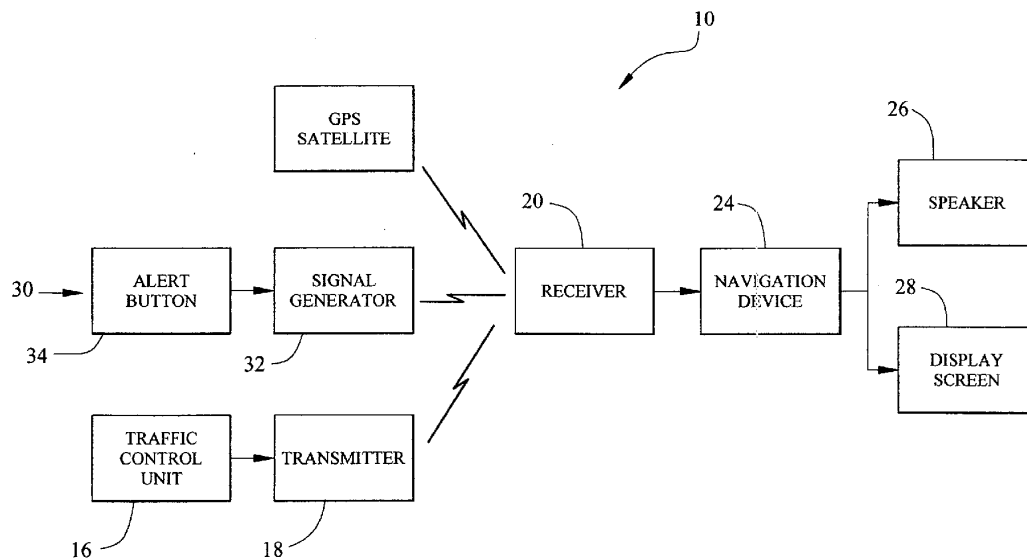
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(57) **ABSTRACT**

A vehicle navigation system for alerting a vehicle driver of the presence and status of traffic devices. The vehicle navigation system may alert a driver of the time remaining before a traffic device, such as a traffic light, changes the flow of traffic. The vehicle navigation system may also alert a vehicle driver of traffic devices, such as stop signs and speed limit signs, when the driver is approaching the traffic device. The vehicle navigation system may alert a driver through audible or visual alerts, or both. The vehicle navigation system may include a display screen that may or may not be attached to a vehicle. The vehicle navigation system may also include an in-vehicle alert system enabling vehicle drivers to send alert messages to other vehicle drivers within a close proximity.



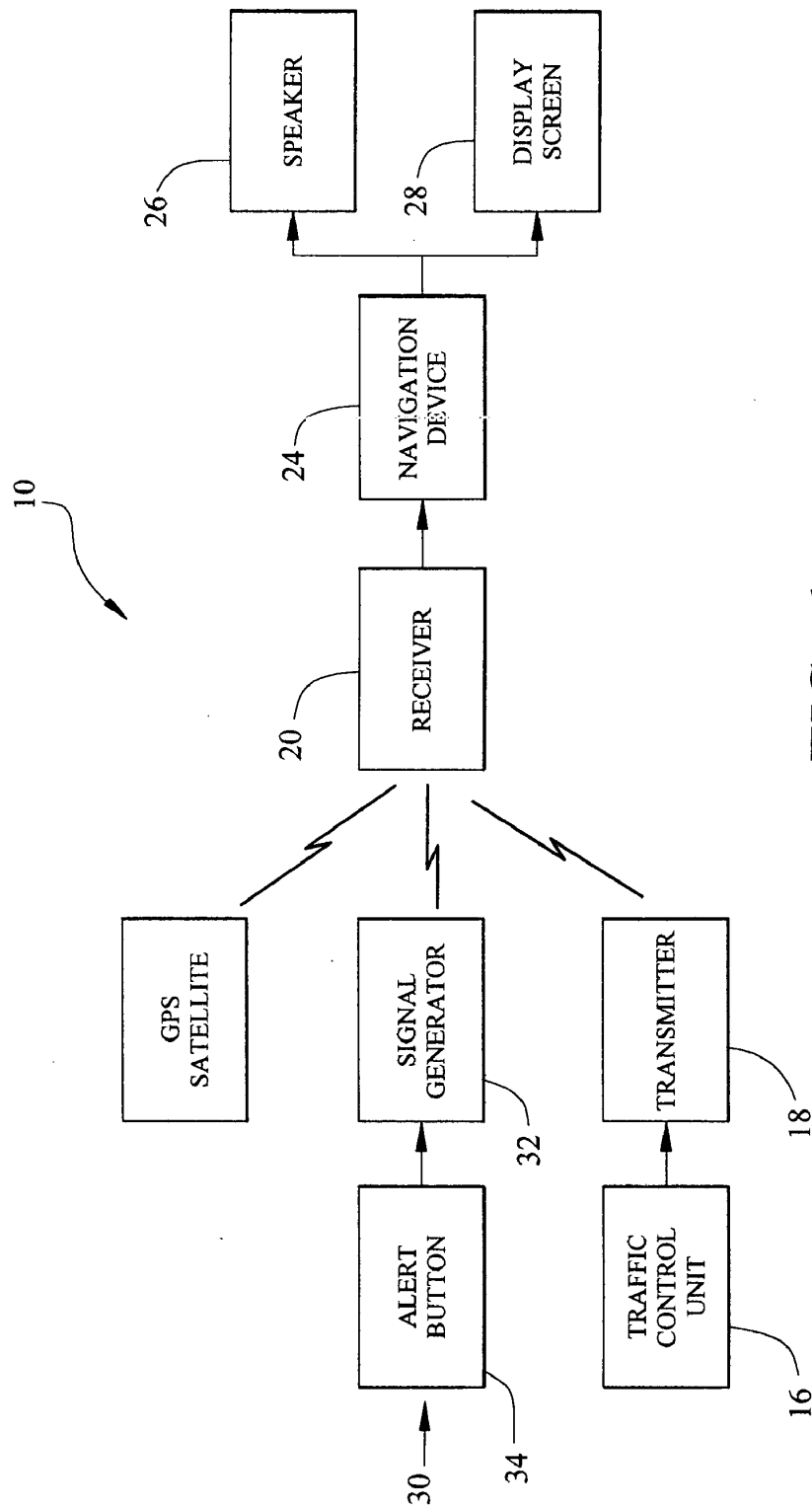


FIG. 1

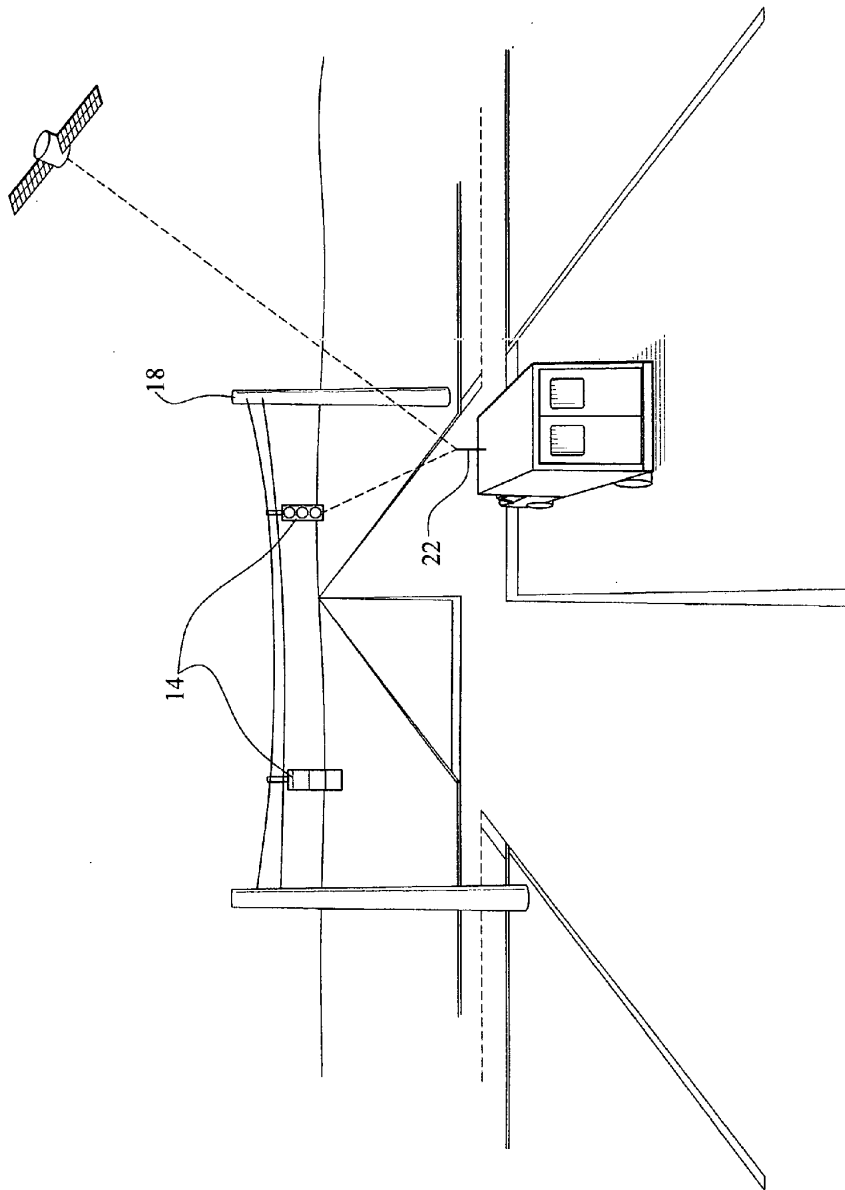


FIG. 2

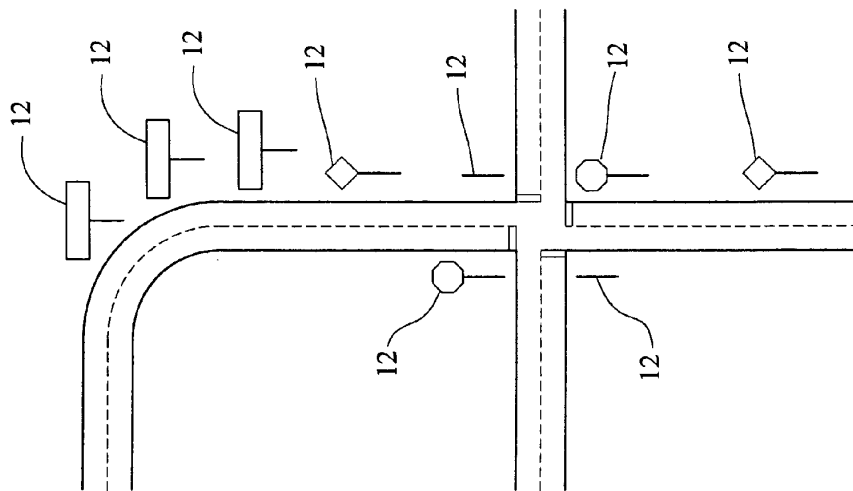


FIG. 3

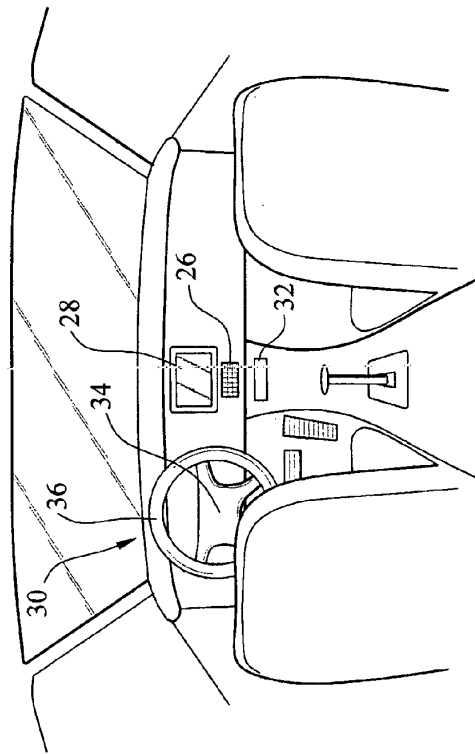


FIG. 4

VEHICLE NAVIGATION AND SAFETY SYSTEMS

FIELD OF THE INVENTION

[0001] This invention is directed generally to vehicle navigation systems, and more particularly, to vehicle navigation systems that provide route information to vehicle drivers.

BACKGROUND

[0002] The flow of vehicular travel is controlled using numerous traffic devices. Traffic lights and signs, such as, stop signs, speed limit signs, school zone signs, dangerous curve signs, and the like have been used to control the flow of traffic. Traffic lights have been used at intersections to control the flow of traffic on intersecting roads for many years. Conventional traffic lights include red lights, yellow lights, and green lights for notifying vehicle drivers of a period of time when the drivers may safely pass through an intersection. The illuminated lights change between green, yellow, and red without warning or notice. The purpose of yellow traffic lights is to notify drivers that the traffic signal will be changing shortly. However, because drivers do not always pay attention, drivers sometimes do not see a traffic signal when the traffic signal switches from a green light to a yellow light. As a result, vehicle drivers often run through red lights because the drivers do not see the traffic light change from green to yellow with enough time to stop before the traffic light changes to red. Running red traffic lights has proven dangerous and has resulted in many unnecessary deaths. Thus, a device is needed for notifying a driver of the existence of a traffic light before the driver enters an intersection and for notifying the driver of the time remaining before the traffic light changes traffic flow.

[0003] Traffic devices, such as traffic signs, have been used for years to alert drivers of the presence of navigational hazards such as curves in the road, pedestrians, speed limits and others. Typically, these signs are placed along the roadside and alert vehicle drivers only when drivers see the signs. If a driver does not see the sign on the roadside, then the driver does not know that a navigational hazard exists. Thus, a need exists for a more efficient device for alerting drivers of navigational hazards.

[0004] Since the early days of automobile use, horns have been used by drivers to get the attention of nearby vehicles. Drivers use horns for a variety of reasons, such as to show thanks, aggression, or to get a driver's attention. While horns have proven to be a convenient device for getting the attention of a nearby vehicle driver, the noise produced by horns is often bothersome. Specifically, in intersections and other areas susceptible to vehicle congestion, horns are used frequently and add substantially to the noise pollution in those areas, which in turn reduces the quality of life in those areas. Thus, a need exists for device for getting the attention of nearby vehicle drivers without creating noise pollution in the process.

SUMMARY OF THE INVENTION

[0005] This invention is directed to a vehicle navigation system for informing a vehicle driver of road hazards that the driver is approaching and for getting the attention of a nearby vehicle driver. The vehicle navigation system includes a traffic control unit that communicates with a

traffic control device for determining the time remaining before the traffic control device changes traffic flow. The traffic control device may be a traffic signal or other such device. The vehicle navigation system may also include a transmitter coupled to the traffic control unit for transmitting at least one signal to a receiver in a vehicle. The signal represents the amount of time remaining before the traffic control device changes traffic flow.

[0006] The vehicle navigation system also includes a receiver for receiving at least one traffic signal from the transmitter and configured to be placed in a vehicle. The receiver may further be configured to receive global positioning system (GPS) signals from satellites to determine the location of the vehicle. The position of the vehicle is then used to determine whether the vehicle is located near a traffic device, such as a road sign, which may be a speed limit sign, a stop sign, and the like.

[0007] The vehicle navigation system may also include a navigation device for receiving one or more traffic signals from the transmitter and alerting the vehicle driver of the time period remaining before the traffic control device changes traffic flow. The navigation device may also alert the driver of locations of traffic devices. The navigation device may alert a vehicle driver through audible or visual alerts, or both. The navigation device may be composed of a display screen for alerting a vehicle driver. The navigation device may also include one or more speakers for audibly alerting a vehicle driver.

[0008] The vehicle navigation system may also include an in-vehicle alert system, which enables a vehicle driver to alert nearby vehicle drivers. The in-vehicle alert system may, in some situations, replace a conventional horn. Instead of alerting a nearby driver with a noise produced outside of a vehicle, the in-vehicle alert system enables a driver to send an alert signal to a driver of another vehicle where the alert signal is delivered as an alert message inside the other vehicle. The alert message may be produced as an visual message or an audible message, or both. By confining the alert message to the inside portion of a vehicle, the outside noise associated with attempting to contact another vehicle nearby may be greatly reduced, if not completely eliminated.

[0009] An advantage of this invention is that a vehicle driver is alerted to navigational hazards before the driver encounters the hazard so that the driver can make necessary adjustments, such as reduce the speed of the vehicle, to avoid damaging the vehicle or to avoid unsafe conditions.

[0010] Another advantage of this invention is that a vehicle driver knows when a traffic light will change, thereby enabling the vehicle driver to change the speed of the vehicle as necessary.

[0011] Yet another advantage of this invention is that a vehicle driver may get the attention of a nearby vehicle driver by sending an alert message that alerts the vehicle driver in the vehicle without a noise being produced outside of the vehicle.

[0012] These and other features and advantages of the present invention will become apparent after review of the following drawings and detailed description of the disclosed embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The accompanying drawings, which are incorporated in and form a part of the specification, illustrate

preferred embodiments of the presently disclosed invention(s) and, **20** together with the description, disclose the principles of the invention(s). These several illustrative figures include the following:

[0014] **FIG. 1** is a schematic diagram of a vehicle navigation system;

[0015] **FIG. 2** is a perspective view of the vehicle system of **FIG. 1** installed in a vehicle and in communication with a traffic control device and a GPS satellite;

[0016] **FIG. 3** is a top plan view of a road intersection; and

[0017] **FIG. 4** is a partial perspective view of the interior portions of a vehicle having the vehicle navigation system of **FIG. 1** installed.

DETAILED DESCRIPTION OF THE INVENTION

[0018] **FIG. 1** shows a vehicle navigation system **10** for keeping drivers of vehicles apprised of traffic devices **12** and of traffic control devices **14** that the vehicles are approaching, as shown in **FIGS. 2 and 3**. The vehicle navigation system **10** can handle numerous tasks. For instance, vehicle navigation system **10** can communicate with a traffic control device **14** to determine when the traffic control device **14** will change the flow of vehicular traffic. The vehicle navigation system **10** may also alert drivers of approaching traffic devices **12**, which may be road signs, to warn the driver of, for instance, changes in speed limits or dangerous curves. The vehicle navigation system **10** may also allow drivers to alert nearby drivers using an in-vehicle alert system in place of, or in addition to, a conventional car horn.

[0019] The vehicle navigation system **10** may include a traffic control unit **16** in communication with a traffic control device **14**. In one embodiment, the traffic control device **14** is a conventional traffic light, as shown in **FIG. 2**. However, the traffic control device **14** is not limited to a conventional traffic light. Rather, the traffic control device **14** may be other traffic control devices, such as, but not limited to, traffic lights controlling traffic flow at special events, emergency traffic signals controlling traffic and enabling emergency vehicles to safely enter a roadway, and other such devices. The traffic control unit **16** may be in communication with traffic control device **14** through wireless or wired communication systems. The traffic control unit **16** interfaces with the control systems of the traffic control device **14** and determines the amount of time remaining before the traffic control device **14** changes the flow of traffic. If the traffic control device **14** is a conventional traffic signal, the flow of traffic is changed when the light changes from green to red, or vice versa.

[0020] The traffic control unit **16** may be formed from many devices. In one embodiment, traffic control unit **16** includes one or more microcontrollers for determining the time remaining before a traffic control device **14** changes its signal, which thereby changes the flow of traffic. The traffic control unit **16** is in communication with a transmitter **18** for transmitting at least one signal to a receiver **20**. The transmitter **18** communicates with receiver **20** using wireless communications, such as conventional RF technology, or other wireless technologies. Transmitter **18** should be positioned relative to a road so that a receiver **20** mounted to a vehicle is capable of receiving communications from trans-

mitter **18** before a vehicle containing the receiver **20** passes the traffic control device **14** to which the transmitter **18** is attached. Transmitter **18** could be attached to, for instance, a traffic control device **14**, a pole supporting traffic control device **14**, or other item.

[0021] Vehicle navigation system **10** also includes a receiver **20**. Receiver **20** may receive one or more traffic signals from transmitter **18**. Receiver **20** may be configured to be permanently attached to a vehicle. For instance, in one embodiment, receiver **20** may be installed in the dash of a vehicle and may include an antenna **22** for increasing the quality of the reception. Antenna **22** may be permanently or releasably mounted to interior or exterior surfaces of a vehicle.

[0022] Vehicle navigation system **10** also includes a navigation device **24** for receiving one or more signals from the receiver **20** and alerting a vehicle driver of numerous approaching navigational concerns. For instance, navigation device **24** may alert a vehicle driver of a time period remaining before a traffic control device **14**, such as a traffic light, changes traffic flow. Navigation device **24** may audibly or visually alert the driver. Navigation device **24** may audibly alert the driver through a speaker **26** permanently or releasably attached to a vehicle, as shown in **FIG. 4**. Navigation device **24** may communicate with the speakers installed by the manufacturer as a part of the stereo system. In another embodiment, an auxiliary speaker **26** may be coupled to navigation device **24**. The auxiliary device may or may not be permanently attached to a vehicle.

[0023] Navigation device **24** may also include a display screen **28** for displaying alerts and other features, as shown in **FIG. 4**. The display screen **28** may be permanently or releasably attached to a vehicle, or not attached to the vehicle at all. Display screen **28** may have any shape or style; however, display screen **28** should be displayed in a vehicle so that either the driver and possibly passengers in the vehicle can view the screen. Display screen **28** may display numerous pages, which may be changed by touching the screen or by depressing one of several buttons in the vehicle. These buttons may be located in various locations, such as, but not limited to, on a steering wheel, on a dash, on a control panel, on a console between the driver's and front passenger's seats, or other such location.

[0024] In one embodiment, display screen **28** can display the amount of time remaining before a traffic control device **14** changes traffic flow. This time period may be displayed in various units of time, but preferably is displayed in seconds. The display of the time period may be displayed on the entire display screen **28** or just a portion of display screen **28**. Vehicle navigation system **10** may be configured to display the time remaining before a traffic control device **14** changes traffic flow and audibly alerts a driver of the amount of time remaining. Vehicle navigation system **10** may be configured to give the driver the ability to choose whether the driver receives an alert audibly, visually, or in both manners. In addition, vehicle navigation system **10** may include a device, such as a switch that may or may not be on display screen **28**, for turning the system on and off.

[0025] Receiver **20** may also be configured to receive GPS signals from satellites to determine the location of a vehicle in which receiver **20** is installed. The GPS signals are sent to navigation device **24** to be processed. Navigation device

24 processes the GPS signal to determine the location of the vehicle in which receiver **20** is located. Once the navigation device **24** determines the location of the vehicle, navigation device **24** determines the proximity of the vehicle to other traffic devices **12**. Traffic devices **12** include, but are not limited to, stop signs, speed limit signs, reduced speed limit signs, school crossing signs, dangerous curve ahead signs, slippery road surface signs, lane ends signs, and other such traffic devices.

[0026] Navigation device **24** determines the proximity of the vehicle to such traffic devices **12** and alerts a driver of the traffic device **12**. Alerting vehicle drivers of traffic devices **20** increases the awareness of drivers and creates a safer environment for operating vehicles. For example, as a driver approaches a traffic device **12** reducing a speed limit from 55 miles per hour (mph) to 45 mph, the navigation device **24** would alert the driver of this change in speed limit. The navigation device **24** alerts a driver that the driver is approaching a specific traffic device **24** once the driver is closer to the traffic device than a predetermined threshold distance. This distance may be, for instance, 45 feet. This threshold distance may vary based on the speed limit of the road proximate to the traffic device **12**. For instance, navigation device **24** may alert a driver traveling on a road having a speed limit of 55 mph when the driver is less than 200 feet from the traffic device **12**, while the navigation device **24** may alert a driver traveling on a road having a speed limit of 35 mph when the driver is less than about 100 feet from the traffic device **12** so that the driver will have enough time to adjust the speed of the vehicle accordingly.

[0027] The latitudinal and longitudinal coordinates for each traffic device **12** may be stored in navigation device **24** in a database which may, for instance, be a removable chip. The database may be updated periodically to keep the location of traffic devices **12** up to date. In another embodiment, navigation device may be adapted to communicate with a central database that stores the location of traffic devices and transmits their location to each navigation device **24**. The central database is not located in individual vehicles, but is located in a building remote from the vehicle.

[0028] The driver may be alerted using audible or visual alerts, or both. Audible alerts may be a specific sound or combination of sounds that identify to a driver that the driver is approaching a particular type of traffic device **12**. For instance, one high pitch beep could signify a change in speed limit and two beeps could signify a stop sign. The audible alerts may also be a voice, such as a computer generated voice or a recorded voice, that alerts a driver that the driver is approaching traffic device **12** by telling the driver what type of traffic device **12** the driver is approaching. The audible alerts may be in English, Spanish, German, Italian, Japanese, or other language.

[0029] The display screen **28** may alert a driver that the driver is approaching a traffic device **12**. The display screen **28** may display a roadmap and allow a user to zoom in or zoom out using physical or touch screen keys. The roadmap may show traffic devices **12** as represented by symbols that may or may not resemble the traffic device **12** that each symbol represents. The display screen **28** may alert a driver by flashing a message on the screen.

[0030] Vehicle navigation system **10** may also include an in-vehicle alert system **30** enabling a vehicle driver to alert

nearby vehicle drivers. In-vehicle alert system **30** may operate as a substitute for a conventional horn. In this embodiment, in-vehicle alert system **30** eliminates noise pollution caused from vehicle horns, increases driver awareness and increases driver reaction time. In another embodiment, in-vehicle alert system **30** may be used in addition to conventional vehicle horns.

[0031] In-vehicle alert system **30** may include a signal generator **32** for generating alert signals. The alert signal may be a RF signal or other appropriate type of signal. Signal generator **32** may be controlled with an alert button **34**. Alert button **34** may be coupled to a vehicle steering wheel **36** in a fashion similar to a conventional horn actuation button. In other embodiments, alert button **34** may be located in other areas of a vehicle or coupled to other components of the vehicle. Alert button **34** may have any shape not interfering with a vehicle driver or operation of the vehicle. Alert button **34** may cause signal generator **32** to generate a signal by depressing alert button **34**.

[0032] In-vehicle alert system **30** may include receiver **20** for receiving alert signals generated by signal generator **32** in another vehicle. Receiver **20** may be in communication with speaker **26** and display screen **28**. In-vehicle alert system **30** operates by receiving an alert signal and communicating the alert signal as an alert message to a vehicle driver using a navigation device. The navigation device may include, but is not limited to, speaker **26** or display screen **28**. The alert signal may be communicated in a vehicle as an audio message using speaker **26**, or as a visual message displayed on display screen **28**, or as a combination of an audio and visual message. The type of message displayed in a vehicle may be changed by a vehicle driver.

[0033] In another embodiment, in-vehicle alert system **30** may be used to get the attention of drivers in nearby vehicles in other ways. Specifically, signal generator **32** may be coupled to the electrical system of the vehicle in which the signal generator is mounted so that when a driver depresses an alert button **34** in the vehicle, in-vehicle alert system **30** causes the headlights of the vehicle in which the in-vehicle alert system is mounted to flash on and off. In-vehicle alert system **30** may alternatively cause the parking lights, or other lights on the vehicle, to flash on and off.

[0034] The alert signal can operate as a replacement to a conventional horn. When a first driver needs to get the attention of a second driver, such as when the second driver pulls out in front of the first driver, the first driver may push alert button **34**. Depressing alert button **34** causes signal generator **32** to generate an alert message. The strength of the signal may vary. In one embodiment, signal generator **32** generates a signal that may be received by vehicles having in-vehicle alert system **30** installed and located within about 100 feet of the signal generating vehicle. In other embodiments, signal generator **32** may generate a signal that may be received by other vehicles at distances greater than about 100 feet or at maximum distances that are less than 100 feet.

[0035] All vehicles having an in-vehicle alert system **30** that receive an alert signal alert the occupants of the vehicles of the alert signal. Specifically, in-vehicle alert system **30** generates an audible alert message, a visual alert message, or an audible and visual alert message that is presented inside the vehicle so that unwanted noise is not generated outside of the vehicle. In-vehicle alert system **30** may have the

capability of being turned off so that when other nearby vehicles generate alert signals, the in-vehicle alert system 30 in the vehicle having the system turned off does not generate an alert message.

[0036] The foregoing is provided for purposes of illustrating, explaining, and describing embodiments of this invention. Modifications and adaptations to these embodiments will be apparent to those skilled in the art and may be made without departing from the scope or spirit of this invention.

I claim:

1. A vehicle navigation system, comprising:

a traffic control unit in communication with a traffic control device for determining time remaining before the traffic control device changes traffic flow;

a transmitter coupled to the traffic control unit for transmitting at least one signal to a receiver, wherein the signal represents the amount of time remaining before the traffic control device changes traffic flow;

a receiver for receiving at least one traffic signal from the transmitter and for receiving global positioning system signals; and

a navigation device for receiving the at least one traffic signal from the transmitter, alerting a driver of the time period remaining before the traffic control device changes traffic flow, and alerting the driver of locations of traffic devices.

2. The vehicle navigation system of claim 1, wherein the traffic control unit and transmitter are included in the traffic control device.

3. The vehicle navigation system of claim 1, wherein the traffic control device is a stop light.

4. The vehicle navigation system of claim 1, wherein the device for alerting a driver of the time period remaining before the traffic control device changes traffic flow comprises a speaker for audibly alerting the driver as to the amount of time remaining before the traffic control device changes the traffic flow.

5. The vehicle navigation system of claim 1, wherein the device for alerting a driver of the time period remaining before the traffic control device changes traffic flow comprises a display device for visually alerting the driver as to the amount of time remaining before the traffic control device changes the traffic flow.

6. The vehicle navigation system of claim 5, wherein the display device displays the amount of time remaining before the traffic control device changes using numerals.

7. The vehicle navigation system of claim 5, wherein the display device displays the amount of time remaining before the traffic control device changes using a clock dial.

8. The vehicle navigation system of claim 1, further comprising an in-vehicle alert system, comprising a signal generator for generating alert signals and a receiver for receiving at least one alert signal.

9. A vehicle navigation system, comprising:

a traffic control unit in communication with a traffic control device for determining time remaining before the traffic control device changes traffic flow;

a transmitter coupled to the traffic control unit for transmitting at least one signal to a receiver, wherein the signal represents the amount of time remaining before the traffic control device changes traffic flow;

a receiver for receiving at least one traffic signal from the transmitter; and

a navigation device for receiving the at least one traffic signal from the transmitter and alerting a driver of the time period remaining before the traffic control device changes traffic flow.

10. The vehicle navigation system of claim 9, wherein the traffic control unit and transmitter are included in the traffic control device.

11. The vehicle navigation system of claim 9, wherein the traffic control device is a stop light.

12. The vehicle navigation system of claim 9, wherein the device for alerting a driver of the time period remaining before the traffic control device changes traffic flow comprises a speaker for audibly alerting the driver as to the amount of time remaining before the traffic control device changes the traffic flow.

13. The vehicle navigation system of claim 9, wherein the device for alerting a driver of the time period remaining before the traffic control device changes traffic flow comprises a display device for visually alerting the driver as to the amount of time remaining before the traffic control device changes the traffic flow.

14. The vehicle navigation system of claim 13, wherein the display device displays the amount of time remaining before the traffic control device changes using numerals.

15. The vehicle navigation system of claim 9, further comprising an in-vehicle alert system, comprising a signal generator for generating alert signals and a receiver for receiving at least one alert signal.

16. A vehicle navigation system, comprising:

a signal generator for generating alert signals;

a receiver for receiving at least one alert signal generated by the signal generator; and

a navigation device for alerting a driver of a vehicle of the at least one alert signal.

17. The vehicle navigation system of claim 16, wherein the navigation device comprises a speaker for audibly conveying the alert signal to the driver.

18. The vehicle navigation system of claim 16, wherein the navigation device comprises a display device for visually alerting the driver of the alert signal.

19. The vehicle navigation system of claim 16, wherein the navigation device comprises a speaker for audibly conveying the alert message to the driver and a display device for visually alerting the driver of the alert message.

20. The vehicle navigation system of claim 16, further comprising a switch for turning the vehicle navigation system off.

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