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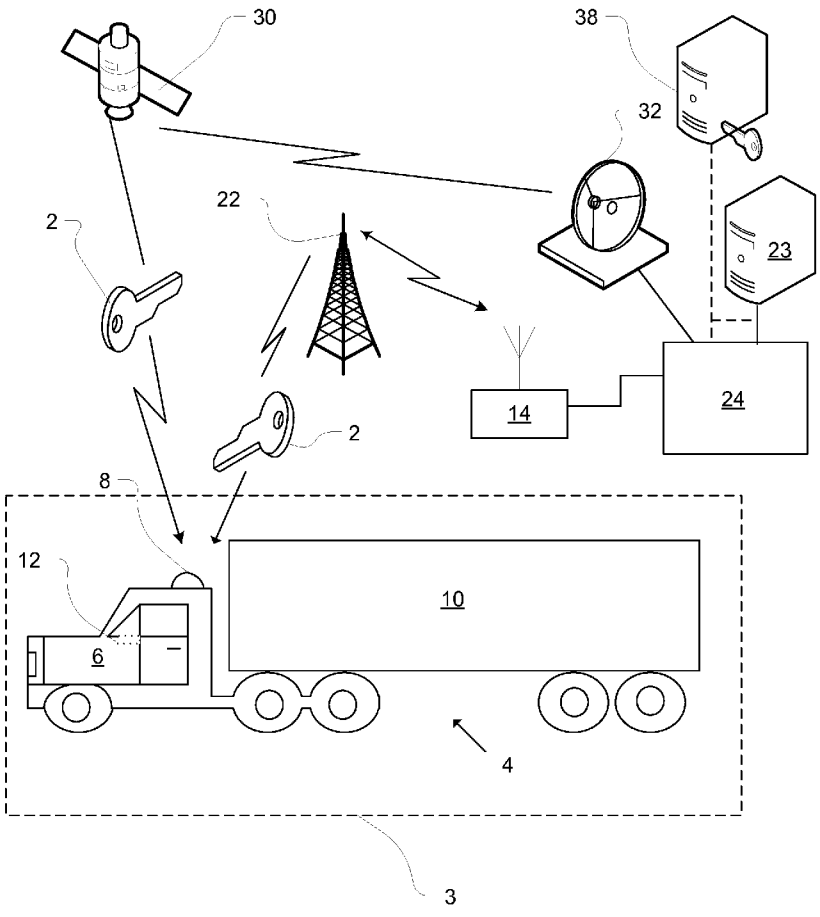
(54) Title: DIGITAL OVER-THE-AIR KEYING SYSTEM



(57) Abstract: A system for providing operational access to equipment or vehicles is disclosed wherein digital access codes are assigned and transported over-the-air governing a vehicle's or equipment's use. The access codes can be generated in connection with comparison of entered and stored biometric data and/or entered code from a keypad. Various security protocols can be used to ensure the secure dispatch and delivery of code information.

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DIGITAL OVER-THE-AIR KEYING SYSTEM

BACKGROUND

[0001] Asset tracking is of paramount importance in a number of industries such as the trucking industry and the equipment leasing and rental industries. Knowing the location of equipment, trucks and shipped goods enables predictive planning of actual events and better management of drivers and assets. For instance, good communication between a vehicle (and/or its operator) and its dispatcher advantageously permits scheduling controls. Good communications systems also address concerns regarding equipment, vehicle and/or freight theft. Wireless communication systems are well known for transmitting information between fixed stations and one or more geographically dispersed mobile receivers carried in trucks or on a piece of equipment. For example, the Global Positioning System (GPS), a system of low earth orbiting satellites, has been used to determine a piece of equipment's or a vehicle's position. Further, satellite communication systems have also been used in the trucking industry for many years to provide messaging information between fleet-owned dispatch centers and their respective tractor-trailer vehicles. Such systems offer significant benefits to fleet owners because they allow almost instantaneous communications and real-time position information. An example of such a satellite communication system is disclosed in U.S. Patent No. 4,979,170 entitled "Alternating Sequential Half Duplex Communication System and Method"; U.S. Patent No. 4,928,274 entitled "Multiplexed Address Control in a TDM Communication System"; U.S. Patent No. 5,017,926 entitled "Dual Satellite Navigation System"; and U.S. Patent No. 6,124,810 entitled "Method and Apparatus for Automatic Event Detection in a Wireless Communication System," all of which have been assigned to the assignee of the present invention and all being incorporated herein by reference thereto.

[0002] In the satellite communication system described in the above-mentioned patents, fleet-owned dispatch centers communicate using land-based systems such as telephone or fiber-optic networks with a hub, otherwise known as a network management facility (NMF). The NMF acts as a central communication station through which all communications between vehicles and a dispatch center pass. The NMF includes a number of Network Management Centers (NMCs), each NMC being responsible for providing a communication path for the NMF to geographically dispersed vehicles

and/or equipment in the communication system using a geo-stationary satellite. A geostationary satellite includes one or more transponders. Transponders relay up and down link signals, (providing amplification and frequency translation) between geographically-dispersed earth stations which may be fixed or in-motion. Each NMC is assigned with different up and down link frequencies in order to avoid interference involving other Mobile Communication Terminals (MCTs) that are operating on the same satellite but with a different NMC. In the satellite communication system of the above referenced patents, each NMC system is capable of handling the communication needs of approximately 30,000 vehicles. Each MCT in the communication system comprises; a transceiver, modulator/demodulator, a CPU and GPS receiver which allows for text message exchange between the driver and dispatcher and position determination of the vehicle.

[0003] Access to and security of machinery, vehicles and freight are of the utmost importance and such concerns have come under greater scrutiny as of late. Of particular concern is the theft of vehicles or equipment or the unauthorized use of vehicles or equipment, especially those vehicles carrying hazardous freight.

[0004] There is therefore a need to provide strict vehicle or equipment access control. A need also exists to employ wireless communication systems in a manner which enables access and/or verification or change of access to vehicles or equipment. Until now, no such system has offered such access control with the efficacy of the system to be described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] **FIG. 1** illustrates a diagram of a wireless communications system deploying the digital keying system.

[0006] **FIG. 2** illustrates a block diagram of MCT **12** connected to biometric reader **25** comprising a fingerprint reader, retinal scanner, voice analyzer, etc.

[0007] **FIG. 3** illustrates a block diagram of an embodiment employing GT/Web.

[0008] **FIG. 4** illustrates a block diagram of a rental activity system.

[0009] **FIG. 5** illustrates a flowchart of a digital access key distribution protocol.

[0010] **FIG. 6** illustrates is a block diagram of one implementation of tools used to carry out the protocol according to FIG. **5**.

[0011] Applicable reference numerals have been carried forward.

DETAILED DESCRIPTION

[0012] The foregoing discussed needs are addressed by a digital keying system deployed through a wireless communications system as shown in the diagram of **FIG. 1**. A digital key code, also referred herein and shown as digital access key **2**, is assigned to an individual driver (not shown) of a vehicle or operator of a piece of equipment shown generally as box **3**. For example, in one embodiment, box **3** may include vehicle **4** which is illustrated in **FIG. 1** as a tractor trailer truck having cab **6** connected to trailer **10**. Alternatively, digital keys can be assigned to a group of drivers or drivers that drive certain commodities or materials such as hazardous materials. The digital keys can provide for a granularity that a physical key cannot. Additionally, the key may be disabled to deny vehicle operational access in instances where a driver has been dismissed. Alternatively, the key may be set to allow vehicle operation by a driver only during certain times. Digital key codes are assigned over-the-air.

[0013] With reference to **FIG. 1**, a wireless transceiver, known as a Mobile Communications Terminal (MCT) **12,** for communicating with a remote station such as NMF **14**, is shown within cab **6**. In one embodiment, antennas for MCT **12** can be located within radome **8**. A radome is an enclosed housing, usually made of a low-loss dielectric material, that serves to protect antennas or sensors mounted on ground-based vehicles, ships, airplanes and the like without significantly altering the electrical performance of the enclosed antenna(s) or sensor(s). In one aspect of an embodiment, MCT **12** comprises an OnmiTRACS® satellite transceiver manufactured by QUALCOMM Incorporated of San Diego, California, for communicating wirelessly with satellite **30**. However, MCT **12** may alternatively comprise a digital or analog cellular transceiver. In another embodiment, MCT **12** resides entirely onboard the vehicle **4**. In other embodiments, MCT **12** uses a terrestrial wireless communication system to communicate with NMF **14**, such as an analog or digital cellular telephone system (through base transceiver station (BTS) **22**), or a wireless data communications network (such as a digital packet data network). Further communications can be carried out from NMF **14** using network **24** which may represent the Public Switched Telephone Network (PSTN) or a cable television network (CATV) through which wireless communications are carried out in conjunction with satellite **30** using satellite

dish **32**. Network **24** may also include the Internet. Digital key codes are transmitted to vehicle **4** (i.e., the associated communications device of vehicle **4**) in connection with providing driver authorizations for use of the vehicle.

[0014] In some embodiments, a biometric reader may be used to verify the identity of a driver as a precondition to the transmission of a digital key code to vehicle **4**. Thus, a biometric login is provided. **FIG. 2** illustrates a block diagram of MCT **12** connected to biometric reader **25** comprising one or more of a fingerprint reader, retinal scanner, voice analyzer, etc. MCT **12** receives biometric data from biometric reader **25** and transmits it to a remote site such as NMF **14** which relays the data for verification to a site remote from vehicle **4**, such as authorization server **23**, using one of the foregoing described communication systems. At the remote site, the biometric data received is matched with a corresponding digital access key or code. In one aspect, a digital key code matched to the biometric data is transmitted to MCT **12**. MCT **12** may also optionally contain or be attached or connected to keyboard **42** for inputting identification data. Alternatively, MCT **12** may include (or be attached to) badge reader **26** for reading a badge that includes identification information. Badge reader **26** may supplement or be used in place of biometric reader **25**. Use of reader **26** is especially contemplated in instances where, on occasion, the biometric data or reader may not operate properly so that badge information may cause the digital key code to be transmitted to MCT **12**.

[0015] With reference still to **FIG. 2**, MCT **12** comprises a radio frequency (RF) transceiver **27** for transmitting and receiving information including voice and data. The term transceiver as used herein is also contemplated to encompass a transmitter and a receiver, separate from one another, to carry out communications. High frequency communication signals are transmitter/received by RF transceiver **27**, which are down-converted into baseband signals during reception and up-converted from baseband to high frequency signals during transmission. MCT **12** also comprises a modulator/demodulator **29** which provides an interface between processor **31** and RF transceiver **27**, allowing information from processor **31** to be modulated in accordance with the particular wireless communications being used by MCT **12**, and also to demodulate received information for use by processor **31**. Modulator/demodulator **29** may also include a JAVA® virtual machine to provide platform portability between communication protocols at MCT **12** and a remote site. Processor **31** controls the

various processes and functions of MCT **12**. Further, processor **31** is programmed **to** interpret the digital key code information received from authorization server **23** to determine the access rights conveyed by the digital key code. Memory **33** is an electronic memory for storing various data including data and instructions for interpreting the digital code access as described herein.

[0016] In one aspect, the biometric logic may be used to recall certain bio-specific settings associated with a user such a position of controls, seat position and various other preferences noted in connection with the initial vehicle access by a user. This logic may be processed by processor **31** such that biometric settings are stored within memory **33** and made available in connection with the digital key code obtained from authorization server **23**. In addition, reminders can be sent to user through the users' MCT or on the vehicle's communication terminal (e.g., radio) such as, "Please complete your timesheet."

[0017] In another aspect, biometric reader **25** may be incorporated into a vehicle's controls (steering wheel, hand grips, etc.) This would also allow for periodic verification (possibly without the operator's knowledge or interaction) that an authorized user is still operating the equipment or vehicle.

[0018] The foregoing system as shown in **FIG. 1** is readily adaptable for use with any equipment. MCT **12** need only be associated with that equipment and operable to receive the digital access code. The digital access code in addition to causing access grant for vehicle or equipment use, can additionally define a number of parameters such as vehicle or equipment use and geographical boundaries or times. Consequently, the access code can circumscribe the place, time and extent of vehicle or equipment operation. One operator may have permission to drive a truck within a 30 mile radius of its current location, while another operator may have permission to operate a crane only between the hours of 8:00 a.m. and 4:00 p.m.

[0019] Access to a vehicle can easily be controlled by the digital over-the air keying system. For instance, should a driver be dismissed from his/her employ, the foregoing system easily permits denial of access to a vehicle by the dismissed driver. Further, rental equipment use can easily be controlled. For instance, upon expiration of a rental agreement, access to rental equipment may be denied. However, a digital access code may be updated "on-the fly" - something not readily possible with a physical key. Therefore if rental equipment is being accessed after the expiration of a rental

agreement or in violation of the agreement due to attempted use of equipment at a location on a second (unauthorized) job site, the renter can optionally renew, extend or amend the rental contract (and be billed accordingly) by agreeing to and "signing" an updated, new or extended contract digitally using a biometric login such as a fingerprint, or alternatively using an assigned password. Further, a variety of functions can be defined and controlled in combination with a controller operating in conjunction with the vehicle or equipment. For instance, in a rental situation, hourly rates can be altered depending on which vehicle is being used. Further, login time/hours may be integrated into a rental company's back office software for billing purposes.

[0020] In one aspect, should an attempted login occur using the same password or passcode entered (using for instance, biometric reader **25** or badge reader **26** of **FIG. 2**) at two separate job sites within a time period during which such attempts would be physically impossible by a single person, (e.g. attempts 10 minutes apart at two sites over 100 miles apart), access lockout may occur at both sites and an alert may be generated. However, in one preferred embodiment, a central issuing authority providing access to sites or equipment would not provide near simultaneous (or close in time) access to separate sites using the same key.

[0021] In another aspect, a digital key is issued from a dispatch center or other issuing authority with a "time to live." The "time to live" is a time period during which the digital key can provide access. Various permissions for the key may also be issued at the time of key issuance. For instance, these permissions may include where the rental equipment can be operated and what class of drives license the operator must have in order to operate certain equipment/vehicles. Additionally, should a vehicle or piece of equipment not be detected within a coverage area (site where equipment should be) for an extended period of time (with no communication possible to update the key), the authorization keys may be locked-out. Further, these permissions may be revoked and changed over-the air in near-real time.

[0022] A concept embodied herein enables issuance of a single key per person, while shifting to machines the task of remembering multiple keys as opposed to people having multiple keys, whether physical or by code, for each piece of equipment. Further, the digital access code or key conveyed to the equipment includes the information defining the access (e.g., the extent or degree of access) to the equipment.

[0023] In another embodiment, GT/Web can be used to assign/manage key codes to operators or groups of operators of equipment that can be sent wireless using GT to a piece of equipment or a group of equipment. GT/Web is service offered QUALCOMM® Incorporated that provides a Web interface for GlobalTRACS (GT) a system that provides wireless and satellite communications using a TCP/IP protocol over the Internet for mobile personnel using a single messaging system. FIG. **3** illustrates a block diagram of an embodiment employing GT/Web. GT wireless control unit **50** is substituted for and functions in a similar manner to MCT **12** of FIG. **1**. For instance, at a large job site with multiple contractors, a code could be entered using keypad **42** attached to GT mobile communications unit **50**. In addition or alternatively, biometric sensor **40** attached to unit **50** can be used to identify authorized operators. Database **44** with which GT mobile communications unit **50** is in contact, is used to compare biometric sensor data with database data to determine a match within a specified tolerance. A program running on a remote server (not shown) can perform the comparison function. The server can return authorization for access to a vehicle or a piece of equipment through unit **50** using a relay driver (not shown). Alternatively, the comparison can be made locally. Stored data may be compared, in unit **50,** with biometric or keyboard **42**-entered data.

[0024] In other embodiments using GT/Web unique codes may be assigned to operators for entry by the operators on keypad **42** at the start of a work shift. This would allow contractors to use GT/Web to track/report/identify operator use of equipment, the length of time of each use and the amount of work achieved, thereby enabling productivity metrics to be developed for operators and equipment.

[0025] While key codes would enable the start of a piece of equipment, GT mobile communications unit could be used to reset the code remotely in the instance where operating time limits have been reached. Such expiration of time can result in the automatic shut down or slow down of a piece of equipment. Termination of use of equipment can occur in connection with operator termination, rental equipment contract expiration, rental equipment theft/vandalism, attempted operation of equipment past curfew hours, etc.

[0026] In one embodiment, a system using digital over the air keying is shown which may, for instance, be used to implement a vehicle or equipment rental activity. With reference to **FIG. 4**, which illustrates a block diagram of a rental activity system,

rental/leasing agency **16** causes the dispatch of a digital key code wireless through NMF **14** and BTS **22** to a piece of equipment or vehicle (hereafter designated equipment/vehicle **5**) being rented or leased by having the key code sent to the MCT associated with (e.g. connected or coupled thereto) equipment/vehicle **5**. MCT **12** sends the digital key code to controller **46** to which MCT **12** is coupled. The digital key code contains all of the access rights granted a particular user of equipment/vehicle **5** who need only input biometric data or a code at terminal **41** (e.g. a biometric scanner or a keyboard) connected to equipment/vehicle **5**. A manifest of renters need not be maintained for archival purposes, since retention of such renters in memory is needed for only a short period of time relative a rental or lease period. In one aspect, biometric data (e.g. fingerprint, voice scan (voiceprint), retinal scan, etc.) may be taken at rental/leasing agency **16** from a renter/lessor. A scanner at the site of equipment/vehicle **5** reads the biometric data from the user and transmits, via MCT **12**, this information back to authorization server **23** associated with rental/leasing agency **16**. A proper match of the biometric data with access rights currently on file (e.g., in a memory storage (not shown) associated with authorization server **23**), results in the authorization server **23** forwarding a digital key code through NMF **14** and BTS **22** to equipment/vehicle **5**. Alternatively, input of a code, assigned by rental/leasing agency **16**, at terminal **41** is transmitted via MCT **12** to authorization server **23**. A proper match of the inputted code with access rights currently on file (e.g., in the memory storage associated with authorization server **23**), results in the authorization server **23** forwarding a digital key code through NMF **14** to equipment/vehicle **5**. In one embodiment, memory **33** connected to MCT **12** may hold the inputted code information or scanned biometric data for a brief period of time, e.g. equal to the length of the rental or lease period. Further, authorization information may be accessed in connection with inputting/scanning code or biometric data during use of equipment/vehicle **5**. Processor **31** connected to (or alternatively) within MCT **12** compares the stored code or biometric data with the inputted/scanned code or biometric data entered during each equipment/vehicle use period (e.g. at startup or login). The transmitted digital code from authorization server **23** may also be maintained in memory **33**. If the inputted/scanned code or biometric data matches the stored code or biometric data in memory, processor **31** permits use of equipment/vehicle **5** according to the access granted by the stored digital key code. This embodiment dispenses with a requirement

to contact authorization server **23** every time a user logs in. However, for added security, the access allowed by the stored digital key code should be time limited, (e.g. no greater than some time period less than the rental/lease period).

[0027] Since the digital key codes are being transmitted wirelessly for possible detection from a myriad of sources, well-known encryption protocols and encryption methods may be employed in connection with generating a digital access key. The communications system of FIG. **1** may be used to implement a digital access key distribution protocol in connection with public/private key server **38**. In one embodiment using symmetric cryptography, assuming that a secret key is held by each NMF **14** and MCT **12**, these keys are shared with server **38**. NMF **14** or MCT **12** can request a session key from public/private key server **38** to communicate with one another. A session key is one aspect of key **2** in that it is a digital key valid only during a particular session of communication between NMF **14** and MCT **12**. Server **38** generates a session key (which in one aspect is randomly generated) and encrypts the session key, using the secret key of NMF **14**, as well as encrypts the same session key for MCT **12** using the secret key held by MCT **12**. Server **38** sends the session key, encrypted according to the secret key of MCT **12**, and it sends the same session key, encrypted according to the secret key of NMF **14**, to the session key requestor (either NMF **14** or MCT **12**). The session key requestor decrypts its assigned session key (encrypted with its secret key) and transmits the encrypted key of the entity it wishes to communicate with to that entity which in turn decrypts its session key using its assigned secret key. Thereafter, secure communications can ensue in the form of the dispatch of a digital access key **2**, encrypted according to the session key, from NMF **14** to MCT **12**. Digital access key **2** contains code which can be interpreted at the vehicle or equipment and it can be used to control or gain access to a particular vehicle, component, or system. FIG. **5** illustrates a flowchart of the foregoing described digital access key distribution protocol.

[0028] Other protocols are possible such as one based on the well-known interlock protocol often used to foil a man-in-the–middle cryptographic attack. At some point, digital code information may be transported over the Internet. Consequently, security protocols such as the Secure Sockets Layer (SSL) or its derivatives such as Transport Layer Security (TLS) can be employed. However, in the case where less security is

contemplated, it is possible to send the digital key code wirelessly from an NMF without the necessity of encrypting the digital access code transmission.

[0029] FIG. **6** illustrates is a block diagram of one implementation of tools used to carry out the protocol described above and shown in the FIG.**5**. Accordingly, these tools provide a method for placing secret and digital access keys in the possession of MCT **12** of FIG. **2**. Biometric sensor **40** and keypad **42** are operatively connected to MCT **12**. Biometric sensor **40** in one embodiment is a fingerprint reader. In another embodiment, biometric sensor **40** serves as a retinal scanner. In other embodiments, biometric sensor **40** can analyze voice patterns or determine identity through a fingerprint reader, retinal scanner or voice pattern analyzer in combination with a subject entering a code or password on keypad **42**. Further, instead of a biometric login or password, a proximity sensor could be used to pick up access data stored on a security badge or helmet. Biometric data may be stored in memory **33**, such as a flash memory, connected to MCT **12** or it may be remotely and wirelessly accessible by MCT **12** through NMF **14**. It is also possible for memory **33** to be located within MCT 12. In one aspect, once it has been determined that the biometric data sensed by biometric sensor **40** is within a predefined threshold level, a corresponding secret key held within memory **33** is used in the manner described above and shown in FIG. **5** to determine a session key through which an encrypted digital access key code is received and interpreted by equipment controller **46** to govern control of the equipment or vehicle as specified according to user, group or classification of user, etc. For unauthorized/unrecognized logins to use a piece of equipment using a biometric login such as a fingerprint, the image of the unauthorized print may be stored or transmitted to the equipment owner and logged. A login system may be configured such that numerous unauthorized logins may trigger an alert. The number of unauthorized logins (as determined over a specified period of time if desired) may be configured by a customer (e.g., owner or lessor of equipment). Since biometric readers such as fingerprint scanners read minutia points on a finger and compare those points to a template using an algorithm for identification, nearest fit data may be stored in connection with logging unauthorized access attempts in an effort to identify offenders. In the case of a fired employee or an employee no longer authorized to use a piece of equipment, attempts to access equipment may be rendered ineffective and a record maintained of unauthorized attempts to access equipment. This is especially useful since often, while an employee may be terminated from employment,

accounts, issued to a terminated employee providing equipment access, may not have been terminated.

[0030] In the foregoing embodiments, it should be noted that for further control, by an equipment or vehicle owner, etc., use authorizations can be limited in time. For instance, verification of the authorization can be set up to occur within, for instance, 6 hours of a previous authorization request, thereby requiring the operator of the equipment or vehicle to resubmit to the authorization procedure. For vehicles capable of operating with more than one user, such as tractor trailers, dual log-in verification may be achieved which would allow other functions (e.g., navigation text entry while driving, etc.). To prevent a second user from logging in and not accompanying the first driver, a second verification or multiple re-verifications may be required after a pre-determined number of miles or hours.

[0031] Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. For instance, the foregoing described digital keys may in fact embody the biometric data. For example, a digital key assigned to a person could embody that person's thumbprint characteristic. Additionally, the authorization of equipment may be linked to an employee's work schedule, a job site schedule, a geofence operation schedule involving an authorized job site, etc. Further, authorization may be based on safety considerations, e.g., whether an operator is trained or qualified to use a particular piece of equipment, etc. It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.

CLAIMS

1. An apparatus for use in controlling equipment access comprising:
a receiver operable to receive a digital access code;
a biometric sensor operable to detect biometric data;
a transmitter operable to transmit said biometric data to a remote location, wherein said digital access code is received in connection with a determination that said biometric data warrants a predetermined extent of access to said equipment by a user, said digital access code defining the predetermined extent of access to said equipment.

2. An apparatus as recited in claim 1 wherein said digital access code specifies the length of time of access during which said equipment is operated.

3. An apparatus as recited in claim 1 wherein said equipment includes a vehicle.

4. An apparatus as recited in claim 1 wherein said biometric sensor consists of a fingerprint reader, a retinal scanner, a voice scanner or a combination thereof.

5. An apparatus as recited in claim 1 further comprising a device operable to receive a pass code, said pass code being used in connection with said biometric data to determine access to said equipment.

6. An apparatus for use in controlling equipment access comprising:
a receiver operable to receive information including a digital access code;
a biometric sensor operable to detect biometric data;
a memory for storing biometric data coupled to said receiver;
a comparator operable to compare said biometric data from said receiver with biometric data detected by said biometric sensor, wherein said digital access code is transmitted from a remote location in connection with a determination that said biometric data warrants a predetermined extent of access to said equipment.

7. An apparatus as recited in claim 6 wherein said digital access code specifies the length of time of access during which said equipment is operated.

8. An apparatus as recited in claim 6 wherein said equipment includes a vehicle.

9. An apparatus as recited in claim 6 wherein said biometric sensor consists of a fingerprint reader, a retinal scanner, a voice scanner or a combination thereof.

10. An apparatus as recited in claim 6 further comprising a device operable to receive a pass code, said pass code being used in connection with said biometric data to determine access to said equipment.

11. An apparatus as recited in claim 6 wherein said memory is a flash memory.

12. A system for providing a digital key code over-the-air comprising:

a transmitter/receiver;

an apparatus remote from a piece of equipment through operable to provide said digital key code through said transmitter/receiver, said digital key code defining a predetermined extent of access to said piece of equipment;

a memory for storing identification data; and

a comparator operable to compare identification data received from said equipment with identification data stored in said memory.

13. A system as recited in claim 12 wherein said access codes are provided over-the-air according to a protocol consisting of TCP/IC, SSL, TLS, a protocol employing symmetric cryptography, an interlock protocol or a combination thereof.

14. A system as recited in claim 12 further comprising a device operable to receive a pass code, said pass code being used in connection with said biometric data to determine access to said equipment.

15. A system as recited in claim 14 further comprising a biometric sensor coupled to said comparator wherein said biometric sensor consists of a fingerprint reader, a retinal scanner or a combination thereof for supplying said biometric data.

16. A system as recited in claim 12 wherein said digital transmitter/receiver sends information using GT/Web.

17. A method for determining access to a piece of equipment using a digital key comprising:
receiving a request for access to said piece of equipment;
transmitting a digital key over-the-air in response to verified identification data, said digital key defining a predetermined extent of equipment access.

18. A method as recited in claim 17 wherein said identification data is biometric data.

19. A method as recited in claim 17 wherein said digital key is transmitted in connection with a protocol consisting of TCP/IC, SSL, TLS, a protocol employing symmetric cryptography, an interlock protocol or a combination thereof.

20. A method as recited in claim 17 wherein said digital key specifies the duration of time during which said piece of equipment can be operated.

21. A method as recited in claim 17 wherein said digital key specifies the geographic area of operation of the piece of equipment.

22. A method as recited in claim 17 wherein said digital key specifies which group of individuals can operate said piece of equipment.

23. A method as recited in claim 17 wherein a single digital key is assigned to an entity and wherein said key is operable to define access by said entity to multiple pieces of equipment.

24. A method as recited in claim 23 wherein said entity consists of an individual person or a group of people.

25. A method as recited in claim 17 wherein said digital key includes said biometric data.

26. A method as recited in claim 17 wherein said extent of equipment access is time limited.

27. A method as recited in claim 17 wherein the predetermined extent of equipment access is capable of being changed in connection with changing the digital key.

28. A method as recited in claim 17 wherein an alert is issued in response to said identification data being unverifiable in connection with receiving a predetermined number of requests for access to a piece of equipment.

29. A method as recited in claim 28 wherein use of said piece of equipment is locked out in connection with the issuance of said alert.

30. An apparatus for use in controlling equipment access comprising:
a receiver operable to receive a digital access code;
a proximity sensor operable to detect identification data;
a transmitter operable to transmit said identification data to a remote location, wherein said digital access code is received in connection with a determination that said identification data warrants a predetermined extent of access to said equipment by a user, said digital access code defining the predetermined extent of access to said equipment.

31. An apparatus as recited in claim 30 wherein said identification data lies in an object consisting of a badge or a helmet.

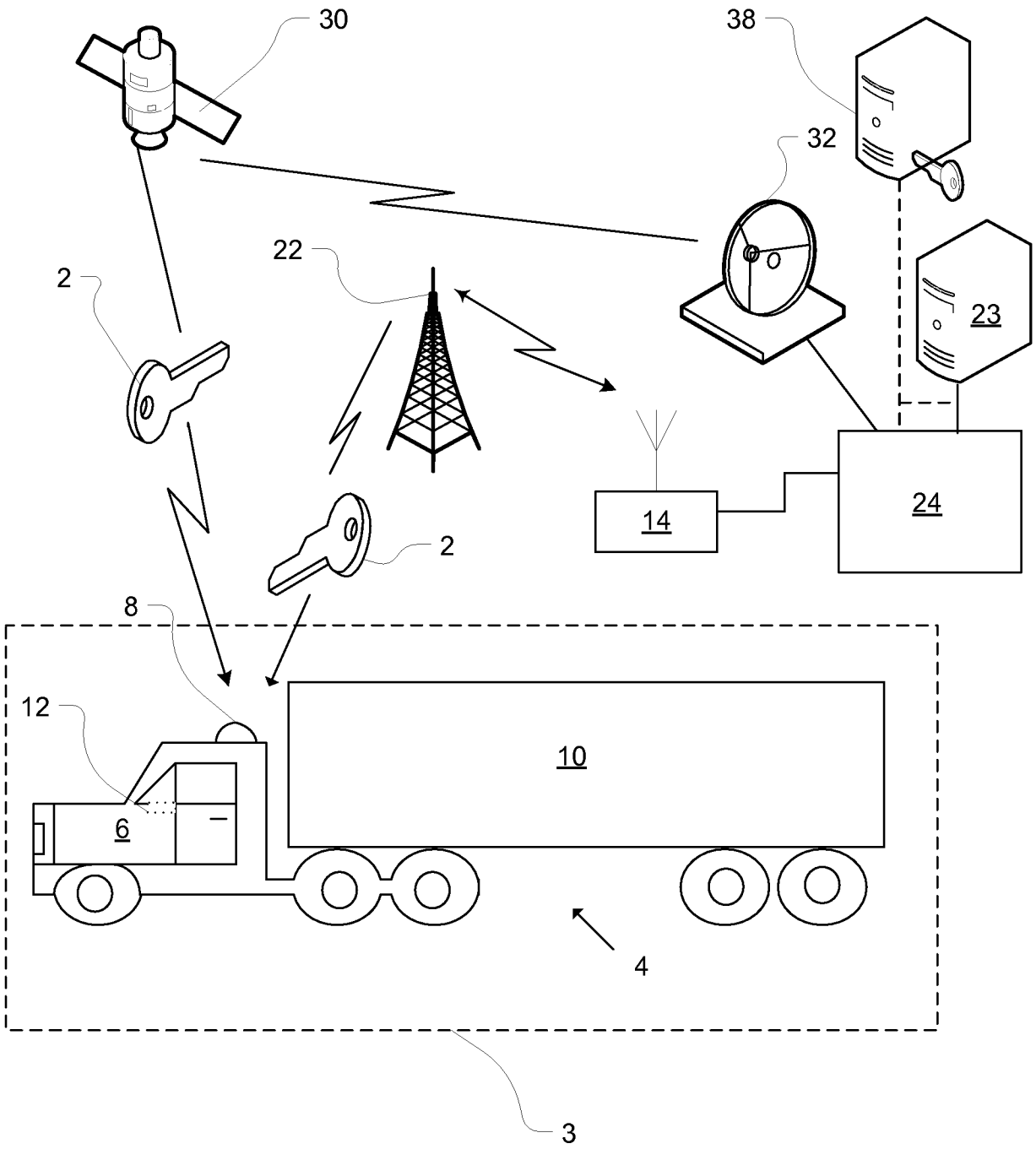

Fig. 1

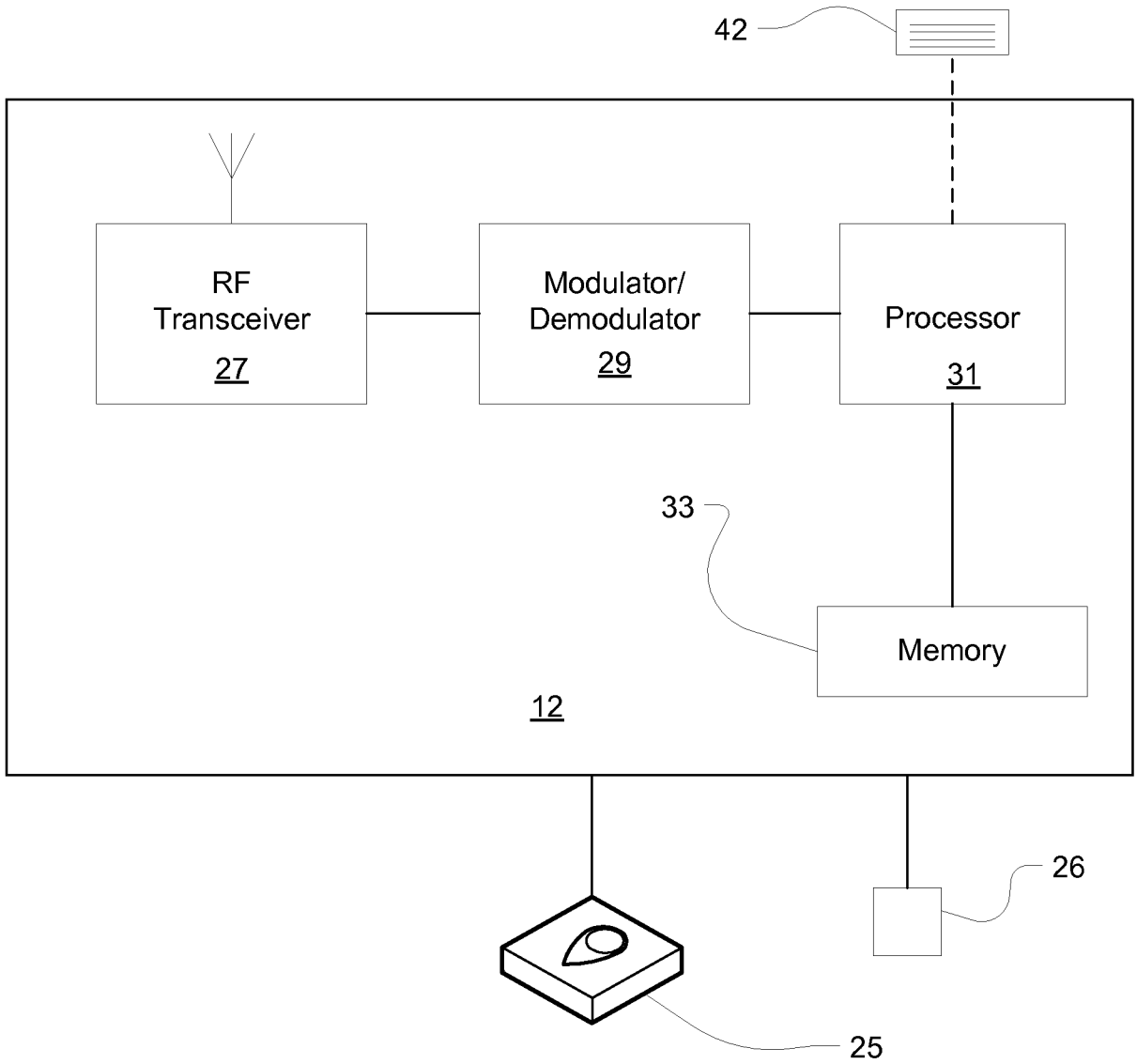
42
RF
Transceiver
27
Modulator/
Demodulator
29
Processor
31
33
Memory
12
26
25

Fig. 2

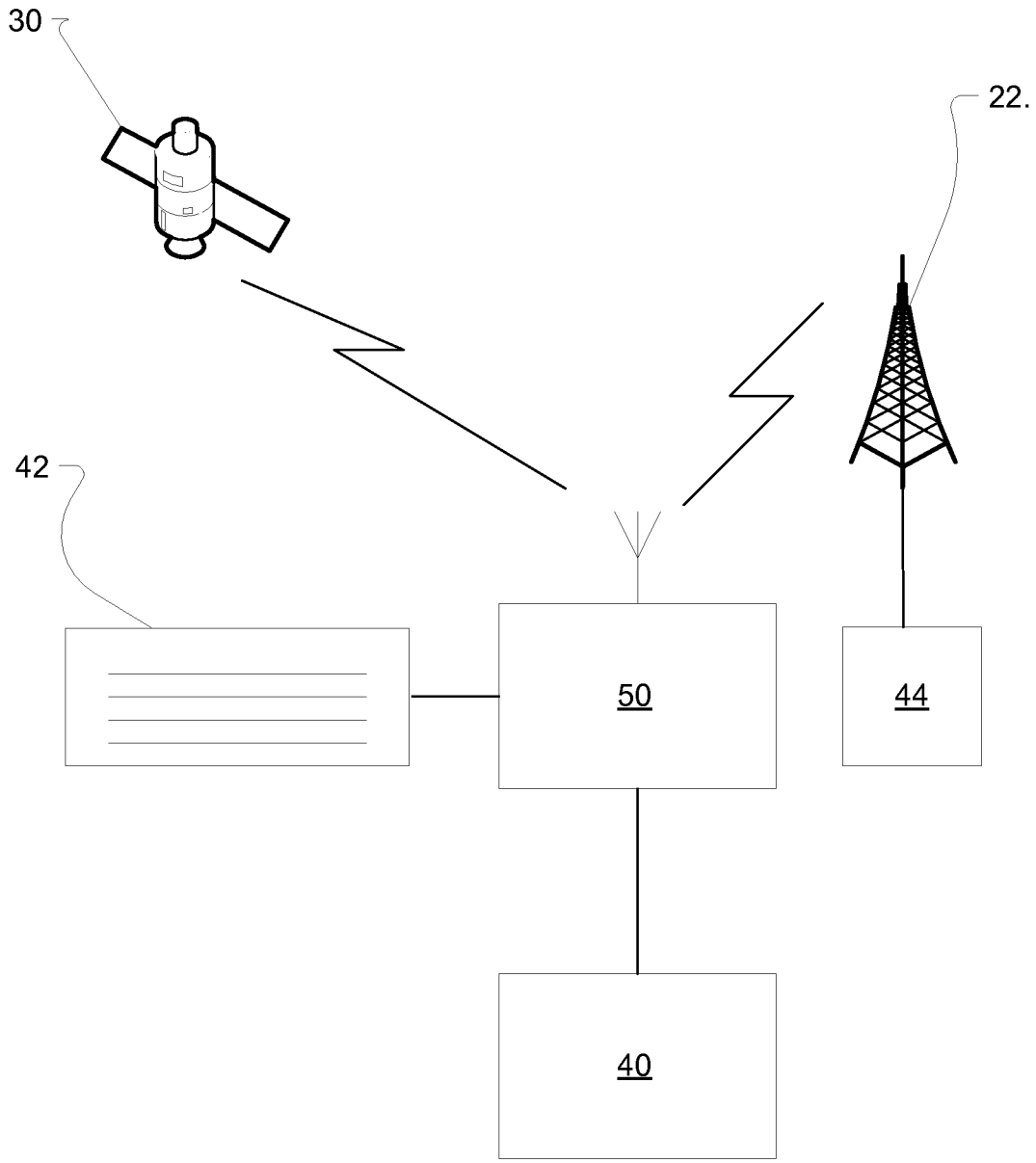

Fig. 3

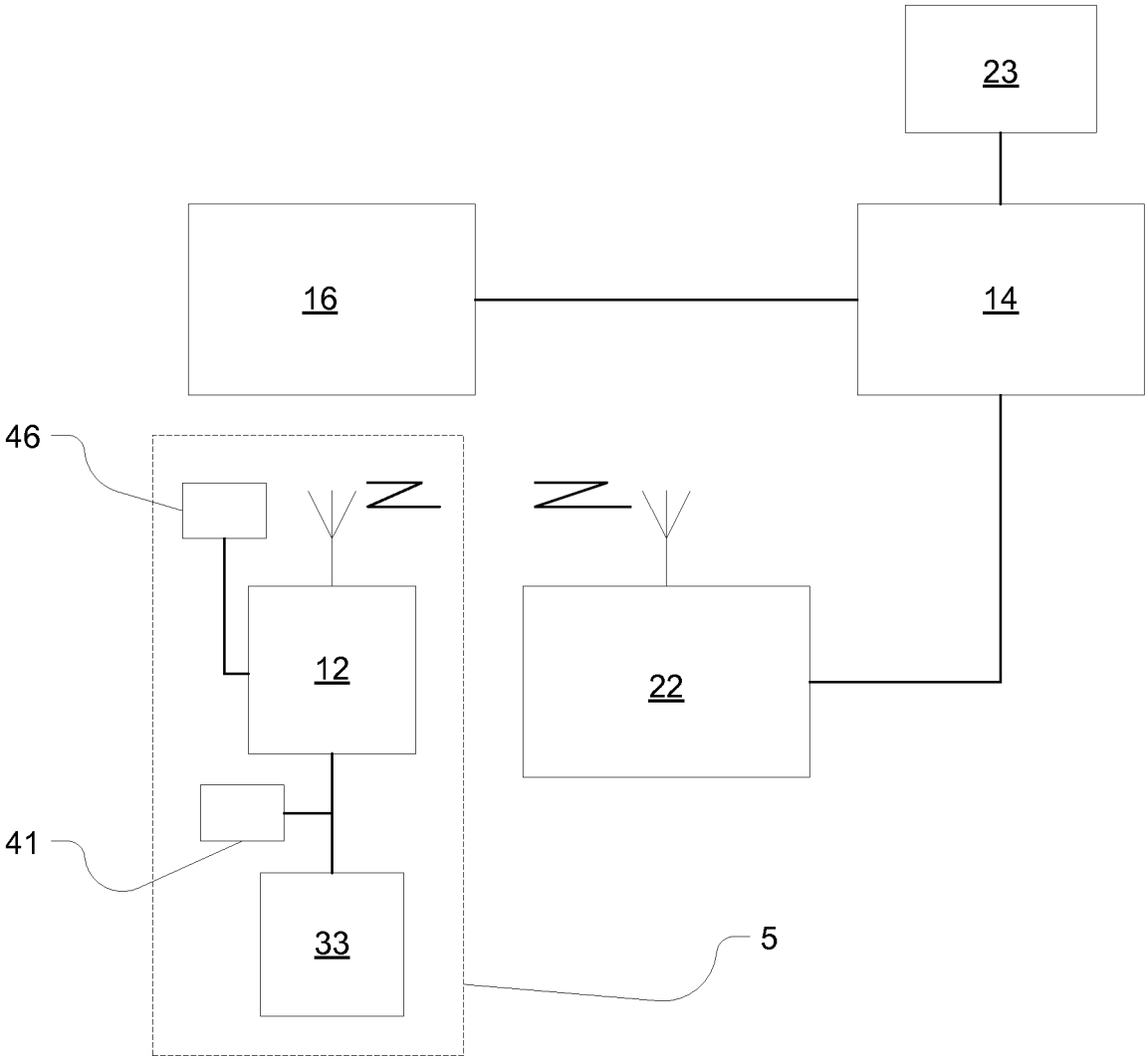

Fig. 4

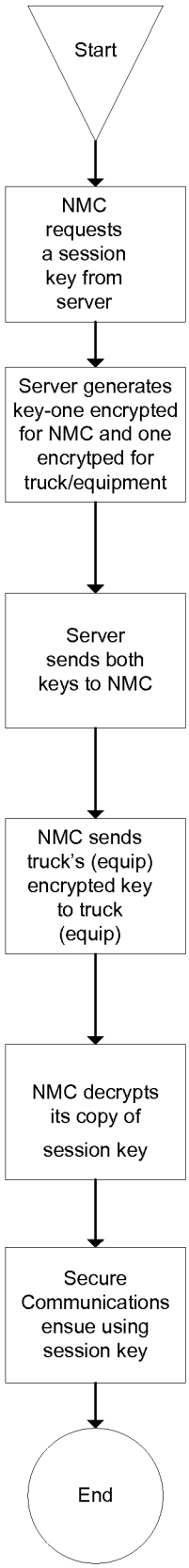
Start
NMC requests a session key from server
Server generates key-one encrypted for NMC and one encrytped for truck/equipment
Server sends both keys to NMC
NMC sends truck's (equip) encrypted key to truck (equip)
NMC decrypts its copy of session key
Secure Communications ensue using session key
End

Fig. 5

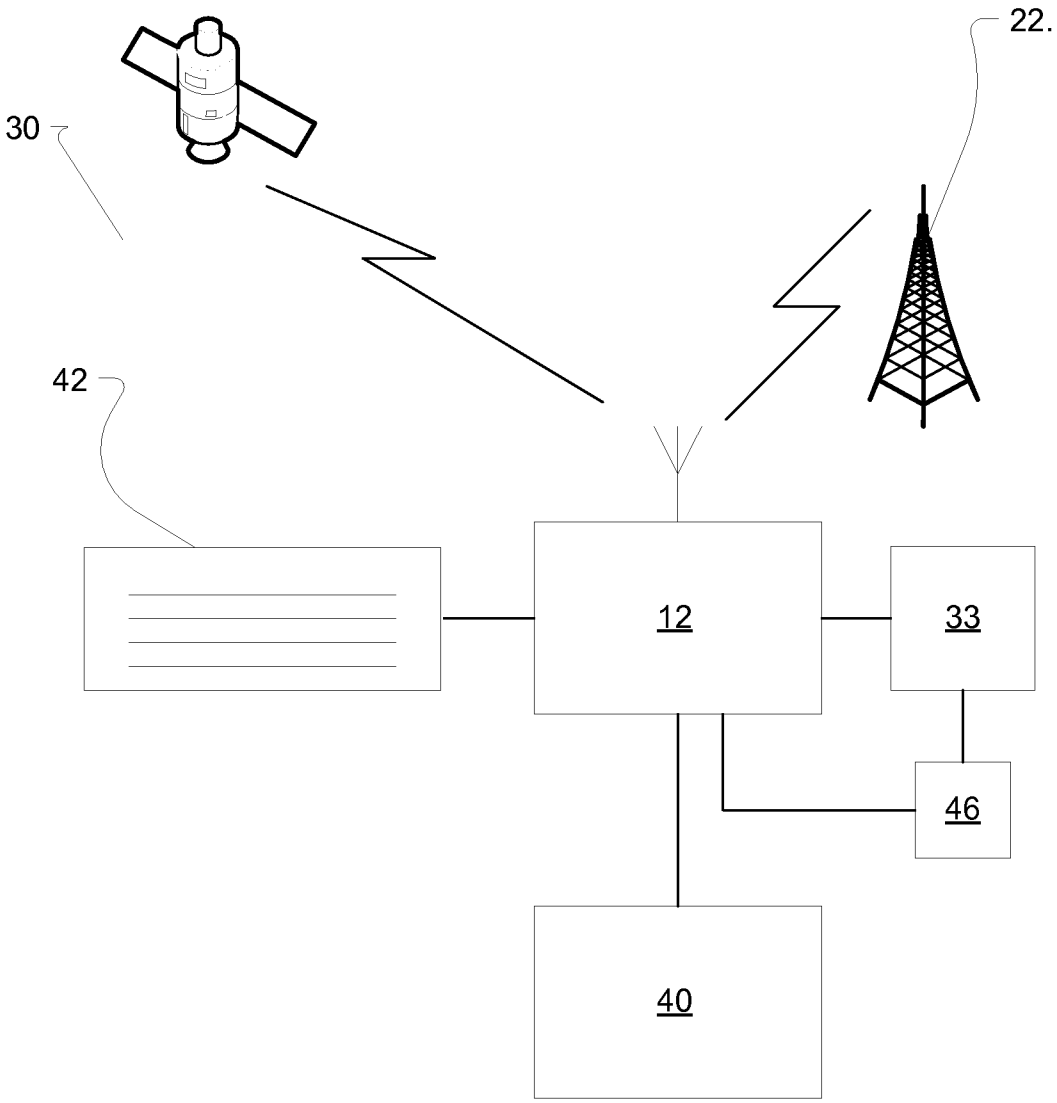

Fig. 6