(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 519 322 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
30.03.2005 Bulletin 2005/13

(51) Int Cl.[7]: **G07B 15/00**

(21) Application number: **04255792.6**

(22) Date of filing: **23.09.2004**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL HR LT LV MK

(30) Priority: **27.09.2003 GB 0322675**
02.12.2003 GB 0327928

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(54) Payment system and method

(57) A payment system and method for paying road tolls automatically is provided. A terminal device carried by a driver or located in the vehicle, is used to track the location of the user/vehicle. When the terminal is determined to have entered a toll zone, the system automatically arranges payment of the toll.

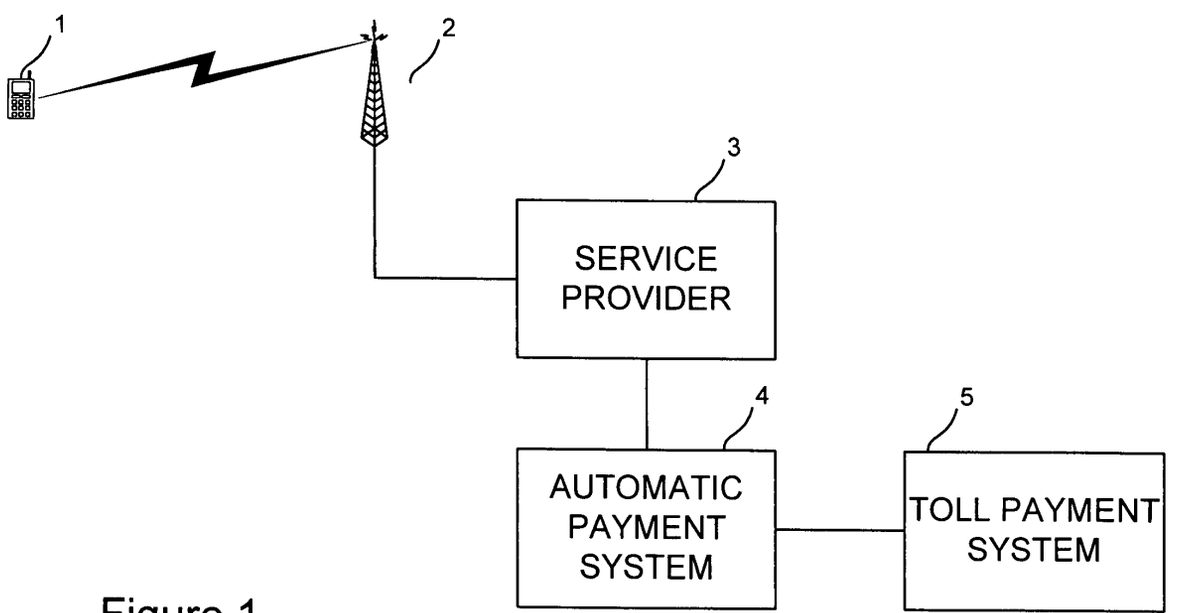

Figure 1

EP 1 519 322 A2

Description

[0001] The field of this invention generally relates to the payment of tolls, which are payable upon entering specified geographical areas in which toll schemes operate.

[0002] Tolls are charged by governments or private companies for many reasons: to raise revenue, to reduce traffic levels, or to pay for construction of, for example, a road system or bridge. The general principle is that to use a section of road, bridge, or area of the road network, a toll is payable. The toll can be charged for in many different ways: for example on a daily basis, on a per-use basis, or on an amount of use basis.

[0003] Congestion charging is just such a toll scheme, and is employed by government to both raise revenue and to reduce traffic levels. The principle used for congestion charging is that for a vehicle to enter a designated area during certain times of the day, the driver must pay a toll. There are many methods of collecting payment that can be implemented, for example the area could have a ring of toll booths at the entrances and exits of the toll area where the driver has to physically stop their vehicle and pay the toll before leaving or entering. A more automated system can also be used, for example one that tracks cars within the toll area and records the vehicle details for cross-referencing with toll payment records.

[0004] An example of the latter congestion charging principle mentioned above is demonstrated in Central London. This scheme works using CCTV cameras to scan number plates of cars driving within the congestion charging zone, and stores these details in a database. Payment of the toll can be made using various methods, and details of these payments are also recorded in a database. At the end of each weekday, the two sets of records are cross-referenced and checked, and those vehicles found not to have a toll paid in time have fine notifications sent to the registered owners of the respective vehicles. At the present time, it is possible to pay the tolls to enter the congestion charge zone in advance, for example for a year. However, this is not the preferred option for many drivers as it involves an up-front payment of the toll, which is non-refundable for days that they do not enter the zone. Instead most drivers prefer to pay separately for each day that they enter the zone, to avoid unnecessary payment of the toll. It is not preferable to pay the charge for every day of the year solely to ensure timely payment of the toll, as this is generally considered to be a waste of money. As a result, there is a danger that drivers will forget to pay the toll on some occasions.

[0005] Therefore, the problem with such toll charges, especially ones that are automated (as used in Central London), is that people forget to pay them on time, or at all, and receive fines. It is possible to purchase vehicle navigation aids, usually devices that use GPS (Global Positioning System) satellite technology, which monitor the position of your vehicle and work out the route to your destination using map data stored in the device. An added feature on some such devices is the ability to warn you upon nearing, and entering, toll charging zones. However, the main problem with this arrangement is that once you have entered the zone, the driver must still remember to pay the congestion charge, or will end up with a fine. Another problem with these GPS devices is that they are generally expensive items, and therefore considered a luxury item that few people buy, meaning that they are not prevalent among many drivers.

[0006] A further problem caused by toll charges is that it is possible that the toll zone may start quite suddenly, meaning that the driver may not realise that they have entered a toll zone.

[0007] As a result, some people will forget to pay road tolls occasionally, or not realise that they have to pay a toll, and these people will end up with a fine. Alternatively, people who do not know how the system works, or that it exists, may not be aware that they have to pay it or how to pay it.

[0008] Therefore according to the present invention there is provided a system for automatically paying tolls comprising: terminal location determining means adapted to receive location signals indicative of the location of a terminal and to provide location data of said terminal; data storage means for storing toll zone data identifying the location of one or more toll zones; and processing means, wherein said processing means is adapted to determine whether a toll is payable by calculating if said location data relates to a location within an area defined by said toll zone data, and if said location data is found to be within said area defined by said toll zone data, sending a payment instruction for initiating a toll payment.

[0009] The present invention also provides a method of operating a toll payment management apparatus comprising: storing toll zone location data; determining the location of a terminal to provide location data; comparing the location data with said stored toll zone location data; and sending a payment instruction for initiating a toll payment if said location data corresponds to a location within a toll zone defined by said toll zone location data.

[0010] An advantage provided by the present invention is that the user does not need to remember to pay the toll, as the system can automatically detect entry into a toll zone and make payment of the toll.

[0011] The present invention may be arranged wherein said processing means only determines a toll is payable after obtaining additional condition data relating to payment criteria from said data storage means and determining if said payment criteria is met.

[0012] This means that payment will not be made accidentally by the system in the case where a toll is not payable.

[0013] The present invention may also be arranged

wherein said payment criteria includes one or more of: the time of day being within a predetermined range, the day of the week being within a predetermined range; previous toll payments having been made; and a credit rating exceeding a predetermined value.

[0014] Consequently people who do not know the payment rules or location of a particular tolling system still have the toll paid when they enter the toll zone through use of the present invention.

[0015] Preferably the system further comprises: messaging means for sending a user warning message; wherein said processing means controls said messaging means to send a warning message if said location defined by said location data is on the boundary of a toll zone defined by said toll zone data.

[0016] In this way warning messages and confirmation messages can be sent to the user, and the user can act upon receiving the warning messages or confirm payment having entered a toll zone.

[0017] The payment means may be adapted to obtain payment instruction data corresponding to the terminal and to send a payment signal to a remote payment device in accordance with said payment instruction data, in response to a payment instruction from said processing means.

[0018] This provides the advantage that the user details can be stored in the system to speed up the payment process, or to keep the user payment records independent from a third party.

[0019] The terminal is preferably a wireless communication terminal. This allows the terminal to communicate with the payment system whilst the user's vehicle is in transit. A further advantage is that the user does not need to buy an expensive piece of equipment to effect the invention, as most already own a suitable terminal device, such as a mobile telephone, that can provide a location as required.

[0020] The location signals may include data corresponding to the location of a base station closest to said terminal. The location signals can include data corresponding to the location of the wireless communication terminal. In this way the automatic payment system can ascertain the location of the terminal independent of the service provider.

[0021] The location signals preferably include data from a plurality of base stations which are in range of said wireless communication terminal. This helps to provide accurate location data to locate the terminal.

[0022] A payment instruction is preferably sent to a server associated with the service provider providing network access to said wireless communication terminal in accordance with payee data stored in the data storage means.

[0023] This provides the advantage that the toll payment can be made conveniently by the user through the service provider billing arrangements.

[0024] Beneficially, the payment instruction is sent to a server associated with a payment agent server in accordance with agent data stored in data storage means.

[0025] This allows toll payment to be made for the user using third party payment means.

[0026] In an alternative arrangement of the invention, the processing means stores said location data provided by said location determining means in said data storage means; and said processing means analyses the location data and stored location data of a terminal to determine a direction of travel; wherein said processing means is adapted to determine if said direction of travel is consistent with entry into an area defined by said toll zone data before determining that a toll is payable.

[0027] Thus by calculating the direction of travel of the user, it is possible to more accurately determine the entry of the user into a toll zone or not, for example whether the user has crossed a bridge over a toll zone but not itself within a toll charging scheme.

[0028] An alternative embodiment of the present invention also provides a wireless communications terminal comprising: location determining means for determining the location of the terminal, data storage means for storing toll zone data identifying the location of one or more toll zones, processing means, and display means, wherein said processing means is adapted to determine whether a toll is payable by calculating if said location data relates to a location within an area defined by said toll zone data, and said display means is adapted to display a warning message if said computation means finds that said terminal is located within said area defined by said toll zone data.

[0029] This provides the advantage that the user can install a device within their vehicle that can determine whether the position of the vehicle is within a toll zone, and to warn the user if this is the case.

[0030] The wireless communications terminal may further comprise messaging means; wherein said processing means controls said messaging means to provide a second warning message if said location defined by said location data is on the boundary of a toll zone defined by said toll zone data.

[0031] In this way the device can warn or inform the driver of the vehicle when the vehicle is on the boundary of the toll zone so that they can take evasive action.

[0032] The terminal may further comprise payment means adapted to obtain payment instruction data corresponding to the terminal and to send a payment signal to a remote payment device in accordance with said payment instruction data, in response to a payment instruction from said processing means.

[0033] The device can then effect automatic payment of a toll if it finds the vehicle to be within a toll zone.

[0034] The remote payment device is preferably a server associated with the service provider providing network access to the terminal, and said payment means sends a payment signal in accordance with payee data stored in data storage means.

[0035] The location data may comprise information identifying the location of a base station with which the

terminal is communicating.

[0036] The location signals may include data corresponding to the location of the wireless communication terminal.

[0037] The processing means preferably stores said location data provided by said location determining means in said data storage means; and said processing means analyses the location data and stored location data of the terminal to determine a direction of travel; wherein said processing means is adapted to determine if said direction of travel is consistent with entry into an area defined by said toll zone data before determining that a toll is payable.

[0038] This provides the advantage that the location of the terminal can be tracked and when compared to map data, the location can be predicted. Also, if the toll scheme is one charged on distance travelled, the information can be used to calculate the toll payment.

[0039] The present invention also provides a carrier medium carrying computer readable instructions for controlling a computer to carry out the method of the present invention.

[0040] The present invention can be implemented either in hardware or on software in a general purpose computer. Further the present invention can be implemented in a combination of hardware and software. The present invention can also be implemented by a single processing apparatus or a distributed network of processing apparatuses. Since the present invention can be implemented by software, the present invention encompasses computer code provided to a general purpose computer on any suitable carrier medium. The carrier medium can comprise any storage medium such as a floppy disk, a CD ROM, a magnetic device or a programmable memory device, or any transient medium such as any signal e.g. an electrical, optical or microwave signal.

[0041] Specific embodiments of the invention will now be described in detail in conjunction with the accompanying drawings in which like reference symbols indicate the same or similar components, wherein:

Figure 1 is a schematic overview of the present invention;

Figure 2 is a more detailed view of the automatic payment system of the embodiment shown in Figure 1;

Figure 3 is an alternative system as seen in Figure 1, with the inclusion of a payment verification system;

Figure 4 is an alternative payment system as seen in Figures 2 and 3, with the inclusion of a messaging means;

Figure 5 is a standalone device for the automatic payment of tolls as per the invention;

Figure 6 is an alternative method of performing the invention, with the use of alternative wireless communication means;

Figure 7 is a flow diagram detailing the steps performed by the present invention; and

Figure 8 is a schematic diagram of a general purpose computer adapted to perform the process of the present invention.

[0042] Figure 1 shows an embodiment according to the present invention. In this embodiment, the vehicle or user of the vehicle carries a mobile phone terminal which acts as a device for determining location information. In other words, the location of the terminal can be established in order to give an indication of the location of the vehicle, or the user with which it is associated. The phone terminal 1 is either carried by a user, who is travelling in their vehicle on a road network, or the phone terminal 1 is permanently or temporarily located in the vehicle.

[0043] The terminal 1 communicates with at least one base station 2, which in turn provides a connection to a mobile telephone service provider 3. An automatic payment system 4 is interfaced with the service provider 3, which can also communicate with the toll payment system 5.

[0044] Figure 2 shows in detail the arrangement of the automatic payment system 4. Location determining unit 41 communicates with mobile service provider 3 to obtain information about the location of the terminal. Processing unit 43 can communicate with the location determining unit 41 to receive location information. The processing unit 43 can also communicate with the payment unit 45 to initiate payment of a toll. The payment unit 45 communicates with toll payment system 5.

[0045] The operation of the automatic payment system 4 will now be described in more detail.

[0046] The location determining unit 41 determines the location of the terminal 1 based upon location data received from the service provider 3. Preferably this is in the form of a grid reference or other means for identifying the location of the user.

[0047] The processing unit 43 receives location data identifying the location of the terminal 1 from location determining unit 41. The processing unit 43 extracts toll zone data from data store 42. The received location data is then compared with toll zone data to determine whether the location data for terminal 1 is within one or more areas defined in toll zone data. If the location data for terminal 1 is found to be within an area defined in said toll zone data, then an "in zone" flag is set.

[0048] Once the "in zone" flag is set, the processing means 43 can carry out a number of further checks to establish whether it is actually necessary to initiate a toll payment. This could include a number of checks depending upon the type of toll zones it is to be used for, the time and date, whether any exemptions apply, whether the toll has already been paid, whether the user does not wish to pay the toll (for example, he is travelling in the zone on foot or on public transport), etc.

[0049] In the simplest case, the processing means

may simply obtain information on the time and day applicability of the toll charge zone which the location data indicates has been entered. This is then compared with current time and day information to determine if the toll is applicable. The processing means 43 may also obtain information on the specific users status in the zone entered. For example, a user may have a discount applicable to some charging zones and not others. This information can be collected in advance and stored in the data store 42. In some cases a toll may be payable for a fixed period, e.g. a day, and is only payable once in that period. The processing means can maintain a record of payments made to determine if a payment is necessary.

[0050] Where a toll is based upon distance travelled within a toll zone, the processing means may simply store a record of the various locations, over time, of the terminal whilst in the toll zone, so that later it can analyse the series of locations to determine how far along a toll road, or within a toll zone, a terminal has travelled. For example, a user with terminal enters a toll road zone and the entry is detected by the processing means. For a period after wards, the processing means continues to note the terminal being in the toll zone. Finally, at a later time, the processing means can determine the path of the terminal and for what distance (or time if that is the charging criteria) the terminal was in the zone. From this, it can determine what toll fee is necessary.

[0051] As mentioned above, the user may wish to intervene to prevent a payment being made where it is not necessary. For example, a user who normally travels into the zone in a vehicle may on occasion travel by train where no toll is incurred. They may however still carry their terminal with them, for example if this was a personal mobile phone. Thus, as they entered a charging zone, the processing means would determine that such entry had taken place and the in zone flag would be set. The user may have known in advance they would be entering the zone without the vehicle and this information could have been stored in the data store 42. Alternatively, the processing means may request confirmation from the user. This is described in more detail below. The system can be made even more sophisticated by analysing how the terminal travelled into the zone. If the path of a terminal follows a railway line then it may determine that it is unlikely that a toll is required etc.

[0052] Once the processing means has determined that payment is required, a payment signal is passed to the payment unit 45. The payment unit 45 is adapted to initiate a payment to the toll payment system 5 or a third party agent.

[0053] Due to the variations in possible payment methods, the payment unit 45 is adaptable to use a method suitable for payment of a toll to each respective toll payment body. When a payment signal is received by the payment unit 45, it obtains information concerning the user and their preferred payment method and also the toll charging authority from the data store 42. These payment details can include method of payment, the particulars of the preferred method of payment such as credit card details, service provider account details, etc.

[0054] There may be several ways in which payment of the toll can be carried out. For example, the toll charging system in London allows payment by credit card, SMS messaging service, at a designated pay point, e. g. in shops, and so on. Other possible methods may involve having accounts established with the toll authority. The system is adaptable to allow the user to select one or more of these payment methods. Thus, if the user has selected to pay by credit card, their details would be stored in the data store 42. These would be extracted and then passed on to the toll charging authority. Alternatively, the payment unit may arrange the payment to a third party which accepts the payment on behalf of the toll charging authority and then advises that payment has been received.

[0055] Thus the payment unit is adaptable to arrange the payment in a number of ways which are known to a skilled man and so not described here in detail.

[0056] A further option is for the user to have an account, details of which are updated in data store 42, and the paid tolls are recorded or charged to this account and the bill paid by other means, and possibly at a later date. Another option is to have the payment unit 45 connected to a payment verification system 6, as shown in Figure 3, which verifies that the payment method is correct and authorises the amount to be taken from the account.

[0057] A further optional feature of the embodiment is to store the terminal location data received in data store 42. This allows the processing unit to determine the direction in which the terminal is travelling, and can be used to predict the path of travel relative to the toll zone data stored in data store 42. For example, if the vehicle is crossing a bridge over a toll road then direction of travel data can be determined. If on a subsequent check, the direction of travel shows that the terminal was simply passing over a toll road then no payment would be required and payment can be inhibited. As indicated above, the direction of travel can be monitored and if the terminal is travelling towards a toll zone then a warning message, e.g. a recorded message, an SMS message, a pager message etc., can be sent to advise the user of the approaching toll zone.

[0058] If a terminal is on the very edge of a toll zone, it is difficult to determine whether it is just inside or just outside the zone. The processing unit can be adapted to operate in a number of ways. A buffer zone can be defined in the data stored for each toll zone area. If the terminal is determined to be within the buffer zone, the processing means can note that a potential entry into the zone has taken place but take no further action. If subsequently the terminal location is determined to be within toll zone then the data concerning the entry into the buffer zone can be disregarded. However, if subse-

quent monitoring of the location of the terminal does not fall within the toll zone then a cautionary warning could be sent to the user to advise that the terminal passed close to a toll zone but it is necessary to confirm that entry into the zone took place. The user could then arrange payment manually or respond to the processing means to confirm payment should take place. The processing means could send an SMS message to the user terminal with the user confirming payment or not by replying with an SMS message or otherwise. Other methods could be used such as calling the user on their phone terminal and sending a recorded message with the user acknowledging using spoken voice commands or key presses. Other interactive methods of determining whether payment is required are well known in the art.

[0059] In order to provide this confirmation function, the embodiment described above may further include a messaging unit 44, as shown in Figure 4. In this modified arrangement, the messaging unit 44 communicates with the data store 42, the processing unit 43 and to the service provider 3. If the terminal location data provided by location determining unit 41 to processing unit 43 lies within the buffer zone, for instance when the base station range overlaps the edge of the toll zone, then a message can be sent to the user to request a decision on payment of the toll. In this case, processing unit 43 sends messaging instructions to messaging unit 44, and messaging unit extracts user messaging details from data store 42, and using these details it interfaces with service provider 3 to send a message to the terminal 1. The user can respond using terminal 1 and this message will be received by messaging unit 44. Messaging unit will then send the confirmation instruction to the processing unit which sends a signal to the payment unit 45 to initiate a payment instruction.

[0060] An alternative use for this feature is to use messaging unit 44 to send a warning message to the user when the terminal is detected to be in the buffer zone, but not yet within the boundary. The messaging unit 44 can also be used to alert the user in certain situations, for example: notifying the user when they are near the zone, notifying the user upon entering the buffer zone, notifying the user that they have progressed into the zone and that a toll is payable, notification that the charge has been paid automatically and notification of payment confirmation. The preferred user alerts can be selected by the user and stored in the data store located in the automatic payment system.

[0061] Using a mobile phone to determine location can provide a reasonably high degree of accuracy but is maybe only currently accurate to 100m or thereabouts depending upon a number of factors and the process used to determine the location. In an urban area, base stations are relatively close and so accuracy will increase whereas in open country the spacing of base stations is greater so that even using a triangulation of the signal received at several base stations, accuracy may be lower. A simple system simply provides an indication of the base station to which the mobile phone is communicating with. This may be sufficient in some instances. In others triangulation and monitoring of the power of the received signal can be used to more accurately assess the location of the terminal. However, even with an accuracy of a few hundred metres, the above embodiment can determine with reasonable accuracy when a terminal is within a zone to arrange automatic payment or, when its location is not definitively within a zone, at least provide a warning to the user, who can then decide whether or not to make a payment.

[0062] To minimise processing and data overhead, location information may be based only on the location of the closest base station until the terminal reaches the edge of a toll zone, at which point the system switches to using a more accurate location information technique.

[0063] Other options include the possibility of combining a dedicated location system such as a GPS system, with a mobile communication device. The size and costs of both these types of devices continues to fall and it is becoming feasible to implement both devices in a practical portable terminal.

[0064] A further optional feature for use with toll systems that charge on, for example, a daily basis (i.e. payment of one toll is required for a vehicle to travel around, in and out of the zone that day) is the inclusion of a data storage unit and a clock attached to the payment unit 45. When payment instructions for a particular vehicle are received by payment unit 45, they are stored in data storage unit. At the end of the allotted time period for payment of the toll, which is determined by clock, the payment unit examines the stored payment requests, and ascertains whether there are multiple payment instructions for one vehicle. If there are multiple payment instructions for one vehicle, then only one payment needs to be made for these multiple entries in the data storage unit.

[0065] A further feature that can be implemented is if messaging unit receives a message from the user indicating that they are travelling into the zone without their vehicle, the data store 42 includes a database of user information which can be updated to note specific preferences such as instruction to inhibit payments. is instructed to not pay the toll for that user until further notice. Optionally the user can specify how long the payment bar is applied. A further option is to apply the payment bar automatically for a fixed period of time, for example a day. A further user feature is to store in the database that the user wishes to provide confirmation of toll payment for each payment. In this way, prior to instructing the payment unit to send out a payment instruction, the processing unit initiates a payment authorisation, such as using the messaging unit as described above.

[0066] A further option that can be implemented is to provide a separate device, which can be fixed or free standing in a vehicle, or for example incorporated into

a "hands free" system. The device can be programmed with the car registration information, and optionally mobile phone information and user information. Further, if the vehicle is used by more than one person, then the device can be programmed with multiple mobile phone details to correspond to each person who uses the vehicle. The device can link to the mobile phone using a variety of methods, for instance using a cable or a wireless connection such as Bluetooth®. The device functions to determine that the vehicle is being driven and that charging will apply when entering any toll zones. On this basis, there could be a toll payment bar applied until the device is connected to the mobile phone, at which point the payment bar is lifted. Thus the user need not worry about entering a toll zone without a vehicle and paying the toll by accident.

[0067] A summary of the above process as performed by the present invention is shown in the flow chart of Figure 7.

[0068] The above described embodiment relates to the use of a mobile cellular telephone terminal but other methods of communication are envisaged, using a mobile phone terminal or some other wireless terminal. One method of communication between a terminal and automatic payment system could be provided as a short or long range wireless communication system, in a licensed or unlicensed spectrum, for example through the use of one of the IEEE 802.11 wireless networking standards, or the Bluetooth® standard.

[0069] A second embodiment of the present invention provides a system for automatically arranging payment of a toll charge, as shown in figure 5. The system comprises two main components: a location determining portion 110 and a payment facilitation portion 100.

[0070] The location determining portion 110 is a GPS location system. The location determining portion 110 comprises an antenna 111 which is connected to a receiver 112. This is in turn connected to location determining unit 113 for decoding the received signal to provide an indication of the location of the device. Location determining unit 113 is connected to a processing unit 104 in a communication device, to pass the location information to the processing unit. In this embodiment, the communication device is a mobile telephone. The processing unit 104 can access a data store 105 and is also connected to a payment unit 106. The payment unit is connected to communication system 107, which in turn is connected to antenna 108 for communication with a base station.

[0071] The location determining portion 110 and the payment facilitation portion 100 may be separate units linked together by a wired or wireless connection, or be integrated into one unit.

[0072] Antenna 111 receives a GPS signal which is decoded by the receiver to provide a signal to the location data receiving unit 112 which translates it into device location data. The device location data is sent to location determining unit 113, which determines the position of the device from the received GPS signals. Position data is sent to processing unit 104, which determines whether the device position data lies within a toll zone. The processing means obtains data identifying the toll zones from the data storage 105. If processing unit 104 determines the device location data to be within a toll zone, then an in-zone flag or the like is set. The processing means may then carry out other checks to determine if a toll payment should be made, such as described above in relation to the first embodiment. If a payment is determined to be necessary, then a payment instruction is sent to payment unit 106. Payment unit 106 retrieves payment information, such as user details, payment account details etc. from data store 105 and transmits payment information to a toll payment system 5, through communication system 107 linked to antenna 108, which is received by base station 2 and routed through a service provider 3 to toll payment system 5. This may be in any number of ways such as SMS message, data link etc.

[0073] The location data receiving unit in the above embodiment is a GPS system. However, the location may be determined in other ways. The location may be determined by communicating with the base station of the telephone network. In this way the location determining unit would communicate with the base station via the transmitter/receiver 107 rather than using a separate receiver and antenna. The processing unit may send a message to the base station requesting its location, with the base station calculating the location and responding with that information. Alternatively, the terminal may work out its own location by measuring test signals from one or more base stations.

[0074] An alternative method of communication between payment unit and toll payment system is envisaged, such as a short or long range wireless communication system.

[0075] In an alternative embodiment, there is provided a device 150 shown in Figure 6 that can operate using a wireless data communication standard, such as 802.11b or Bluetooth® . The toll zone is preferably ringed with wireless communication access points 200 that can communicate with device 150, or alternatively the access points 200 are located so the coverage extends over the entire toll zone. The position of the device 150 can be determined by triangulating the device position using a plurality of wireless access points, or by the use of multiple directional-specific aerials which can determine if the device 150 is within, or outside of, the zone. With short range wireless communications, it is sufficient to simply determine the closest access point or antenna to determine the location of the device, as the range of each access point will generate location data that is accurate enough for this purpose. The device 150 communicates at intervals with the automatic payment system 201 via at least one access point 200 to update its location by sending location data to the location data input unit 61 when the device is in communi-

cation with at least one access point 200, the location data specifying to which access point the device is connected. If the device is determined by computation means 62 to be within a toll zone, then computation unit 62 loads the user data from data store 63 and sends a payment instruction to billing unit 65, which in turn relays the payment instruction to payment unit 5. An optional feature is to then have computation unit 62 instruct messaging unit 64 to send a confirmation message to device 150 to indicate that the charge has been paid. Device 150 can optionally comprise a display unit on which to display information that the charging zone has been entered, and that the charge has been paid by automatic payment unit 201.

[0076] Alternatively, the device can detect any cameras monitoring the toll zone, or some other signal, such as an infra red, laser or radar beam that is output at the toll zone boundary.

[0077] The present invention can be implemented in general purpose computer, as shown in Figure 8. The general purpose computer comprises a processor 814 connected to a bus 817, the bus 817 also being connected to a program memory 815, a data store 816, a location signal input 812 and payment communication unit 811. Program memory 815 contains a payment criteria program, a payment program, and an "in-zone" calculation program. Data store 816 contains toll zone data and payment criteria data.

[0078] Location signal input receives a location signal for a terminal, and this is sent to the processor 814 via bus 816. Processor 814 loads "in-zone" calculation program from program memory 815 and toll zone data from data store 816, and determines whether the location provided by the location signal input is within a toll zone as defined in the toll zone data. If the location is found to be within a toll zone, then the payment criteria program is loaded by the processor 814 from program memory 815 along with payment criteria data specific to the toll zone and specific to the user, from data store 816. The processor 814 then determines whether the toll is payable, and the amount of toll payable, dependent upon the criteria of the payment criteria data. The toll, once calculated and if payable is then authorised by the processor using the payment communication unit 811.

[0079] Various specific embodiments of the present invention have been described above. However, it is not intended that the invention be limited to these embodiments. Various modifications will be apparent to those skilled in the art. The features of the above described arrangements may be combined in various ways to provide similar advantages in alternative arrangements.

Claims

1. A system for automatically paying tolls comprising:

terminal location determining means adapted to receive location signals indicative of the location of a terminal and to provide location data of said terminal;

data storage means for storing toll zone data identifying the location of one or more toll zones; and

processing means, wherein

said processing means is adapted to determine whether a toll is payable by calculating if said location data relates to a location within an area defined by said toll zone data, and

if said location data is found to be within said area defined by said toll zone data, sending a payment instruction for initiating a toll payment.

2. A system according to claim 1 wherein said processing means only determines a toll is payable after obtaining additional condition data relating to payment criteria from said data storage means and determining if said payment criteria is met.

3. A system according to claim 2 wherein said payment criteria includes one or more of: the time of day being within a predetermined range, the day of the week being within a predetermined range; previous toll payments having been made; and a credit rating exceeding a predetermined value.

4. A system according to claim 1, 2 or 3 further comprising:

messaging means for sending a user warning message; wherein

said processing means controls said messaging means to send a warning message if said location defined by said location data is on the boundary of a toll zone defined by said toll zone data.

5. A system according to any one of claims 1 to 4 further comprising payment means adapted to obtain payment instruction data corresponding to the terminal and to send a payment signal to a remote payment device in accordance with said payment instruction data, in response to a payment instruction from said processing means.

6. A system according to any one of claims 1 to 5 wherein said terminal is a wireless communication terminal.

7. A system according to claim 6 wherein said location signals include data corresponding to the location of a base station closest to said terminal.

8. A system according to claim 6 wherein said location signals include data corresponding to the location

of the wireless communication terminal.

9. A system according to claim 6 wherein said location signals include data from a plurality of base stations which are in range of said wireless communication terminal.

10. A system according to any one of claims 6 to 9 wherein said payment instruction is sent to a server associated with the service provider providing network access to said wireless communication terminal in accordance with payee data stored in data storage means.

11. A system according to any one of claims 6 to 9 wherein said payment instruction is sent to a server associated with a payment agent server in accordance with agent data stored in data storage means.

12. A system according to any one of claims 1 to 11 wherein said processing means stores said location data provided by said location determining means in said data storage means; and said processing means analyses the location data and stored location data of a terminal to determine a direction of travel; wherein said processing means is adapted to determine if said direction of travel is consistent with entry into an area defined by said toll zone data before determining that a toll is payable.

13. A wireless communications terminal comprising:

location determining means for determining the location of the terminal,
data storage means for storing toll zone data identifying the location of one or more toll zones,
processing means, and
display means, wherein
said processing means is adapted to determine whether a toll is payable by calculating if said location data relates to a location within an area defined by said toll zone data, and
said display means is adapted to display a warning message if said processing means finds that said terminal is located within said area defined by said toll zone data.

14. A wireless communications terminal according to claim 13 further comprising
messaging means; wherein
said processing means controls said messaging means to provide a second warning message if said location defined by said location data is on the boundary of a toll zone defined by said toll zone data.

15. A wireless communications terminal according to claims 13 or 14 further comprising payment means adapted to obtain payment instruction data corresponding to the terminal and to send a payment signal to a remote payment device in accordance with said payment instruction data, in response to a payment instruction from said processing means.

16. A wireless communications terminal according to claim 15 wherein
said remote payment device is a server associated with the service provider providing network access to the terminal, and said payment means sends a payment signal in accordance with payee data stored in data storage means.

17. A wireless communications terminal according to any one of claims 13 to 16 wherein
said location data comprises information identifying the location of a base station with which the terminal is communicating.

18. A wireless communications terminal according to any one of claims 13 to 17 wherein
said location signals include data corresponding to the location of the wireless communication terminal.

19. A wireless communications terminal according to any one of claims 13 to 18 wherein
said processing means stores said location data provided by said location determining means in said data storage means; and said processing means analyses the location data and stored location data of the terminal to determine a direction of travel; wherein said processing means is adapted to determine if said direction of travel is consistent with entry into an area defined by said toll zone data before determining that a toll is payable.

20. A method of operating a toll payment management apparatus comprising:

storing toll zone location data;
determining the location of a terminal to provide location data;
comparing the location data with said stored toll zone location data; and
sending a payment instruction for initiating a toll payment if said location data corresponds to a location within a toll zone defined by said toll zone location data.

21. A carrier medium carrying computer readable instructions for controlling a computer to carry out the method of any one claims 20.

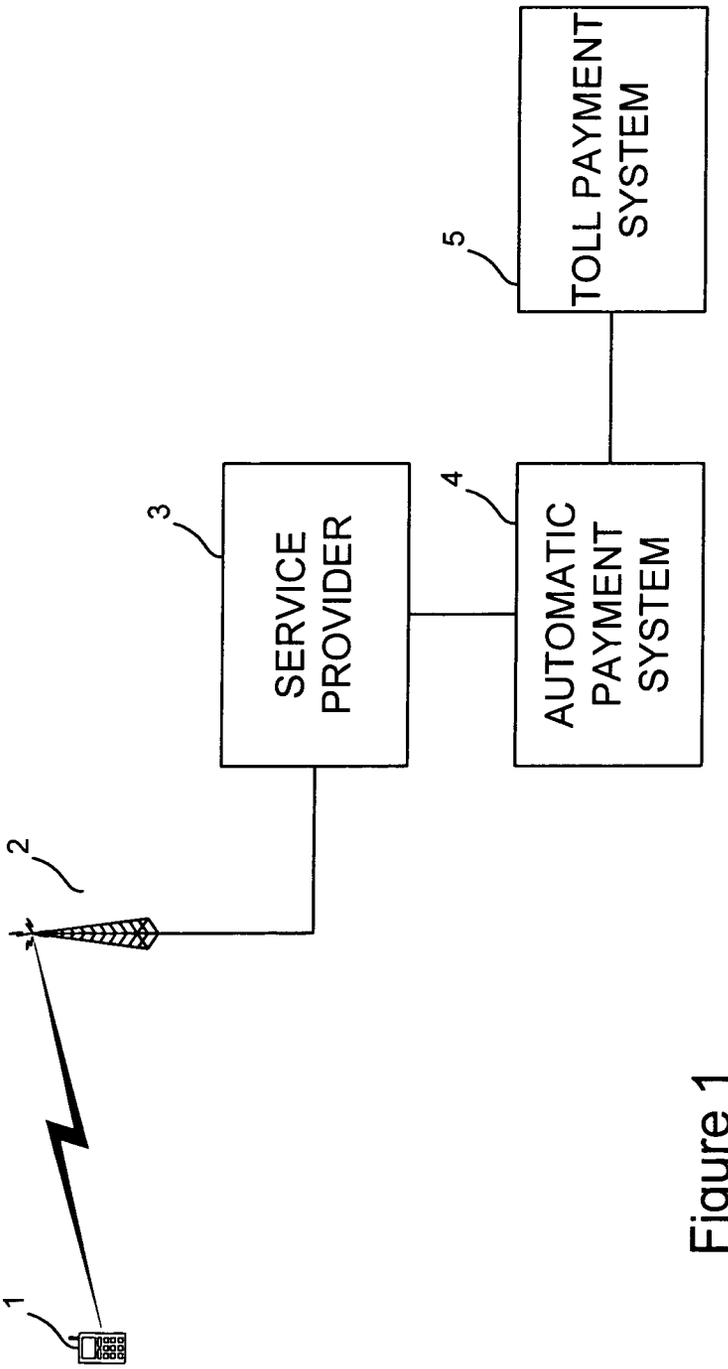
1
2
3
SERVICE PROVIDER
4
AUTOMATIC PAYMENT SYSTEM
5
TOLL PAYMENT SYSTEM

Figure 1

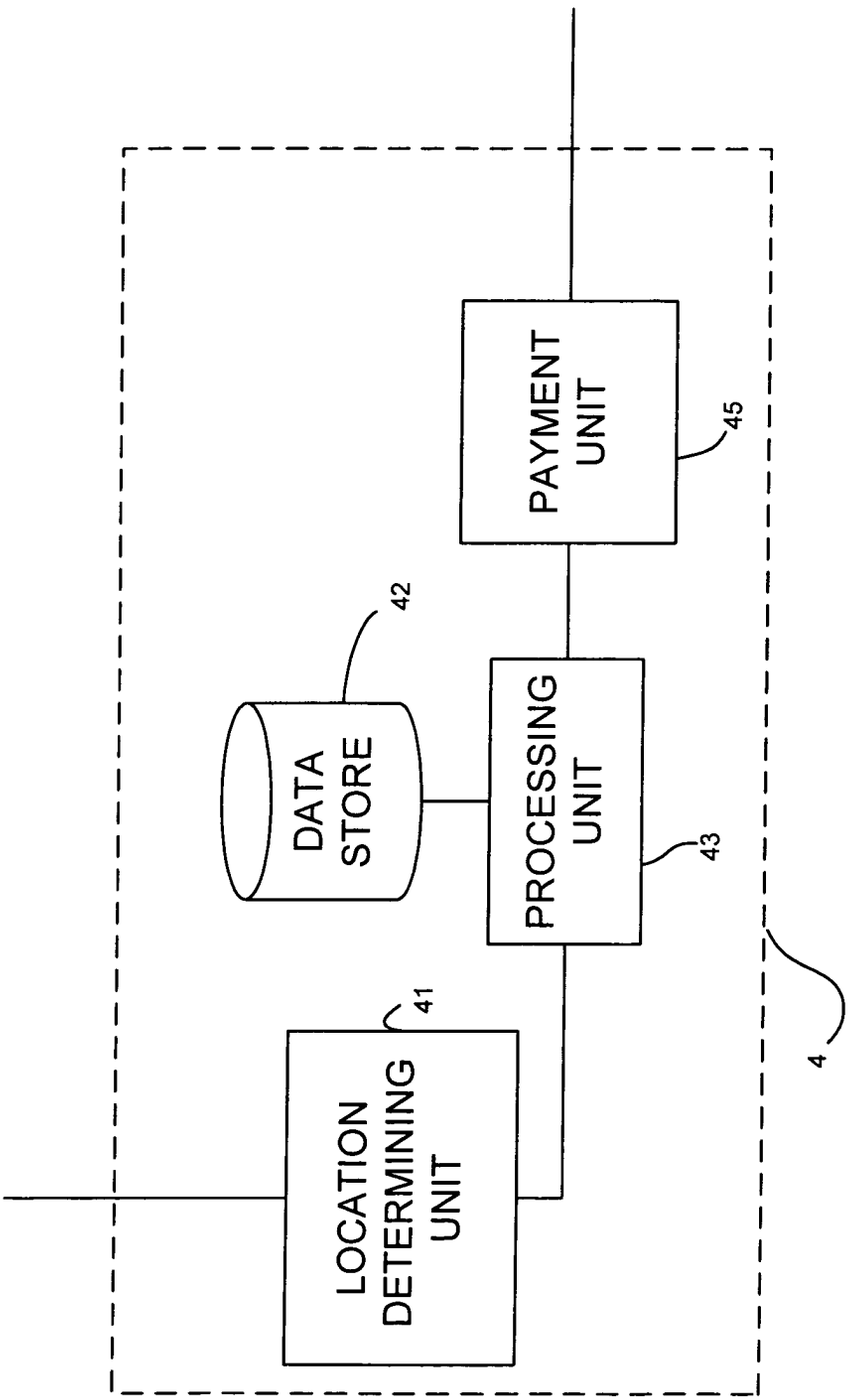
PAYMENT UNIT
45
42
DATA STORE
PROCESSING UNIT
43
41
LOCATION DETERMINING UNIT
4

Figure 2

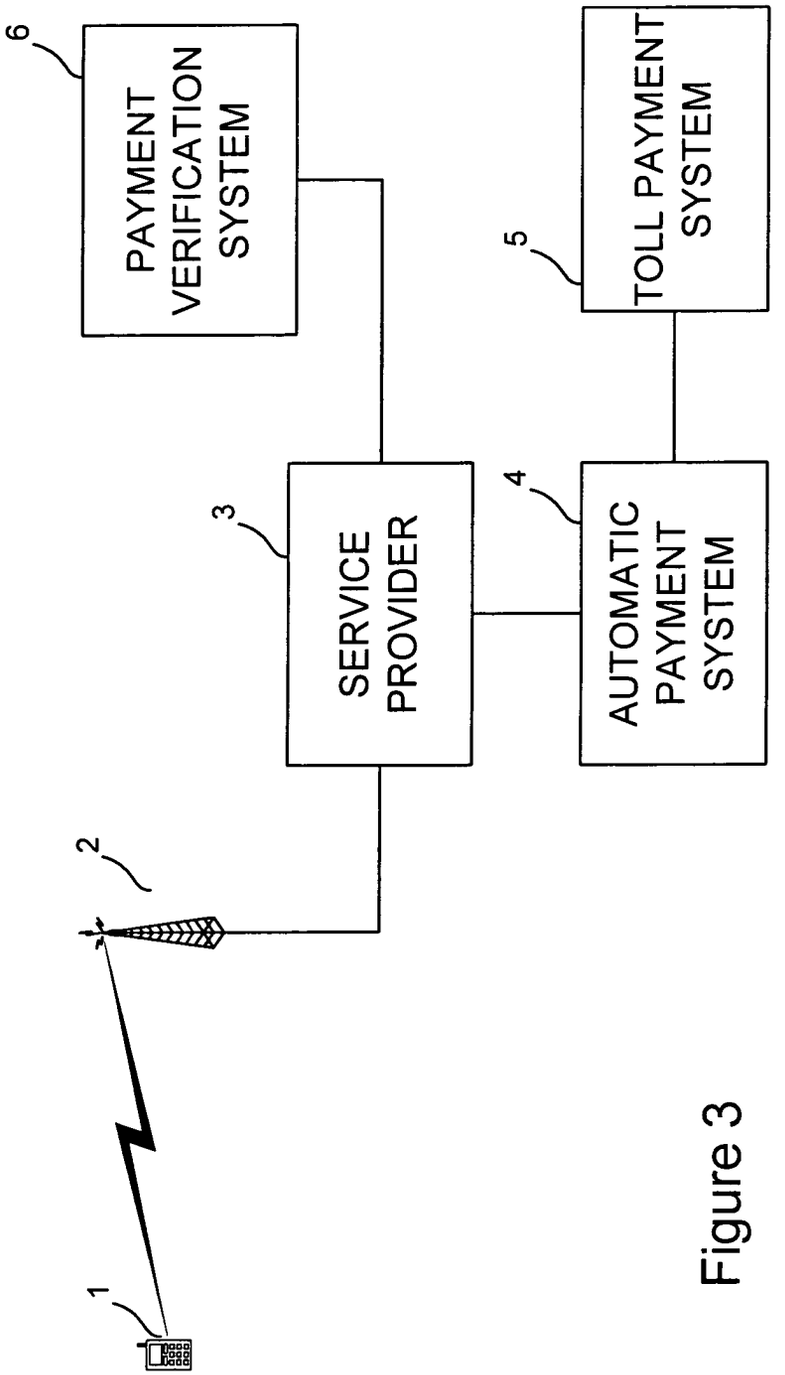
6
PAYMENT VERIFICATION SYSTEM
5
TOLL PAYMENT SYSTEM
3
SERVICE PROVIDER
4
AUTOMATIC PAYMENT SYSTEM
2
1

Figure 3

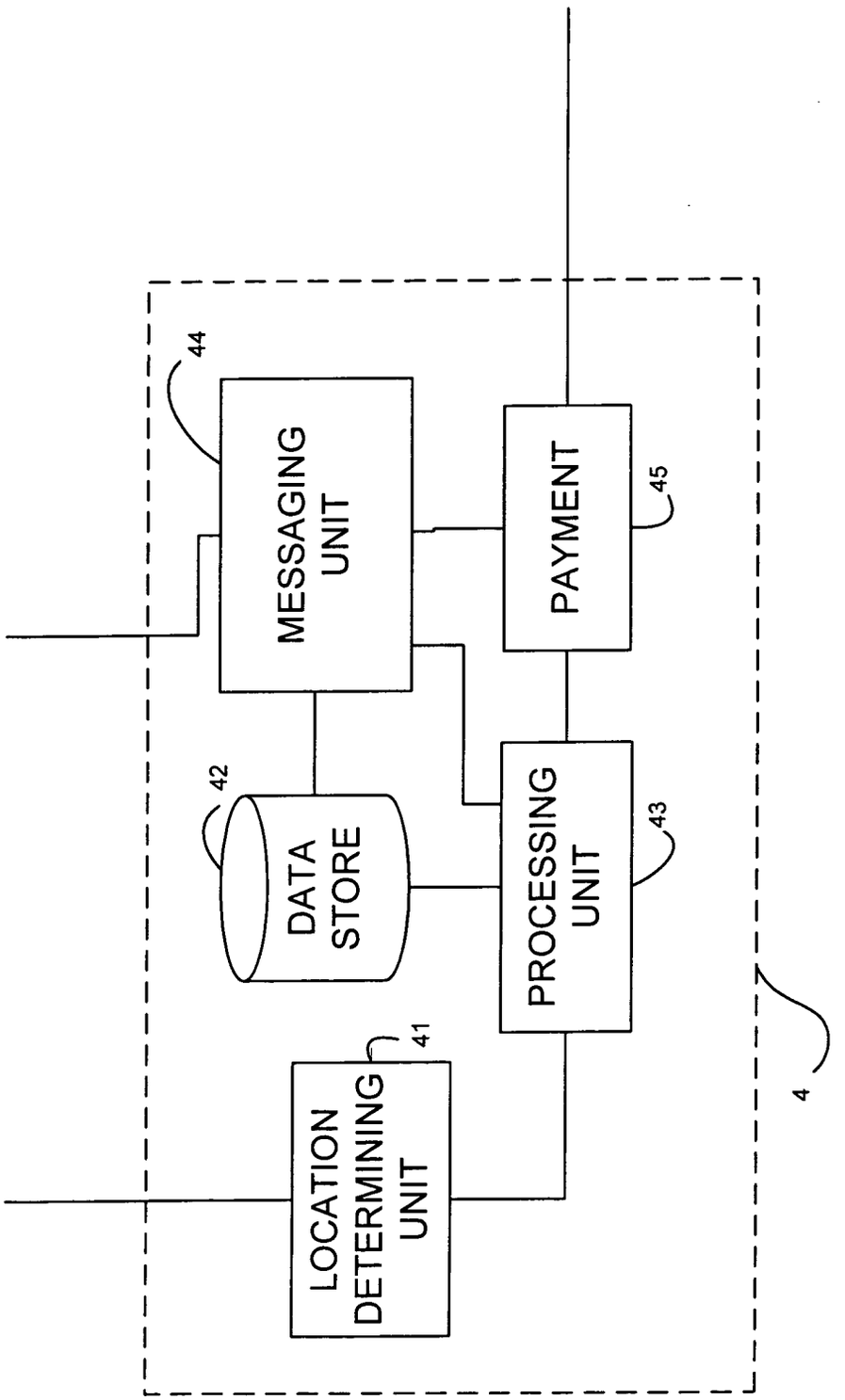
MESSAGING UNIT
44
PAYMENT
45
DATA STORE
42
PROCESSING UNIT
43
LOCATION DETERMINING UNIT
41
4

Figure 4

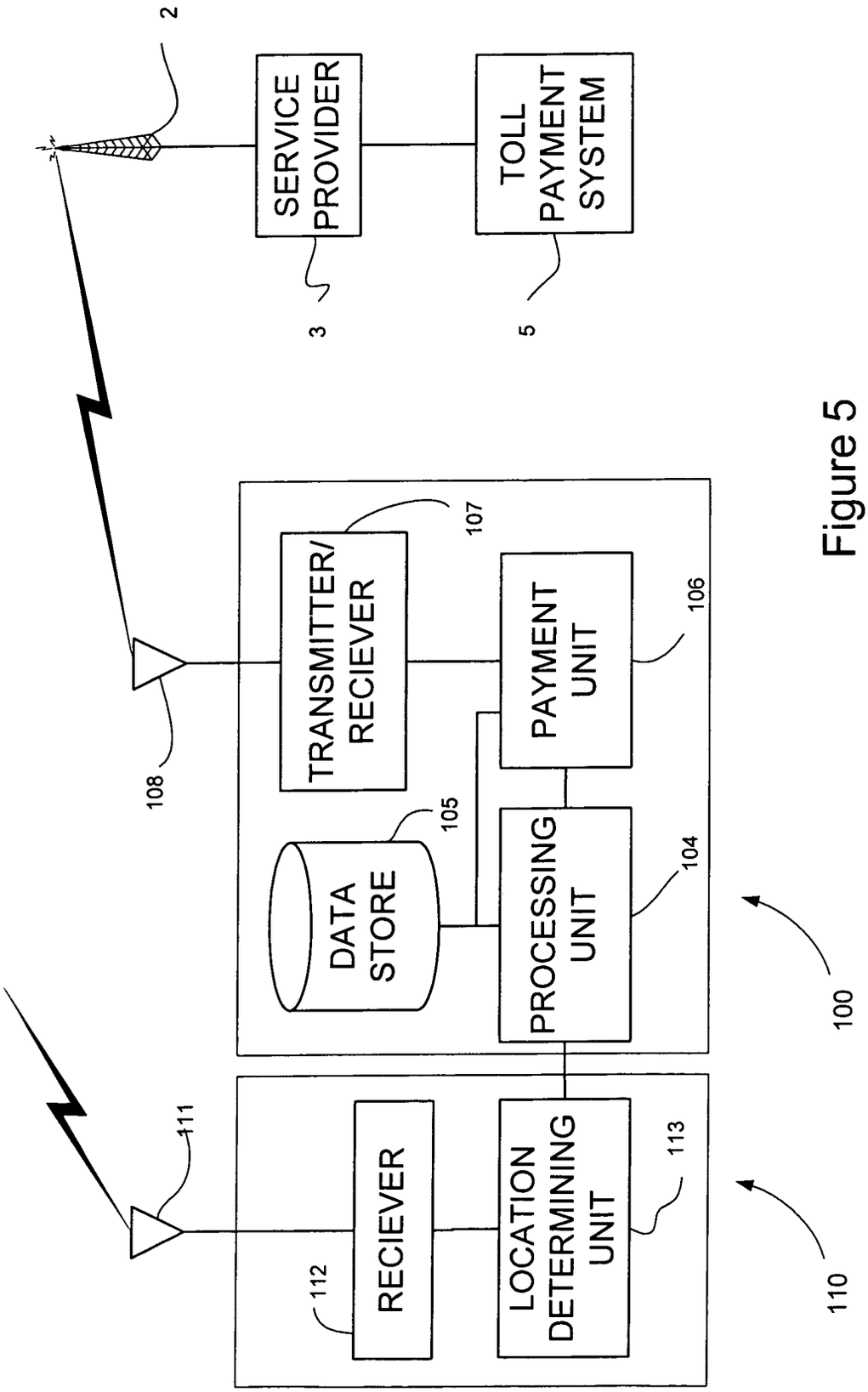
2
SERVICE PROVIDER
TOLL PAYMENT SYSTEM
3
5
108
TRANSMITTER/ RECIEVER
107
PAYMENT UNIT
106
105
DATA STORE
PROCESSING UNIT
104
100
111
RECIEVER
112
LOCATION DETERMINING UNIT
113
110

Figure 5

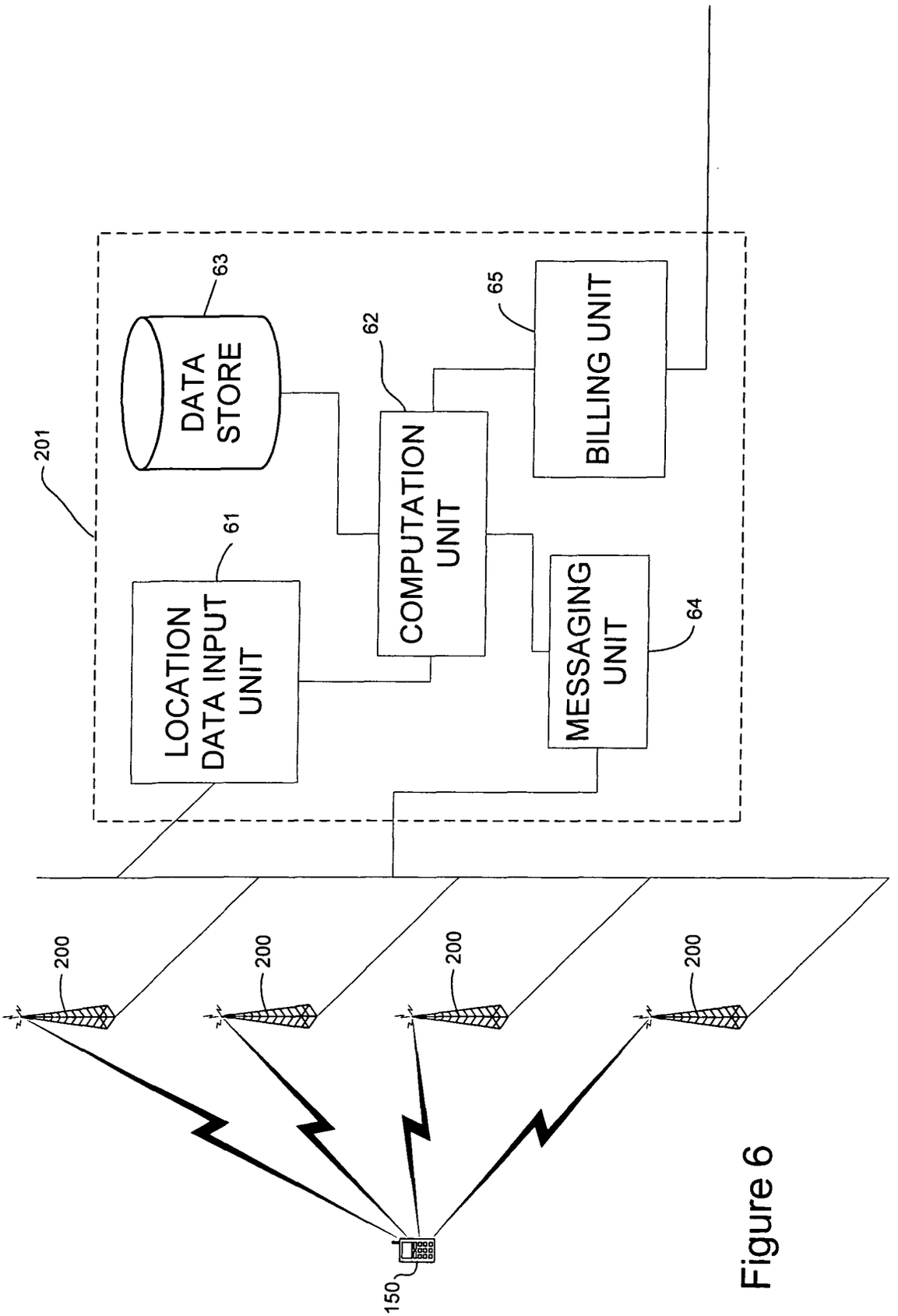
201
63
DATA STORE
62
65
BILLING UNIT
61
LOCATION DATA INPUT UNIT
COMPUTATION UNIT
MESSAGING UNIT
64
200
200
200
200
150

Figure 6

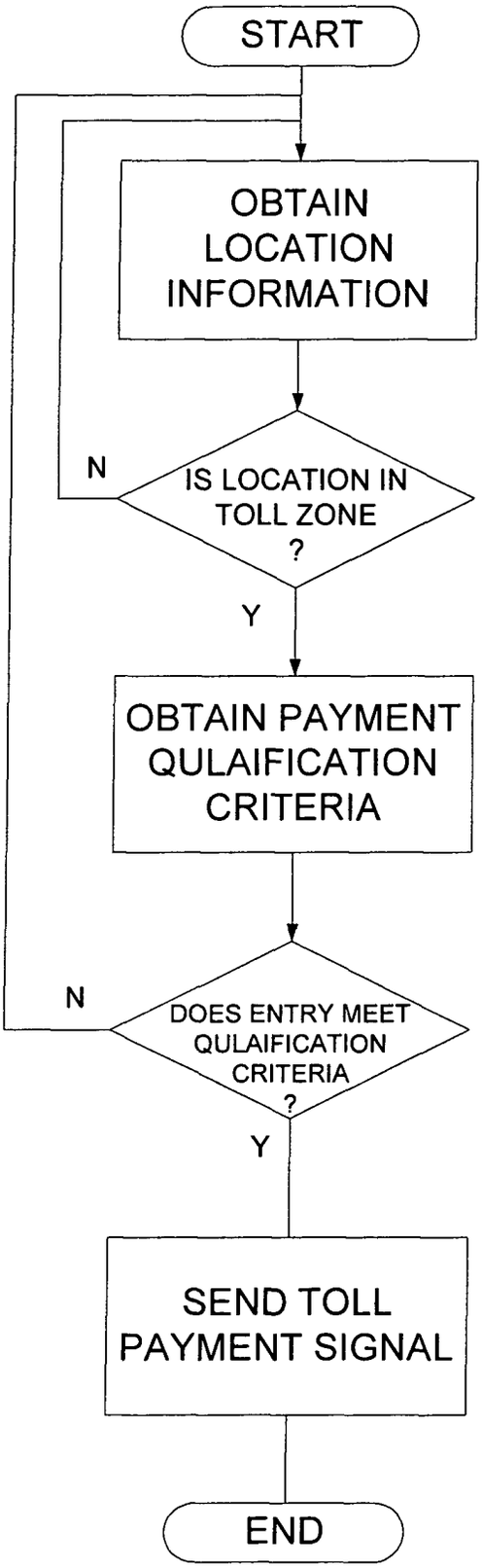
START
OBTAIN LOCATION INFORMATION
IS LOCATION IN TOLL ZONE ?
N
Y
OBTAIN PAYMENT QULAIFICATION CRITERIA
DOES ENTRY MEET QULAIFICATION CRITERIA ?
N
Y
SEND TOLL PAYMENT SIGNAL
END

Figure 7

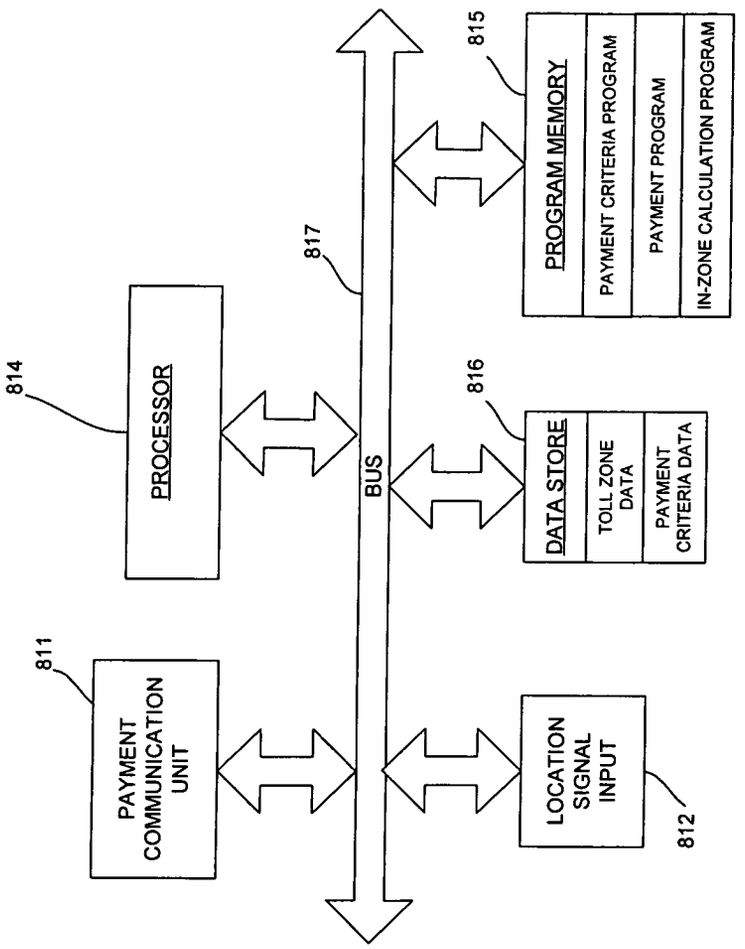
811
PAYMENT COMMUNICATION UNIT
814
PROCESSOR
817
BUS
812
LOCATION SIGNAL INPUT
816
DATA STORE
TOLL ZONE DATA
PAYMENT CRITERIA DATA
815
PROGRAM MEMORY
PAYMENT CRITERIA PROGRAM
PAYMENT PROGRAM
IN-ZONE CALCULATION PROGRAM

Figure 8