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(54) Parking Locator

(57) A parking locator (104) having one or more sensors (108) and a logic device is disclosed herein. The sensors (108) are generally configured to detect the presence of an object within a parking space (112). The logic device determines whether a vehicle is present within a parking space based on information from the sensors and may communicate this to one or more external devices. The parking locator includes a body (120) to which the one or more sensors and logic device are attached. The body may conform to a parking header (116) or curb. Parking locators may be configured in a parking locator system comprising clusters of one or more parking locators which communicate to a location server or other external device. The location server may organize and store parking information and communicate parking information to user devices.

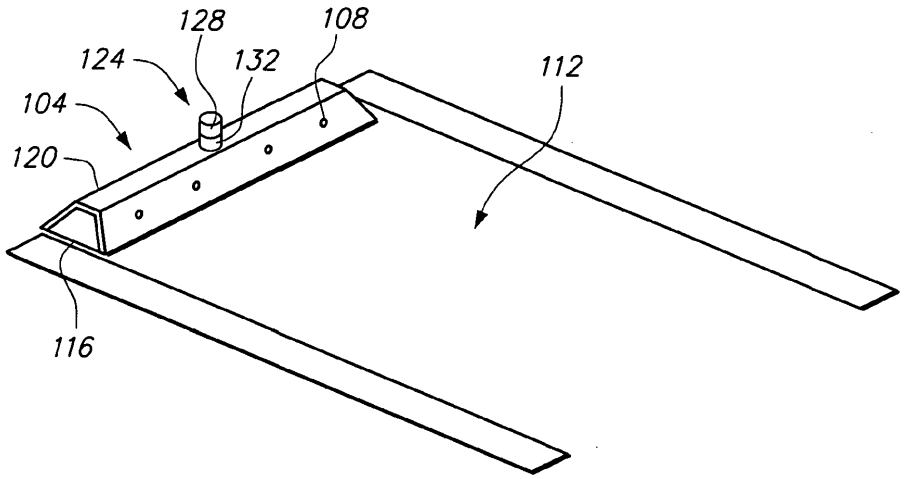

FIG. 1

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention.

[0001] The invention relates to a method and system for determining the status of vehicle parking, including the location of available vehicle parking.

2. Related Art.

[0002] Locating parking is a big problem in cities all around the world. As drivers search for a parking space, they waste gas, waste time and add to the traffic problems of big cities. The frustration of the search for a parking spot creates stress for those drivers that must frequent big cities for their jobs. Health problems have been linked to high levels of stress.

[0003] Thus, what is desired and disclosed herein is an apparatus, system and method to optimize the search for a parking space and reduce the time searching and the amount of energy wasted.

SUMMARY OF THE INVENTION

[0004] A parking locator for detecting the presence or absence of a motor vehicle within a parking space is disclosed herein. In one embodiment, the parking locator comprises at least one sensor configured to detect the present of an object at a parking space, and at least one transmitter for transmitting sensor information to one or more other devices.

[0005] In one embodiment, the parking locator comprises a body for supporting the one or more sensors and other elements of the locator. The body may be configured to be self-supporting, or be configured to be supported by another element, such as by conforming to at least a portion of a parking header. The one or more sensors may be secured to the body.

[0006] The parking locator may further comprise a logic device in electrical contact with the sensors. The logic device may be configured to communicate the presence of a vehicle within a parking space to an external device when one or more of the sensors detect the presence of an object within the parking space. The logic device may also be configured to communicate the absence of a vehicle within the parking space to an external device when none of the sensors detect the presence of an object within the parking space.

[0007] The logic device may have various configurations. In one embodiment, the logic device comprises one or more sensor inputs configured to receive sensor information from the sensors, a processor configured to determine the presence of a vehicle within the parking space based on the sensor information and generate parking information accordingly, and a wired or wireless transceiver configured to communicate parking information to one or more external devices. It is noted that parking information will generally comprise information indicating the presence or absence of a vehicle within the parking space, and that the processor will determine that a vehicle is present within the parking space when one or more of the sensors detect the presence of an object within a parking space.

[0008] The parking locator may communicate via its logic device in various ways. For example, the logic device may be configured to communicate wirelessly, such as by, but not limited to, GPRS communication.

[0009] The parking locator may have different sensor configurations. For example, the parking locator may have sensors selected from the group consisting of acoustic, electromagnetic, radio frequency, light, and motion sensors. The sensors may be secured to the body by one or more pivoting mounts, along the length of the body, or both.

[0010] It is contemplated that the parking locator may be used with a variety of parking spaces. Thus, in one embodiment, the parking locator's body is configured to substantially conform to at least a portion of a curb rather than a parking header. Also, the body may be planar in shape to allow the parking locator to be installed or attached to planar surfaces of a parking space such as but not limited to the parking space itself or a wall.

[0011] A parking locator system is also disclosed. In one embodiment, the parking locator system comprises one or more clusters comprising a control box configured to communicate parking information comprising information indicating the presence or absence of a vehicle within one or more parking spaces to an external device, and one or more parking locators configured to generate the parking information and communicate the parking information to the control box. In one or more embodiments, the parking locator system's clusters may be associated with one or more parking areas selected from the group consisting of parking garages, parking lots, and one or more city blocks.

[0012] In the parking locator system, the one or more parking locators may comprise a body, one or more sensors configured to detect the presence of an object within a parking space and secured to the body, and a logic device in electrical contact with the one or more sensors. The logic device may be configured to generate the parking information comprising information indicating the presence of a vehicle within the parking space when one or more of the sensors detect the presence of an object within the parking space. Also, the logic device may be configured to generate parking information comprising information indicating the absence of a vehicle within the parking space when none of the sensors detect the presence of an object within the parking space.

[0013] The parking locators may be connected and configured to communicate with the control box in various ways. For example, the parking locators may be configured to wirelessly communicate parking information to the control box. In addition, the parking locators may be

connected in a daisy chain to the control box by one or more electrical cables selected from the group consisting of communications cables and power cables. When in a daisy chain configuration, the control box may further comprise a power distributor connected to an external power source and configured to power the parking locators through the electrical cables. It is noted that the control box may be configured to communicate in various ways as well. For example, the control box may communicate parking information to an external device via text messaging, GPRS, or both.

[0014] A location server may be provided in some embodiments of the parking locator system. Generally, the location server is a computer or other device capable of organizing and storing the parking information from a plurality of the one or more clusters, and configured to communicate the parking information to one or more user devices. In these embodiments, the control box for each of the one or more clusters may be configured to communicate the parking information to the location server. The location server may then organize and store the parking information as well as communicate the parking information to user devices. User devices may be PDAs, cell phones, GPS units, or other devices capable of displaying or presenting parking information to a user.

[0015] The location server may be configured to communicate the parking information in response to a request for the parking information from the one or more user devices, or to communicate the same in real-time. Similar to the above elements of the invention, the location server may communicate parking information in various ways such as but not limited to text messaging or GPRS. It is noted that in one or more embodiments, the parking locator system may be configured to collect a fee prior to communicating parking information to the one or more user devices.

[0016] Other systems, methods, features and advantages of the invention will be or will become apparent to one with skill in the art upon examination of the following figures and detailed description. It is intended that all such additional systems, methods, features and advantages be included within this description, be within the scope of the invention, and be protected by the accompanying claims.

According to an example, there is provided a parking locator system comprising a location server configured to receive parking information indicating the presence or absence of an object within a plurality of parking spaces and provide information to a mobile user device identifying one or more unoccupied parking spaces within a vicinity of a specified location in response to a request including a user location from said mobile device, said information comprising map information to indicate a location of said one or more unoccupied parking spaces within the vicinity of the specified location in relation to the said user location, a plurality of parking locators configured to generate said parking information and communicate said parking information to said location server, each of said plurality of parking locators comprising one or more sensors each of said one or more sensors configured to detect the presence of an object within at least one parking space; and a logic device in communication with said one or more sensors and the location server, said logic device configured to generate said parking information based on input from the one or more sensors. The said one or more sensors can be selected from the group consisting of acoustic sensors, electromagnetic sensors, radio frequency sensors, light sensors and motion sensors. The object can be an obstruction that is not a motor vehicle, or alternatively, the object can be a vehicle. In an example, the object can be a vehicle that is only partially within one of the plurality of parking spaces. At least one of the parking locators can include a transceiver for allowing two way communications to and from the parking locators. At least one parking locator can be configured to receive configuration settings from an external device via the transceiver. At least one parking locator can be configured to receive commands for adjusting the one or more sensors from an external device via the transceiver. The commands can switch on or off the one or more sensors. The commands can calibrate the one or more sensors. The at least one parking locator can be configured to receive diagnostic commands from an external device.

In an example, the parking locator system can further comprise a control box configured to receive the parking information from at least one of the parking locators to communicate parking information comprising information indicating the presence or absence of a vehicle within one or more parking spaces to said location server. At least one of the parking locators can form part of a curb next to a street. At least one of the parking locators can be coupled to a curb next to a street. A first parking locator can be configured to communicate parking information to a second parking locator.

According to an example, a parking space locator comprises a location server configured to accept a request to locate one or more unoccupied parking spaces and reply by communicating information identifying said one or more unoccupied parking spaces within a vicinity of a user; and one or more parking locators associated with one or more parking spaces comprising: a body; one or more sensors secured to said body, each of said one or more sensors configured to detect the presence of an object within a parking space; a logic device in communication with said one or more sensors, said logic device configured to generate parking information comprising information indicating the presence or absence of a vehicle within said one or more parking spaces based on input from the one or more sensors; and a transceiver configured to communicate said parking information to said location server. The parking space locator of can further comprise a power distributor configured to provide power to the one or more parking locators, wherein the one or more parking locators are connected in a daisy chain by one or more power cables and the power dis-

tributor is connected to one of the one or more parking locators. The location server can be configured to accept a location along with said request to locate said one or more unoccupied parking spaces whereby said location server communicates said information identifying said one or more of unoccupied parking spaces within a vicinity of said location. The location server can be configured to charge a fee for use of said parking space locator. The fee can be charged for use of said parking space locator for a time period selected from the group consisting of hours, days, months, and years. The fee can be paid from a cell phone, and can be charged upon entering a city where said parking space locater is installed.

In an example, the one or more sensors can be secured to said body by one or more pivoting mounts. The location server can be configured to reply by communicating directions to one or more of said one or more unoccupied parking spaces within a vicinity of a user. The body can comprise a shape that conforms to at least a portion of a curb to retrofit said curb with said one or more parking locators. The body can comprise a shape that conforms to at least a portion of one or more parking headers to retrofit said one or more parking headers with said one or more parking locators. The location server can be configured to request user account information from a user and communicate said information identifying one or more of said unoccupied parking spaces within a vicinity of a user only if said username and password is valid.

According to an example, a parking locator system comprises a location server configured to provide information identifying one or more unoccupied parking spaces within a vicinity of a specified location in response to a request for said one or more unoccupied parking spaces, wherein said request specifies said location, one or more clusters comprising a control box configured to communicate parking information comprising information indicating the presence or absence of a vehicle within one or more parking spaces to said location server, and one or more parking locators configured to generate said parking information and communicate said parking information to said control box, said one or more parking locators comprising a body, one or more sensors secured to said body, each of said one or more sensors configured to detect the presence of an object within a parking space, and a logic device in communication with said one or more sensors, said logic device configured to generate said parking information based on input from the one or more sensors. The one or more sensors can be secured to said body by one or more pivoting mounts. The request can comprise a text message consisting of information identifying said location. The location server can include a database configured to store one or more user accounts whereby said location server is configured to respond to a user only if said user has one of said one or more user accounts. The location can be provided by a user. The location server can provide directions to said one or more unoccupied parking spaces in response to said request. The parking locator system can further comprise one or more tower lights adjacent said one or more parking locators, said one or more tower lights comprising one or more lights connected to said control box, and a vertical support configured to support said one or more lights at an elevated position, whereby said control box emits light from the one or more lights based on the presence or absence of a vehicle in said parking space. The one or more clusters can be associated with one or more parking areas selected from the group consisting of parking garages, parking lots, and one or more city blocks. The location server can comprise a database and is configured to organize and store said parking information from said one or more clusters in said database. The location server can collect a fee prior to responding to said request, and the fee can be paid through a cell phone. The fee can be collected upon entering a city where said parking locator system is installed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention. In the figures, like reference numerals designate corresponding parts throughout the different views.

[0018] Figure 1 illustrates a perspective view of a parking locator associated with a parking header according to an embodiment of the invention.

[0019] Figure 2 illustrates a side perspective view of parking locators associated with a curb according to an embodiment of the invention.

[0020] Figures 3A-3E each illustrate a cross sectional view of a parking locator's body according to various embodiments of the invention.

[0021] Figure 4 illustrates operation of a parking locator according to an embodiment of the invention.

[0022] Figure 5 is a block diagram of a logic device according to an embodiment of the invention.

[0023] Figure 6 is a block diagram of a plurality of parking locators connected in a daisy chain according to an embodiment of the invention.

[0024] Figure 7 is a block diagram of a parking locator system according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] In the following description, numerous specific details are set forth in order to provide a more thorough description of the present invention. It will be apparent, however, to one skilled in the art, that the present invention may be practiced without these specific details. In other instances, well-known features have not been described in detail so as not to obscure the invention.

[0026] As will be further described below, the parking locator is generally configured to detect whether a motor vehicle or other object is located within a parking space or other location, and accordingly generate parking in-

formation. Parking information as discussed herein comprises information indicating the presence or absence of a vehicle within one or more parking spaces, and/or the location of an object within a space. It is noted that parking information may include details such as the location or identification of specific parking spaces, directions thereto, and other parking related information as well.

[0027] The parking locator may notify external devices or user devices whether or not it detects the presence of a motor vehicle in the parking space it is monitoring by communicating parking information to these devices. As discussed herein, an external device may be another parking locator or another component of the invention. An external device may also be a computer or other device capable of receiving parking information and performing operations thereon, such as displaying, analyzing, storing, or forwarding the parking information. A user device may also be a computer or other device capable of receiving parking information and performing operations thereon. Typically, however, a user device differs from an external device in that user devices will generally be used to present or display parking information to a user, such as for example a driver.

[0028] Each parking locator may monitor one or more parking spaces, depending on the configuration of its sensors, and may be connected to form a parking locator system capable of detecting the presence of vehicles within one or more parking areas such as but not limited to parking garages, parking lots, or one or more city blocks.

[0029] In one or more embodiments, the parking locator may be used with existing or new parking spaces such as those within a parking garage, on a street next to a curb, or located in a parking lot. Of course, the parking locator may be used with any parking space including temporary event parking and parking spaces in both paved and unpaved areas. The parking spaces or locations may or may not be marked. In one or more embodiments, the parking locator may communicate wirelessly which allows parking locators to be easily deployed in various parking areas.

[0030] Figures 1 and 2 illustrate various embodiments of the parking locator 104. In Figure 1, the parking locator 104 is associated with a parking space 112 such as those found in parking lots. In Figure 2, the parking locator 104 is associated with curb 204 or street parking spaces 112. Though shown in a specific configuration, it is contemplated that the parking locator 104 may be used with all manner of parking spaces 112 such as but not limited to perpendicular, angled, or parallel parking. In addition, it is contemplated that the parking locator 104 may be configured to account for uncommon, illegal, or improper parking. For example, the parking locator 104 may properly report the presence of a vehicle within a curbside parking space 112 even when one or more wheels of the vehicle are on the curb 204. This type of parking may occur in dense urban areas. The parking locator 104 may also be configured to properly report that a vehicle is illegally or improperly parked such as if a vehicle occupies more than one parking space 112, or if the vehicle is located in a space or location in which parking it not permitted or is time-limited.

[0031] The parking locator 104 may include a tower light 124 to indicate if a parking space if occupied or available. For example, the tower light 124 may include a green light or portion 128 and a red light or portion 132 which respectively indicate when a parking space is available or occupied. Of course, additional lights or portions may be provided. In addition, it is contemplated that the tower light 124 may have a single light or portion capable of displaying or emitting multiple colors. The tower light 124 may have other shapes and sizes and may be configured with a speaker system to announce the location of a parking space where a motor vehicle has just parked or just left. In one embodiment, the tower light 124 is mounted on a pole to elevate the tower light so that it may be seen from a distance. The height of the pole may vary according to the situation at hand. For example, the tower light 124 may be mounted at a higher position (i.e. on a taller pole) when in a larger parking lot or area or where it is contemplated that larger vehicles will be parked.

[0032] The tower light 124 is advantageous in that it allows open and occupied parking spaces to be easily identified from a distance. Thus, users will not have to drive around a parking area to find an open space. As will be described further below, the tower light 124 may be connected to and controlled by the logic device of the parking locator through one or more electrical, optical, or wireless connections.

[0033] In one or more embodiments, the parking locator 104 has a body 120 which may be formed in a variety of different configurations. Generally, the body 120 is a structure which supports the components of the parking locator 104. The body 120 may be configured to be free-standing or self-supporting. In other embodiments, the body is configured to accept or engage another body, such as a parking header 116 or curb 204. In one embodiment, the body 120 is shaped to fit over the edge of a curb 204 on the street as shown in Figure 2 or formed to fit over the top of a parking header 116 such as that shown in Figure 1.

[0034] It is contemplated that the body 120 may be flat or planar and attached to the parking space 112 or be mounted in or on the parking space. The body 120 may be manufactured from many different types of material including but not limited to cement, plastic, rubber, metal, stone, composites, and even wood or wood products. A durable material is generally preferred.

[0035] It is noted that though generally described herein as fitting over a curb 204 or parking header 116, the parking locator's body 120 may be a solid mass forming the edge of a curb or may be a parking header itself. The body 120 may be mounted to the parking surface or another object by various means, such as adhesive, mechanical fasteners or the like.

[0036] Figures 3A-3C illustrate side views of various embodiments of the parking locator 104 which may fit over curbs 204, parking headers 116, and the like. For example, Figure 3A shows an embodiment where the parking locator 104 is configured to fit over a square curb. Figures 3B-3C shows an embodiment having a body 120 configured to fit over a trapezoidal parking header 116. Of course, the parking locator 104 may be configured to fit over any shape and thus a wide variety of parking locators are contemplated. In addition, the parking locator 104 may be configured to partially or entirely cover various curbs 204, parking headers 116 or other structures as shown, for example, in Figures 3B and 3C respectively.

[0037] As stated, it is contemplated that the parking locator 104 may have a planar body 120 such as shown from side view in Figure 3B. In this configuration, the parking locator 104 may be mounted to many different surfaces such as the surface of a curb 204, parking header 116, parking space 112, or even a wall. It is noted that the body 120 of the parking locator 104 may include one or more curves as well to accommodate rounded curbs 204, parking headers 116, or other rounded structures.

[0038] Figures 3D and 3E illustrate side views of embodiments of the parking locators 104 having a solid or substantially solid body 120. Generally, these embodiments are meant for stand alone use. For example, in Figure 3D, the body 120 is formed as a parking header 116 and thus the parking locator 104 may be used without requiring an existing parking header. In Figure 3E, the parking locator's body 120 is formed as the edge of a curb 204 rather than formed to cover the curb. It is noted that these embodiments need not be completely solid and thus may have one or more hollow sections such as to save on materials or weight. For example, the body 120 shown in Figure 3D could have one or more holes running along its length to save materials and reduce the weight of the parking locator 104.

[0039] In one embodiment, the body of the parking locator may comprise another element, such as a concrete parking stop. In such embodiment, the stop might be modified to accommodate the one or more sensors and/or other components of the parking locator. In addition, the wall of a parking structure, a curb or various other structures might be configured to house, support or contain the various elements of the parking locator.

[0040] Referring back to Figures 1 and 2, the parking locator 104 comprises one or more sensors 108 to detect the presence of a motor vehicle in one or more embodiments. The sensors 108 may be secured to the body 120 of the parking locator 104 in various ways. For example, the sensors 108 may be attached to the exterior surface of the body 120 or may be embedded into exterior surface of the body. In some embodiments, the sensors 108 may be embedded or attached such that a portion of each sensor 108 protrudes or is external to the exterior surface of the body 120. In other embodiments, the sensors 108 may be secured internal to the body 120 (i.e. held within the body) such that no portion of a sensor is exposed. It is contemplated that individual sensors 108 may be secured by various structures, mounts, fasteners, adhesives, or a combination thereof. In one embodiment, the sensors 108 may be secured by a rotating or pivoting mount which allows the sensors to be pointed in a particular direction or angle. In addition, different ways of securing a sensor 108, such as those discussed herein, may be used to secure sensors of a single parking locator 104.

[0041] One advantage to allowing the sensors 108 to be secured in various ways is that particular sensors may operate better depending on how they have been secured. For example, sensors 108 which utilize electromagnetic or radio frequency energy may be secured within the body 120 of the parking locator 104 because such energy can be detected through the body of the parking locator. In contrast, some acoustic or light sensors 108 may be secured such that a portion of these sensors are exposed to better detect sounds or light.

[0042] It is contemplated that in some embodiments, an optically, acoustically, or electromagnetically transparent cover may be used to appropriately protect one or more sensors 108 of the parking locator 104. Other covers may be used as well; however, transparent covers have the advantage of reduced interference with the operation of the sensors 108. Of course, where a sensor 108 is within the body 120 of the parking locator 104 such covers are likely not necessary and thus may not be provided.

[0043] Referring to Figure 4, the sensors 108 may detect the presence of an object within a parking space by emitting one or more detection beams 404 which may comprise acoustic, electromagnetic, radio frequency, or light (including non-visible, such as infrared heat) energy. As will be described further below, a logic device may be used to determine the presence of a motor vehicle within a parking space based on the detection of one or more objects by the sensors 108. Generally, the reflection of a detection beam 404 off an object allows the sensor 108 to detect the object's presence. It is noted that detecting an object includes detecting the presence of a motor vehicle or parts thereof as well as detecting the presence of other physical objects. Though shown as a directed beam, it is noted that the detection beams 404 may be omni directional such as with electromagnetic or radio frequency energy. In addition, one or more of the sensors 108 may be passive sensors which detect vehicles without emitting any detection beams 404.

[0044] For example, the sensors 108 may be acoustic sensors which detect the sound of a vehicle, or the sensors may be radio frequency or electromagnetic sensors which detect changes in surrounding radio or electromagnetic energy due to the presence of metals or other materials in a vehicle. The passive sensors 108 may also detect physical contact or movement, such as physical contact with a vehicle or movement of the pavement (including pressure) due to the presence of a vehicle. The

passive sensors 108 may also detect the weight of a vehicle in one or more embodiments.

[0045] It is contemplated that any type of sensor 108, now known or later developed, which is capable of detecting the presence of an object may be used. In addition, one or more different types of sensors 108 may be used on a single parking locator 104 if desired. The ability to have multiple types of sensors 108 is advantageous in that readings from the various types of sensors may be used to verify the presence of a vehicle such as by comparing the readings from the various sensors. As is known in the art, different types of sensors 108 may have different detection ranges and capabilities and may be chosen to suit different environments, vehicles, or other conditions.

[0046] The sensors 108 may be pointed horizontally, such as at a 0 degree angle, or at any other angle to detect a motor vehicle. In a preferred embodiment, the sensors 108 are pointed upward at a 45 degree angle. It is contemplated that the sensors 108 in some embodiments may be adjustable or pivotable to various angles and that each sensor may be pointed at the same or at a different angle than the other sensors of the parking locator 104. As illustrated in the exemplary embodiment of Figure 4, an angle closer to horizontal may be used to detect vehicles parked further away while an angle closer to 45 degrees may be used to detect vehicles parked close to the parking locator 104. It is noted that pointing a sensor 108 at too high an angle may result in its detection beam 404 going over a vehicle causing the vehicle not to be detected, while pointing a sensor at too low an angle may cause the sensor to detect objects or vehicles outside its parking space. Omni directional, non-omni directional, active, and passive sensors 108 may be pointed and adjusted to various angles in one or more embodiments so as to maximize or fine tune the detection capability of the sensors.

[0047] Though shown in Figure 4 as detecting a vehicle from the front, it is noted that the parking locator 104 may detect a vehicle at any orientation or angle and that the parking locator's sensors 108 may be selected and pointed based on the orientation or angle of the relevant parking space. For example, a parking locator 104 installed on a curb can detect the presence of a vehicle even though the side of the vehicle rather than the front faces the parking locator. The same may be said for diagonally, illegally, or improperly parked vehicles. This is because the parking locator 104 may be configured to detect the location of portions of a vehicle within a particular space as described below.

[0048] Each parking locator 104 may be configured to have more or fewer sensors 108 at various angles and spaced apart at various distances depending on the size, type, shape, or other characteristic of various motor vehicles. For example, more sensors 108 may be included in the parking locator to better detect smaller vehicles such as motorcycles, golf carts, scooters, bicycles, and the like. Additional sensors 108 may also be included to detect vehicles in relatively large spaces. Fewer sensors 108 may be included in the parking locator 104 where larger vehicles such as sedans, trucks, vans and the like are parked.

[0049] Sensors 108 may be positioned or spaced along the parking locator 104 in various ways. As shown in Figures 1 and 2, four sensors are positioned such that two sensors 108 are secured on each side of the parking locator 104. Of course, other sensor positions may be utilized as well. For example, in some parking spaces it may be desirable to detect the presence of motor bikes, electric vehicles, golf carts, or other small vehicles which have a smaller total length then the typical motor vehicle (it should be noted that the parking sensor may be utilized to detect a variety of objects, including vehicles as well as other obstructions such as trash bins, or the like, and that the term "vehicle" is not limited to an automobile but may includes bikes, motorcycles, carts and a variety of other movable objects). Thus, the sensors 108 may be placed closer together. Where there is a need to detect medium size or large vehicles, the sensors 108 may be placed further apart.

[0050] It is contemplated that the sensors 108 may be positioned (as well as pointed) to detect specific parts of motor vehicles. For example, one or more sensors 108 may be positioned, pointed, or both such that the sensors are better suited to detect the wheels or tires of a vehicle. In this case, the sensors 108 may be spaced closer together corresponding to where the wheels or tires are likely to be located when a vehicle is parked. Of course, the sensors 108 may be configured or positioned to detect other portions of a vehicle.

[0051] Each parking locator 104 may be configured by an install technician or others for the number and type of sensors 108 and the position and alignment of the sensors for detection of motor vehicles. For example, sensors 108 may be adjusted, added, or removed by a technician as desired. In addition, sensors 108 may be realigned or replaced to ensure that the parking locator 104 continues to function properly.

[0052] In one or more embodiments, a logic device 504 may be provided. Generally the logic device 504 receives sensor information from one or more sensors 108. Sensor information may be thought of as the data or readings that the sensors 108 output. The logic device 504 may then interpret this information to determine whether a motor vehicle is present within a parking space. The presence of a vehicle may then be transmitted as parking information to other devices, drivers, or others.

[0053] Though the parking locator and its elements such as but not limited to the logic device, sensors, and processor, are generally described herein as detecting the presence of an object or vehicle, it is noted that the absence of an object or vehicle is also detected by the fact that not detecting an object or vehicle implies that the same is not present or absent. Thus, in some embodiments, the absence of an object or vehicle may be communicated simply by not communicating that an ob-

ject or vehicle is present. Of course, the absence of a vehicle may be communicated as well. For example, the sensors or logic device of the invention may communicate information indicating the absence of an object or vehicle when an object or vehicle is not detected.

[0054] It is noted that the logic device 504 may be configured to communicate the presence of a vehicle even if the vehicle is only partially within a parking space. In one or more embodiments, the logic device 504 may communicate that an obstruction is present if a vehicle or other object is partially within a parking space.

[0055] Sensor information may be interpreted by a logic device 504 to determine the presence of a motor vehicle in various ways. For example, if one or more of the sensors 108 detect the presence of an object, the logic device 504 may communicate that there is a vehicle present. Of course, the logic device 504 may be configured to communicate that a vehicle is present if a specific number of sensors detect an object.

[0056] The logic device 504 may be held within the parking locator such as for example, within the parking locator's body or beneath the parking locator's body. In this manner, the logic device 504 is protected from the elements, tampering, and from physical damage by the parking locator's body. It is contemplated that one or more covers removably attached to the body or one or more removable portions of the body may be used to allow the logic device 504 to be accessed for maintenance, replacement, adjustment, configuration, or other reasons.

[0057] In one embodiment, the parking locator includes at least one transmitter configured to transmit information. In a preferred embodiment, as the exemplary embodiment of Figure 5 shows, the logic device 504 may comprise at least one transceiver 516, as well as one or more sensor inputs 532, one or more processors 508, and one or more memory devices 512. It is noted that a separate memory device 512 may not be required in all embodiments because the processor 508 may have memory or the configuration of the logic device 504 does not require it. In a preferred embodiment, the parking locator comprises a transceiver rather than just a transmitter, thus allowing the two way communications to and from the parking locator. Transmitted information may include parking information including information indicating the presence or absence of a motor vehicle to external devices, as will be described further below. Received information may comprise diagnostic or control instructions.

[0058] The transceiver 516 may utilize various communications links communicate, including those now known or later developed. For example, the transceiver 516 may be configured to communicate via a wired communication link comprising a physical cable such as electrical or optical cable. The transceiver 516 may also be configured to communicate via a wireless communication link. Various communications protocols, packet switched, circuit switched, or otherwise, now known or later developed, may be used with the invention as well. In one or more embodiments, the transceiver 516 may communicate via TCP/IP, GPRS, or text messaging.

[0059] It is noted that the transceiver 516 may be used to install, configure, and maintain the parking locator in some embodiments. For example, a technician or other personnel may connect to a parking locator through the transceiver 516 to setup or update configuration settings or initiate diagnostics. It is contemplated that this connection may also allow one or more sensors to be turned off (i.e. deactivated), turned on (i.e. activated), calibrated, or adjusted. For example, one or more damaged sensors 108 may be turned off to prevent false readings. In addition, one or more sensors 108 may be calibrated or adjusted such as by increasing or decreasing the strength of their detection beams, if applicable, or by increasing or decreasing their sensitivity. It is noted that this connection allows technicians or other personnel to remotely perform these functions. Of course, these functions may be performed through the transceiver 516 locally as well, such as by connecting a laptop or the like directly to the parking locator.

[0060] In some embodiments, the transceiver 516 may be configured to control the tower light 124 illustrated in Figure 1. In these embodiments, the transceiver 516 may be configured to send a signal corresponding to the light, color, or both that should be displayed or emitted by the tower light. It is noted that a separate transceiver 516 or other interface configured to control the tower light may be provided as part of the logic device in one or more embodiments.

[0061] One or more sensor inputs 532 or another interface may also be included in the logic device 504. Generally, a sensor input 532 allows data outputted by one or more sensors 108 to be received by the other components of the logic device 504. For example, the sensor input 532 may be a terminal or other connector through which the output leads or connectors 520 of a sensor 108 may be connected. It is contemplated that each sensor input 532 may be selected to correspond to the output of one or more sensors 108. For example, a sensor input 532 may be configured to accept a particular optical or electrical connection from a sensor 108. In some embodiments, the sensor input 532 may be configured to accept wireless transmissions from one or more sensors 108.

[0062] In one embodiment, the sensor input 532 may translate data from a sensor 108 from one format or type to another. For example, an optical signal may be translated into an electrical signal, or one data format may be translated into another data format. The advantage of this capability is that a variety of sensor information may be translated by the sensor input 532 so that it is of a format or type that the one or more processors 508 of the logic device 504 can utilize. Of course this is not necessary in all embodiments, as the processor 508 or sensors 108 may be configured such that translation of sensor information is not required.

[0063] The one or more processors 508 may be simple

electronic circuits or may be a more complex device such as a microprocessor. It is contemplated that any electronic device or component, now known or later developed, capable of receiving and interpreting input from the one or more sensors 108 may be used as a processor 508.

[0064] As stated above, the logic device may be configured to determine the presence of a vehicle within a parking space. In one or more embodiments, the one or more processors 508 may be used to make this determination. For example, a processor 508 may interpret sensor information from one or more sensors 108 to determine the presence of a motor vehicle within a parking space. For example, if only one sensor 108 detects the presence of an object, the processor 508 may determine that there may be an obstruction, but that no motor vehicle is present. However, if more than one of the sensors 108 detect the presence of an object, the processor 508 may determine that a motor vehicle is present. In one embodiment, each sensor 108 will detect an object, if such object is present, and the logic device's processor 508 will determine whether the object is a motor vehicle depending on the location of the sensors and the number of sensors detecting an object. It is noted that in some embodiments, the detection of an object by a single sensor 108 may be sufficient for the processor 508 to determine that a vehicle is present.

[0065] It is contemplated that the processor 508 may be configured to determine whether a motor vehicle is present in other ways as well. For example, the processor 508 may execute one or more image, sound, or other pattern recognition algorithms on the sensor data to determine the presence or absence of a vehicle. These algorithms may be stored as machine readable code on one or more memory devices 512 of the logic device 504 in one or more embodiments. As stated, memory devices 512 are not necessary in all embodiments because the processor 508 may be configured to perform these algorithms such as in the case of an application specific integrated circuit (ASIC), a field-programmable grid array (FPGA), or other specialized microprocessor.

[0066] In one or more embodiments, the one or more memory devices 512 may be used to store data as well. For example, the parking locator's configuration or other settings such as but not limited to its location on the lot, the configuration of its sensors, and its communication settings may be stored on a memory device 512. In addition, a log containing a record of when motor vehicles are present or absent may be stored on a memory device 512. This is advantageous in that this information may be used to plan additional parking capacity, conduct diagnostics on parking locators, or determine the price of parking, among other things.

[0067] Figure 6 shows a plurality of parking locators 104 connected by power cables 620 and communications cables 624. Generally, the power cables 620 are used to provide power to each parking locator 104 while the communications cables 624 allow each parking locator to transmit data, receive data, or both. It is noted that the power cables 620 and communications cables 624 may be within a single cable having one or more conductors in some embodiments. In addition, it is contemplated that additional cables such as redundant power cables 620 or redundant communications cables 624 may be included in some embodiments as well.

[0068] It is contemplated that a power cable 620 may be any cable though which power can be provided to one or more parking locators 104, and that a communications cable 624 may be any cable through which data can be transmitted, received, or both by one or more parking locators 104. In one or more embodiments, the communications cables 624 may be standard network cables such as but not limited to Ethernet, coaxial, or optical cables. It is noted that in embodiments where the parking locator 104 may communicate wirelessly, such as through a wireless transceiver, communications cables 624 may not be provided. It is contemplated that a parking locator 104 may be solar or battery powered in one or more embodiments. In these embodiments, power cables 620 may not be required but may be used to power parking locators 104 if solar or battery power is inadequate.

[0069] In the embodiment shown in Figure 6, a plurality of parking locators 104 are connected in a daisy chain configuration wherein the power and data input to a second parking locator is routed from a first apparatus while a third parking locator connects to the power and data output of the second parking locator. Of course, it is contemplated that each parking locator may be directly connected to a power source for power, to an external device to transmit and receive data, or both in one or more embodiments. The number of parking locators 104 that may be connected in a daisy chain may be from 1 to n where n is defined by power and distance. It is preferable to organize the parking locators 104 in clusters associated with a particular location in order to provide the details required by a parking location system.

[0070] A control box 604 may be used to facilitate daisy chaining a plurality of parking locators 104 in one or more embodiments. The control box may comprise a power distributor 628 which connects to and sends power from a power source to power the daisy chain of parking locators 104. The power source will typically be an electrical grid however it is contemplated that other power sources such as generators or batteries may be used as well. It is contemplated that the power distributor 628 may be configured to supply power to a particular number of parking locators 104 or a range of a number of parking locators. In one or more embodiments, the power distributor 628 may alter the power from the power source, such as but not limited to converting AC to DC, DC to AC, and increasing or decreasing voltage or current, prior to supplying power to the one or more parking locators 104.

[0071] It is contemplated that each or some of the parking locators 104 may be connected to a power source other than the power distributor 628 in some embodi-

ments. For example, each parking locator 104 in a particular parking lot may be plugged into or connect to the electrical grid or other power source.

[0072] Generally, the control box 604 is connected to one or more parking locators 104 via one or more communications cables 624 or wirelessly to allow data to be communicated to and from each of the one or more parking locators. It is contemplated that the control box 604 be used to notify one or more drivers, parking attendants, other external or user devices, or people of the presence or absence of a motor vehicle at a particular parking locator. For example, in one or more embodiments, the control box 604 receives data indicating whether a particular parking locator 104 has detected or not detected the presence of a vehicle and communicates the same as parking information to one or more external or user devices.

[0073] Typically this occurs by the logic device within a parking locator 104 communicating the parking information comprising information indicating the presence or absence of a vehicle within its associated parking space to the control box 604. Of course, other parking information regarding a parking space may be collected by a parking locator's 104 sensors 108 and communicated to the control box 604 as well. In one embodiment, the parking information provided by a parking locator's 104 logic device may be communicated in the following format:

<Device Number>,<Status Code>,<Location>

[0074] Device Numbers may be numeric or alphanumeric codes which uniquely identify each parking locator 104. Of course, any indicator capable of uniquely identifying a parking locator 104 from a plurality of parking locators may be used as a Device Number. The Location may be a description, geographic coordinates, street name, parking space number, or any other indicator of the parking locator's location. It is noted that Location may not be communicated by a parking locator 104 in all embodiments because a separate record or database of locations indexed by each parking locator's Device Number may be kept and used to retrieve the location of a parking locator. Status codes generally indicate the presence or absence of a vehicle and may include specific information such as but not limited to the following examples:

1. Space Empty
2. Motor Bike Present
3. Small Motor Vehicle Present
4. Motor Vehicle Present
5. Unknown Obstruction Present
6. Apparatus Error
7. Other Status information

[0075] The parking information may then be used by the control box 604 to communicate to one or more users or external devices the current status of one or more parking spaces. Communication of the status of particular parking spaces or of vacant parking spaces in an area may occur in various ways. For example, the control box 604 may be connected to a telephone line, the internet, cellular network, one or more displays or signs, or a combination thereof. Users may then call a number or send a request by text message to receive information regarding open or occupied parking spaces or look up this information on the internet or on a sign. It is contemplated that electronic signs may be posted near the entrance to a parking area or other visible area such that users (such as drivers) may easily see which spaces are open or occupied. The sign may direct users to open spaces such as by providing a map or directions to an open space, or by listing a number or other information that identifies the space.

[0076] The control box 604 may be configured to communicate parking information to users through one or more user devices of various types. In this manner, a wide variety of communication methods may be used. For example, users could receive notifications via text messaging, instant messaging, telephone calls, email, or a combination thereof on any device capable of displaying the same.

[0077] Figure 7 illustrates an embodiment of a parking locator system according to the invention. As shown in Figure 7, the parking locator system is comprised of one or more parking locator clusters 708. As shown, each parking locator cluster 708 comprises one or more parking locators 104 connected in a daisy chain to a control box 604. Each cluster 708 may transmit parking information on a real-time basis to a location server 712 via a network 720. For example, the parking locators or parking locator clusters 708 may continuously transmit parking information to the location server 712. The location server 712, as described further below, may be configured to organize and store the received parking information and provide the parking information to one or more user devices 704.

[0078] These transmissions of information may occur via one or more wired or wireless communication links 716 and networks 720 utilizing various communication protocols. It is noted that in some embodiments, parking information may be transmitted when requested by a location server 712 rather than being transmitted on a real-time basis. For example, parking information may be requested by a location server 712 from one or more parking locators 104 or clusters 708 in response to a driver's or other person's request for parking information. Such a request may be made from a user device 704.

[0079] Though illustrated as two separate networks 720, it is contemplated that user devices 704, location servers 712, clusters 708, and individual parking locators 104 may communicate through a single network or multiple networks. It is also contemplated that the networks may be of different types. For example, communication may occur over the internet, telephone networks, cellular

networks, as well as other wired or wireless networks. The type of network or networks used will depend on the communications requirements used by and with the invention herein.

[0080] In one embodiment, the communication between each cluster 708 and the location server 712 is accomplished through wireless communication links 716. In a preferred wireless embodiment, GPRS communication is used to facilitate communication between each cluster 708 and the location server 712. In another embodiment, the communication between each cluster 708 and the location server 712 is accomplished through wired communication links 716. In a preferred wired embodiment, the clusters 708 and the location server 712 communicate via TCP/IP or other internet protocol. In yet another embodiment, individual clusters 708 may communicate via different wired or wireless networks 720 such as GPRS networks, circuit switched networks, or packet switched networks (e.g. internet).

[0081] As stated, each cluster 708 comprises one or more parking locators 104 connected in a daisy chain to a control box 604. In this embodiment, each cluster 708 communicates via a communication link 716 through its control box 604. Also shown in Figure 7 is a parking locator 104 configured to communicate directly to a location server 712 through a network 720. For example, the logic device of a parking locator 104 may be configured with an appropriate transceiver to allow direct communication of parking information to a location server 712 if desired.

[0082] The location server 712 may compile the collected information on a real-time, periodic, or other basis (e.g. as the information is requested by users) and organize the information based on location and time. This information may then be easily retrieved for users of the system. The location server 712 will typically be a server computer or personal computer having machine readable code configured to perform the functions described herein. However, it is noted that other devices capable of performing the functions herein may also be utilized with the invention.

[0083] In one embodiment, the location server 712 utilizes a database to organize and store parking information. The database may include the following data elements:

1) User Accounts to enable system and service access, which includes account type, name and address information, User device type, and user device configuration.
2) Network Configurations which include each parking apparatus, every transmitter device, location within a defined geographical area, and other configuration information
3) Wireless Network Information and Configuration
4) Support Personnel Accounts
5) Parking Device apparatus status
6) User location and status
7) Traffic Alerts
8) Traffic Information
9) City Fees and Payment Repository
10) Connection to financial institutions for payment services
11) Other related information and real-time status

[0084] The account information such as User and Support Personnel Accounts may be used to allow or deny access to the information stored in the database. For example, User Accounts may have access to traffic and parking information while Support Personnel Accounts may have access to configuration and status information such as network information.

[0085] Thus, it can be seen that the location server 714 is advantageous in that it provides a central storage area, such as the database described above, for parking information. In addition, other related information may be stored and accessed. Further, the location server 714 allows access to such information to be controlled by one or more User, Support Personnel, or other accounts, and provides a single device from which such account holders may access parking and related information. As stated, it is contemplated that the location server 714 may be a computer and thus may be easily programmed to include additional functionality and connected to a wide variety of networks and devices as necessary.

[0086] Similar to individual parking locators 104 or groups of parking locators, the parking locator system provides a service to the user that provides the user with available parking space information within a particular location or region. In one embodiment, the user may send a text message (e.g. SMS message from a cell phone) to a specific short code to request the closest available empty parking space from the system. In another embodiment, a user could send a text message to a particular short code assigned to the parking locator system to request all available spaces. It can thus be seen that a variety of text messages may be sent to the parking locator system and that the system may be configured to provide specific information as requested by a particular text message. An example of such text message requests could look as follows:

"Closest Space?" (to request the closest space)
"All Spaces?" (to request all available spaces within an area)

[0087] A user may provide his or her current location to the system in the text message or that the user's phone may provide the user's current location. For example, the phone may provide GPS coordinates to the system or the user may enter cross streets, zip codes, coordinates, or other location information in a text message. Such a request could look as follows:

" Closest Space to Main St. and 4th St.?"

[0088] In response to a request, the parking locator system may be configured to return a text message to the user, providing driving directions to the open space. For example:

> "Space available on 4th St. between Main St. and River St."

[0089] The system may be configured to send map or other visual information indicating the location of one or more spots, or such information may be synchronized to a map or other data. For example, the system may send a .jpg map showing streets and the location of open parking spots to a user device, such as a phone, for display.

[0090] It is contemplated that the parking locator system may be connected to other user devices such as navigation devices. For example, in-car or handheld GPS/direction systems may be used. The status of parking spaces, preferably open spaces, may then be displayed on a map displayed by the navigation device. In addition, the system may include a GPS system including radio communication and may inform the user specifically about the availability of parking within a specific area. Additional options may include the capability of a GPS enabled user device to also provide integrated information regarding accidents or traffic jams.

[0091] It is noted that user devices, which are generally devices capable of displaying or presenting parking information to a user, may be of various types. For example, in addition to cell phones and navigation devices, PDAs, portable media players, electronic signs, portable game machines, internet terminals, and computers may be used to request and view parking information. It is contemplated that these devices may request and display parking information through various interfaces. For example, some user devices may utilize a web interface or other software interface to allow users to make requests of parking information and to display the same to users.

[0092] In addition, a tower light, such as described above with respect to Figure 1, may be used to display parking information. In this situation the tower light may be configured as a user device in that the tower light would communicate with or be controlled by a location server or a control box without being connected to a parking locator or any logic device therein. It is contemplated that a tower light may be associated with a parking space rather than attached to the parking locator. For example, the tower light may be attached to the parking space itself or may be mounted on a pole extending upward from the parking space. As stated, such pole may be of varying heights as desired for visibility, aesthetic, or other reasons.

[0093] In one or more embodiments, users may be charged for parking information provided by the invention. Many methods for charging the users of the system are possible, including monthly fees, subscriptions, per transaction fees, subsidized by government or advertising, location specific, regional specific, etc... It is noted that any method of accepting payment, now known or later developed may be used with the invention.

[0094] In one embodiment, the location server may be configured to collect a fee or payment and check that a user has paid before communicating parking information to the user. Each user may be identified by his or her phone number, a username and password, or other identifying information. It is contemplated that where a location server is not provided, a control box may be configured to collect payment and check that a user has paid before communicating information to the user.

[0095] The parking locator system may be configured to support a plurality of financial methods for accessing the system and using the service. For example, in many large cities within Europe, drivers are forced by cities to pay for access to city centers to alleviate environmental problems. A cell phone may be used as an electronic purse communicating to the system using protocols such as GPRS to make payment for access to the city. It is thus contemplated that a cell phone may similarly be used to make payment for access to the parking locator system. Such payment may include a single payment for a single day, multiple days, a month, multiple months, or other time period as desired.

[0096] In some embodiments, the system may support time based access where the user simply pays for the time in which they are within a city center or other area and wish to use the parking locator system. In other embodiments, subscription based access may be supported where the user of the system pays a monthly fee to utilize the system to access parking information. It is contemplated that the system may allow payments for access to other services the system is capable of providing including but not limited to traffic information and traffic alert services. There may also be a software development kit (SDK) provided for third parties to add additional services or features to the system such as retail shopping information, entertainment information, restaurant information, and special offers and services.

[0097] While various embodiments of the invention have been described, it will be apparent to those of ordinary skill in the art that many more embodiments and implementations are possible that are within the scope of this invention. In addition, the various features, elements, and embodiments described herein may be claimed or combined in any combination or arrangement.

Claims

1. A parking locator system comprising:

> a location server configured to receive parking information indicating the presence or absence of an object within a plurality of parking spaces and provide information to a mobile user device identifying one or more unoccupied parking

spaces within a vicinity of a specified location in response to a request including a user location from said mobile device, said information comprising map information to indicate a location of said one or more unoccupied parking spaces within the vicinity of the specified location in relation to the said user location;
a plurality of parking locators configured to generate said parking information and communicate said parking information to said location server, each of said plurality of parking locators comprising:

one or more sensors each of said one or more sensors configured to detect the presence of an object within at least one parking space; and
a logic device in communication with said one or more sensors and the location server, said logic device configured to generate said parking information based on input from the one or more sensors.

2. The parking locator system of Claim 1, wherein said one or more sensors are selected from the group consisting of acoustic sensors, electromagnetic sensors, radio frequency sensors, light sensors and motion sensors.

3. The parking locator system of Claim 1 or 2, wherein the object is an obstruction that is not a motor vehicle.

4. The parking locator system of Claim 1 or 2, wherein the object is a vehicle.

5. The parking locator system of Claim 1 or 2, wherein the object is a vehicle only partially within one of the plurality of parking spaces.

6. The parking locator system according to any preceding claim, wherein at least one of the parking locators includes a transceiver for allowing two way communications to and from the parking locators.

7. The parking locator system of Claim 6, wherein the at least one parking locator is configured to receive configuration settings from an external device via the transceiver.

8. The parking locator system of Claim 6 or 7, wherein the at least one parking locator is configured to receive commands for adjusting the one or more sensors from an external device via the transceiver.

9. The parking locator system of Claim 8, wherein the commands switch on or off the one or more sensors.

10. The parking locator system of Claim 8 or 9, wherein the commands calibrate the one or more sensors.

11. The parking locator system of any of Claims 6 to 10, wherein the at least one parking locator is configured to receive diagnostic commands from an external device.

12. The parking locator system of any preceding Claim, further comprising a control box configured to receive the parking information from at least one of the parking locators to communicate parking information comprising information indicating the presence or absence of a vehicle within one or more parking spaces to said location server.

13. The parking locator system of any preceding Claim, wherein at least one of the parking locators forms part of a curb next to a street.

14. The parking locator system of any preceding Claim, wherein at least one of the parking locator is coupled to a curb next to a street.

15. The parking locator system of any preceding Claim, wherein a first parking locator is configured to communicate parking information to a second parking locator.

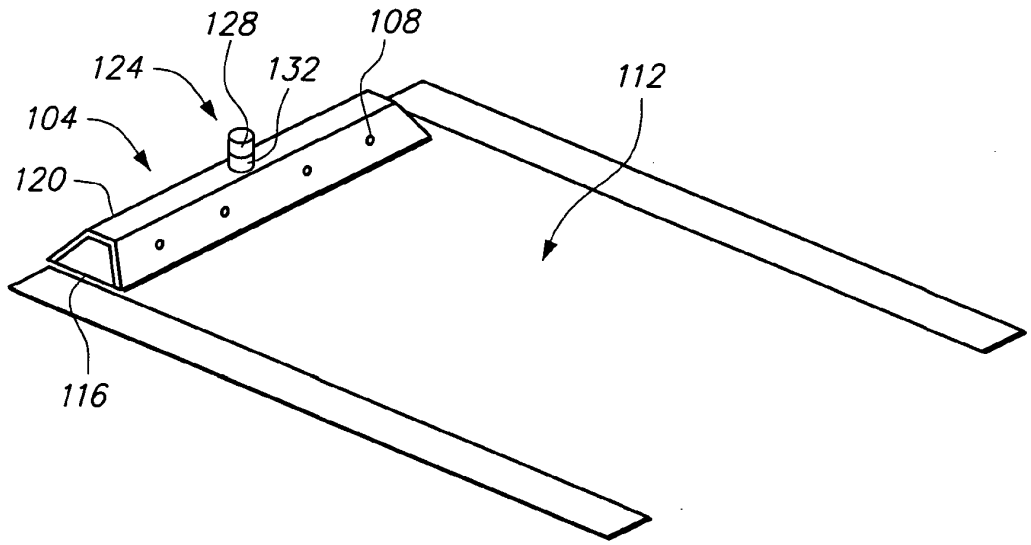
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FIG. 1

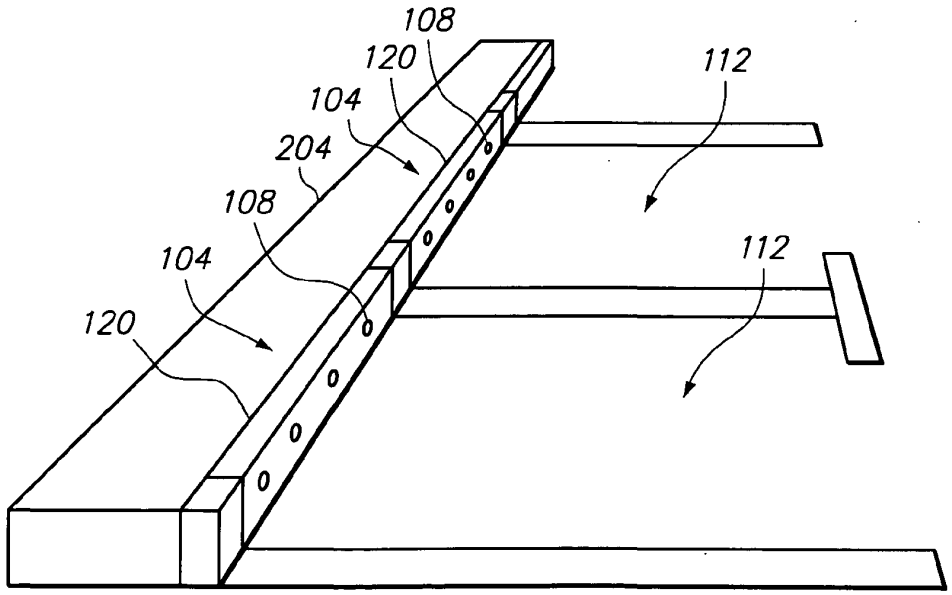
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FIG. 2

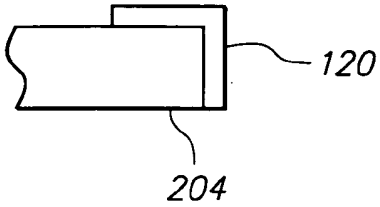

FIG. 3A

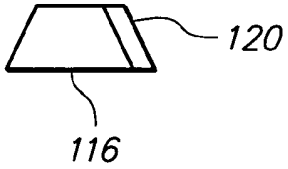

FIG. 3B

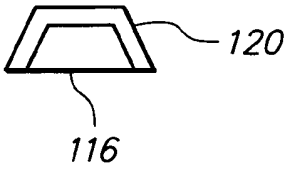

FIG. 3C

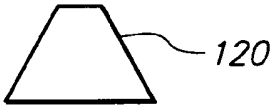

FIG. 3D

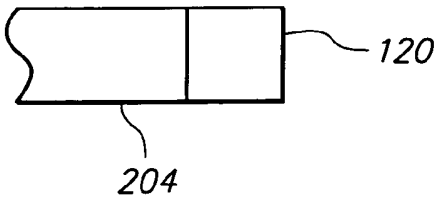

FIG. 3E

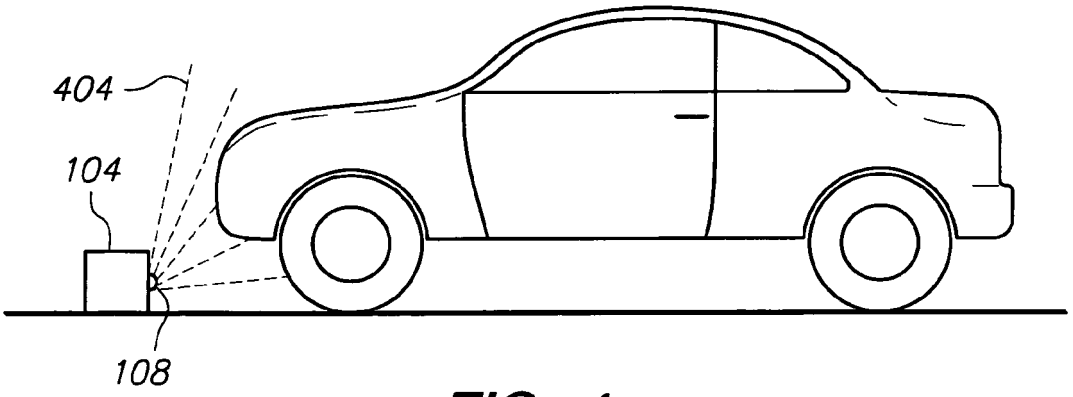
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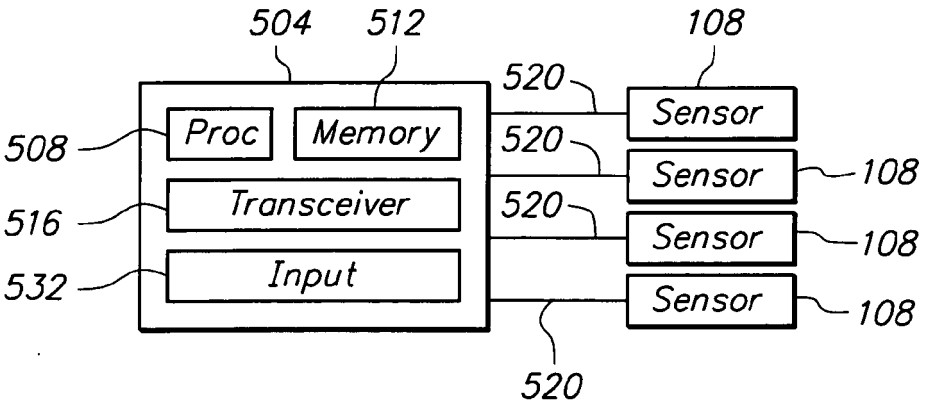
FIG. 4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Sensor
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Input
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Sensor
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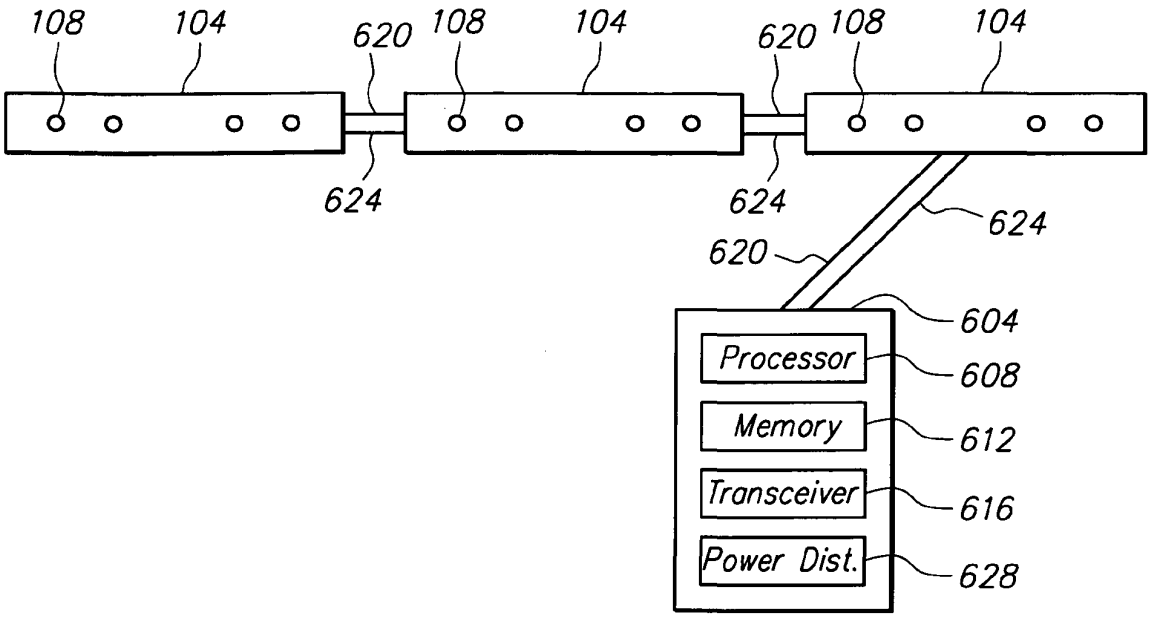
520

FIG. 5

FIG. 6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Processor
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Memory
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Transceiver
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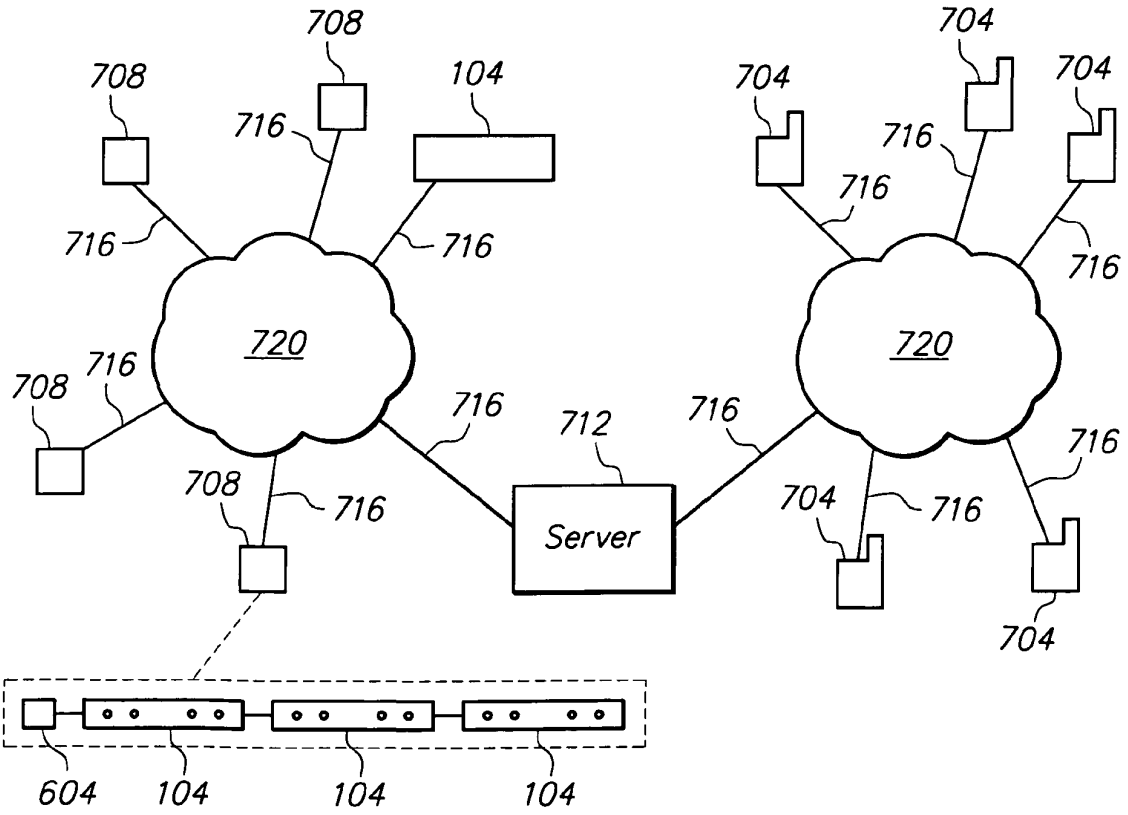
Power Dist.
628

FIG. 7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