

(12) STANDARD PATENT
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. **AU 2015205954 B2**

(54) Title
Monitoring System

(51) International Patent Classification(s)
G08G 1/04 (2006.01) **G08G 1/017** (2006.01)

(21) Application No: **2015205954** (22) Date of Filing: **2015.07.24**

(43) Publication Date: **2015.08.20**

(43) Publication Journal Date: **2015.08.20**

(44) Accepted Journal Date: **2017.08.03**

(62) Divisional of:
2014202983

(71) Applicant(s)
Adox Pty Ltd

(72) Inventor(s)
DEHLSSEN, Grant

(74) Agent / Attorney
Wallington-Dummer, GPO BOX 3888, SYDNEY, NSW, 2001, AU

(56) Related Art
US 2010/0117820
US 2008/0319837

2015205954 24 Jul 2015

ABSTRACT

A vehicle compliance monitoring system for detection of vehicles in restricted parking areas; said system including:

- at least one video camera module mounted above vehicle height for viewing multiple vehicle locations,
 - a first image capture of a vehicle as said vehicle enters a said restricted parking area,
 - a second image capture of said vehicle after a predetermined time lapse; and wherein
- said second image capture is made if said vehicle has not exited said restricted parking area within said predetermined time lapse; said monitoring system further including analytics reactive to movement of vehicles; said analytics derived from video imagery of said vehicle moving into and out of said restricted parking area as recorded by said video camera module.

Also disclosed is a smart pole structure for a parking monitoring system; said smart pole structure comprising a base unit and from which extends an extension pole; mounted to the top of said extension pole is a camera assembly and a communication controller; said camera assembly communicating image information to said communication controller for processing and on-communicating to a remote data processing and database facility.

2015205954 11 Jul 2017

VEHICLE COMPLIANCE MONITORING SYSTEM

TECHNICAL FIELD

[0001] The present invention relates to traffic management and, more particularly to monitoring of illegal parking of vehicles.

BACKGROUND

[0002] It is known to monitor traffic by means of still or video imagery. Thus WO2012038964A2 describes a system for "defining, monitoring and reporting incidences of potential traffic violations, motion or parking" (abstract) by means of video clips. Similarly, JP2773135B2 describes a system for detecting illegal parking through image recognition of a vehicle's registration number.

[0003] Neither of the systems described in the above patent applications discloses a system of timed image capture specifically related to the entry and exit of vehicles at a restricted parking zone.

[0004] It is an object of the present invention to address or at least ameliorate some of the above disadvantages or provide a useful alternative.

Notes

[0005] The term "comprising" (and grammatical variations thereof) is used in this specification in the inclusive sense of "having" or "including", and not in the exclusive sense of "consisting only of".

[0006] The above discussion of the prior art in the Background of the invention, is not an admission that any information discussed therein is citable prior art or part

of the common general knowledge of persons skilled in the art in any country.

SUMMARY OF INVENTION

[0007] Accordingly, in a first broad form of the invention, there is provided a vehicle compliance monitoring system for monitoring restricted parking areas maintained by a plurality of system users, said system comprising:

- at each one of a plurality of restricted parking areas, a digital still or video camera adapted to capture images or video of a vehicle using the restricted parking area, a microprocessor, memory for storage of captured images or videos and a communications module, the microprocessor firstly controlling the camera to capture a first image or video on detection of arrival of the vehicle at the restricted parking area and subsequently if the vehicle remains at the restricted parking area after an allowed parking period to capture a second image or video, secondly storing said images or videos in the memory each with a time and date of capture of the image or video and thirdly causing transmission by the communications module comprising stored images or videos and the associated times and dates to a server facility at a location remote from the restricted parking area; and

- a management system adapted to determine the particular system user having authority over the restricted parking area and to cause transmission from the server facility to the particular system user of at least an alert that the vehicle has overstayed at the restricted parking area,

- and wherein firstly the server hosts a website accessible to system users and secondly in response to the alert the particular system user can receive additional information relating to the alert by downloading from the website.

[0008] In a preferred embodiment:

- the camera is supported by a support structure above vehicle height with a view of the restricted parking area and at least the number plate of a vehicle moving into or out of the restricted parking area; and
- the microprocessor the memory and the communications module are also supported by the support structure.

[0009] Preferably, arrival of the vehicle in the restricted parking area is detected by:

- a movement sensor also supported above vehicle height by the support structure; or
- analysis of imagery from the camera by the microprocessor.

[0010] Preferably, detection of movement of the vehicle into or out of the restricted parking area is effected by a movement sensor and the movement sensor is comprised with the microprocessor the memory and the camera in a camera module.

[0011] Preferably, a registration number of the vehicle is determined manually or by use of image analysis software applied to an image or video transmitted by the communications module.

2015205954 11 Jul 2017

[0012] Preferably, the management system is implemented at a location remote from the server.

[0013] In a preferred embodiment, communication between the management system and the server is via a data network.

[0014] Preferably, communication between the server and system users is via a data network.

[0015] Preferably, the server is in two way communication with the camera module and the allowed parking period is able to be varied by transmission of an instruction from the server to the camera module.

[0016] Preferably, the server is adapted to receive an authorisation to discard information relating to the alert from the particular system user and to then cause the microprocessor to discard stored information relating to the alert.

[0017] Preferably, a plurality of communication modules is associated with one system user and one only of said plurality of communication modules is in communication with the server and the others are short range communication modules in communication with the said one whereby transmissions between said others and the server are via said one.

[0018] The camera and the microprocessor are in a preferred embodiment provided with power by a solar voltaic collector mounted to the support structure.

[0019] In a further broad form of the invention there is provided a method for monitoring compliance of vehicles with parking restrictions at a plurality of restricted

parking areas maintained by multiple system users, including the steps of:

- providing at each one of a plurality of restricted parking areas, a digital still or video camera adapted to capture images or video of a vehicle using the restricted parking area, a microprocessor, memory for storage of captured images or videos and a communications module;

- by the microprocessor, firstly controlling the camera to capture an image or video on detection of arrival of the vehicle at the restricted parking area and subsequently if the vehicle remains at the restricted parking area after an allowed parking period to capture a second image or video of the vehicle, secondly storing said images or videos in the memory each associated with a time and date of capture of the image or video and thirdly causing a transmission by the communications module comprising stored images or videos and the associated times and dates to a server facility at a location remote from the restricted parking area;

- providing a management system adapted to determine the particular system user having authority over the restricted parking area and causing to be transmitted from the server facility to the particular system user at least an alert that the vehicle has overstayed at the restricted parking area; and

- hosting on the server a website adapted on request by the system user receiving said alert to

download images or videos and associated information relating to the alert for review by the user.

[0020] Preferably, the method further includes the step of analysing a recorded image or video relating to the alert to read a number plate of the vehicle whereby ownership of the vehicle can be determined.

[0021] It is preferred that communication between the server and the microprocessor controlling the camera is two-way and that the method includes a step of transmitting from the server to the microprocessor a change to the allowed parking period.

[0022] Preferably, communication between the server and the microprocessor controlling the camera is two-way and the method further includes a step of transmitting from the server to the microprocessor a command to discard stored information relating to the alert when the system user that has received the alert determines that action is not to be taken in response thereto.

BRIEF DESCRIPTION OF DRAWINGS

[0023] Embodiments of the present invention will now be described with reference to the accompanying drawings wherein:

Figure 1 is a general view of a restricted parking area with a monitoring system according to the invention,

Figure 2 is a schematic view of a communications system for use with the parking monitoring system of the invention,

Figure 3 illustrates a pole mounted arrangement suited for use with the system of figure 1 and/or figure 2,

Figure 4 illustrates a network topology in accordance with a preferred embodiment of the system,

Figure 5 illustrates parking compliance workflow in relation to the system, and

Figure 6 illustrates parking compliance workflow in relation to the processing officer.

DESCRIPTION OF EMBODIMENTS

First Preferred Embodiment

[0024] In a first preferred embodiment of a vehicle monitoring compliance system according to the invention with reference to **figure 1**, a restricted parking area **10** is provided with an image capturing module **12** mounted adjacent to the area **10** on a supporting structure **14**. Preferably the supporting structure **14** is mounted to a parking advisory pole **16** and is so placed that the image capturing module **12** at the top of the supporting structure is afforded a clear view of the front or back, and therefore the license plate **18** of a vehicle **20** entering the area **10**. The image capturing module **12** and its supporting structure **14** may be one of a plurality of such modules and support structures arranged along a road or distributed within a parking area for example.

[0025] The imaging device (not shown) of the image capturing module **18** may be a digital still or video camera. Also included in the image capturing or IP module **18** is a motion sensor (not shown) responsive to movement into and out of the restricted parking area **10** by vehicles. The motion sensor may be of any suitable type, including for example, infrared and short range radar systems or analytics. Furthermore, the module **12** is provided with a micro-processor and a communication module for at least transmitting image data over the internet to a monitoring authority or secure server 36 as shown in **figure 2**.

[0026] In a preferred arrangement, the image capturing modules **18** within a given plurality of modules, are provided with short range communication modules for transmission of data within the plurality. One of the plurality of image capturing or IP modules **18**, in addition to its function as an image capturing

module, is a hub module and acts as an edge storage device for image and analytics data captured by the other image capturing modules which are part of a given plurality of modules. In this arrangement, only edge storage equipped image capturing module is provided with a transmission module for communicating with a remote monitoring authority.

[0027] The equipping of the image capturing system of the invention with local, that is incorporated in each image capturing module **18** with analytics software to perform at least some of the initial analysis of the images, time records and other captured raw data, thereby reducing the amount of relevant data for transmission to and storage at the hub module. Further processing at the hub module may reduce the data further thus minimising the volume and band width required for communication with the monitoring authority.

[0028] Preferably, power for the image capturing module and its sub-systems is provided by a solar voltaic panel **22** and storage battery (not shown), or may be supplied from the street light power system or building power.

Second Preferred Embodiment

[0029] In a second preferred embodiment of the invention, still with reference to **figure 1**, the motion sensor may be augmented, or replaced by one or more inductive loops **24** or other vehicle sensor positioned under the surface **26** of the restricted parking area **10** and in communication with the image capturing module **12**. In this instance, still or short video imagery will be taken by the imaging device of the module when a vehicle **20** comes within range of an inductive loop **24**.

Third Preferred Embodiment

[0030] **Figure 3** illustrates a 'smart pole' arrangement suited for use with any of the described embodiments. In this instance the pole **50** comprises a base unit **50A** which can be anchored by means

of base plate **50B** into the pavement **51**. A smaller diameter extension pole **50C** extends from the base unit **50A** amount to the top of the extension pole **50C** is a lateral extender **50D** to which is mounted a camera assembly **52**. Also mounted to the top of the extension pole **50C** is a solar panel **53**. Also mounted to the top of the extension pole **50C** is a logic and communication controller **54**. These components interact with each other so as to provide a 'smart pole' arrangement. As described above, these 'smart poles' may be in communication with all the other smart poles within a plurality of image capturing modules and with a hub module which in turn communicates with the data processing and database facilities **38** of the monitoring authority.

[0031] [0033] With reference to **Figure 4** the camera assembly **52** and logic and communication controller **54** can be deployed widely. They are arranged to communicate over telephone networks **60** and via the internet **61** to servers **62**. In preferred forms the data sent from the smart pole arrangement to the servers is sent securely and the servers managed in a secure environment. In conjunction with the server **62** a management system **63** orchestrates the release of data to users **64a, 64b, 64c**.

Fourth Preferred Embodiment

[0032] The flow charts of **Figures 5** and **6** illustrate steps in parking compliance followed by local processing steps which can be implemented in conjunction with any of the previously described embodiments.

INDUSTRIAL APPLICABILITY

[0033] Software executed by the micro-processor provides for a still or a first short video image to be taken by the imaging device only when a vehicle **20** is detected as entering the restricted parking area **10**, either through the triggering of the motion sensor, infrared or short range radar, analytics, or the reaction of an inductive loop **24** or other vehicle sensor. The image captured is date and time stamped and a timer set to t_0 . If, at the elapse of a predetermined length of time (t_x) there

2015205954 11 Jul 2017

has been no detection of movement by the vehicle **20** out of the restricted parking area **10**, the imaging device is triggered again to take a second still or video image of the vehicle.

[0034] As shown schematically in **figure 2**, the capture of a second still or video image causes the micro-processor **30** to activate the communication system **32** and transmit, via the internet **34** or to a second unit for transmission via the internet, the first and second captured imagery to the monitoring authority **36** of the system. Either manual inspection or image analysis software may then be used to ascertain the license number of the vehicle and appropriate action taken with reference to data processing and database facilities **38** of the monitoring authority.

[0035] Preferably, the system provides for two-way communication between the monitoring authority and the image capturing module. By this means the time lapse between t_0 and t_x can be varied as required to adapt the system to any parking restriction, from "NO PARKING", "NO STOPPING", "DISABLED" or "NO STANDING" to time specific parking, including variations in time limits according to time of day and days of the week.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A vehicle compliance monitoring system for monitoring restricted parking areas maintained by a plurality of system users, said system comprising:

at each one of a plurality of restricted parking areas, a digital still or video camera adapted to capture images or video of a vehicle using the restricted parking area, a microprocessor, memory for storage of captured images or videos and a communications module the microprocessor firstly controlling the camera to capture a first image or video on detection of arrival of the vehicle at the restricted parking area and subsequently if the vehicle remains at the restricted parking area after an allowed parking period to capture a second image or video, secondly storing said images or videos in the memory each with a time and date of capture of the image or video and thirdly causing transmission by the communications module comprising stored images or videos and the associated times and dates to a server facility at a location remote from the restricted parking area; and

a management system adapted to determine the particular system user having authority over the restricted parking area and to cause transmission from the server facility to the particular system user of at least an alert that the vehicle has overstayed at the restricted parking area,

and wherein firstly the server hosts a website accessible to system users and secondly in response to the alert the particular system user can receive additional information relating to the alert by downloading from the website.

2. A system according to claim 1 wherein:

the camera is supported by a support structure above vehicle height with a view of the restricted parking area and at least the number plate of a vehicle moving into or out of the restricted parking area;

the microprocessor the memory and the communications module are also supported by the support structure.

3. A system according to claim 2 wherein arrival of the vehicle in the restricted parking area is detected by:
a movement sensor also supported above vehicle height by the support structure; or
analysis of imagery from the camera by the microprocessor.
4. A system according to claim 3 wherein detection of movement of the vehicle into or out of the restricted parking area is effected by a movement sensor and the movement sensor is comprised with the microprocessor the memory and the camera in a camera module.
5. A system according to any one of claims 1 to 4 wherein a registration number of the vehicle is determined manually or by use of image analysis software applied to an image or video transmitted by the communications module.
6. A system according to any one of claims 1 to 5 wherein the management system is implemented at a location remote from the server.
7. A system according to claim 6 wherein communication between the management system and the server is via a data network.
8. A system according to any one of claims 1 to 7 wherein communication between the server and system users is via a data network.
9. A system according to any one of claims 1 to 8 wherein the server is in two way communication with the camera module and the allowed parking period is able to be varied by transmission of an instruction from the server to the camera module.

10. A system according to any one of claims 1 to 9 wherein the server is adapted to receive an authorisation to discard information relating to the alert from the particular system user and to then cause the microprocessor to discard stored information relating to the alert.
11. A system according to any one of claims 1 to 10 wherein a plurality of communication modules is associated with one system user and one only of said plurality of communication modules is in communication with the server and the others are short range communication modules in communication with the said one whereby transmissions between said others and the server are via said one.
12. A system according to any one of claims 1 to 11 wherein the camera and the microprocessor are provided with power by a solar voltaic collector mounted to the support structure.
13. A method for monitoring compliance of vehicles with parking restrictions at a plurality of restricted parking areas maintained by multiple system users, including the steps of:

providing at each one of a plurality of restricted parking areas, a digital still or video camera adapted to capture images or video of a vehicle using the restricted parking area, a microprocessor, memory for storage of captured images or videos and a communications module;

by the microprocessor, firstly controlling the camera to capture an image or video on detection of arrival of the vehicle at the restricted parking area and subsequently if the vehicle remains at the restricted parking area after an allowed parking period to capture a second image or video of the vehicle, secondly storing said images or videos in the memory each associated with a time and date of capture of the image or video and thirdly causing a transmission by the communications module comprising stored images or videos and the associated

times and dates to a server facility at a location remote from the restricted parking area;

providing a management system adapted to determine the particular system user having authority over the restricted parking area and causing to be transmitted from the server facility to the particular system user at least an alert that the vehicle has overstayed at the restricted parking area; and

hosting on the server a website adapted on request by the system user receiving said alert to download images or videos and associated information relating to the alert for review by the user.

14. A method according to claim 13 including the step of analysing a recorded image or video relating to the alert to read a number plate of the vehicle whereby ownership of the vehicle can be determined.
15. A method according to claim 13 or 14 wherein communication between the server and the microprocessor controlling the camera is two-way and including a step of transmitting from the server to the microprocessor a change to the allowed parking period.
16. A method according to any one of claims 13 to 15 wherein communication between the server and the microprocessor controlling the camera is two-way and including a step of transmitting from the server to the microprocessor a command to discard stored information relating to the alert when the system user that has received the alert determines that action is not to be taken in response thereto.

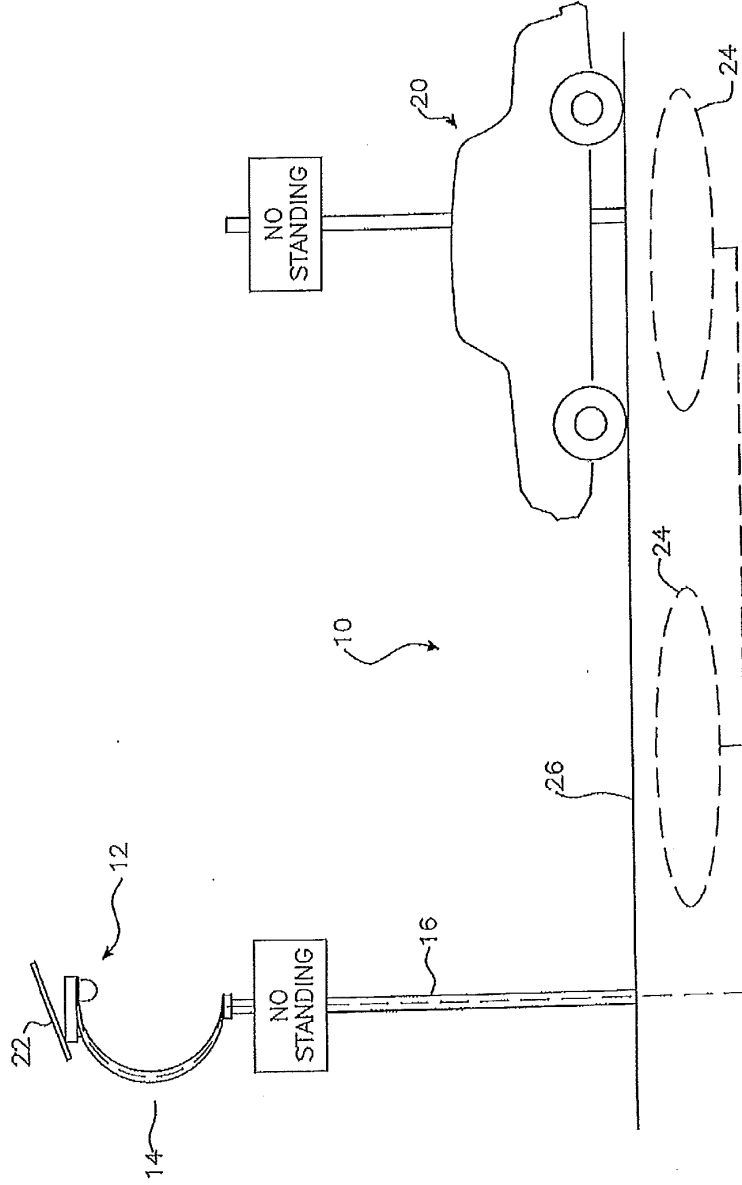


Fig. 1

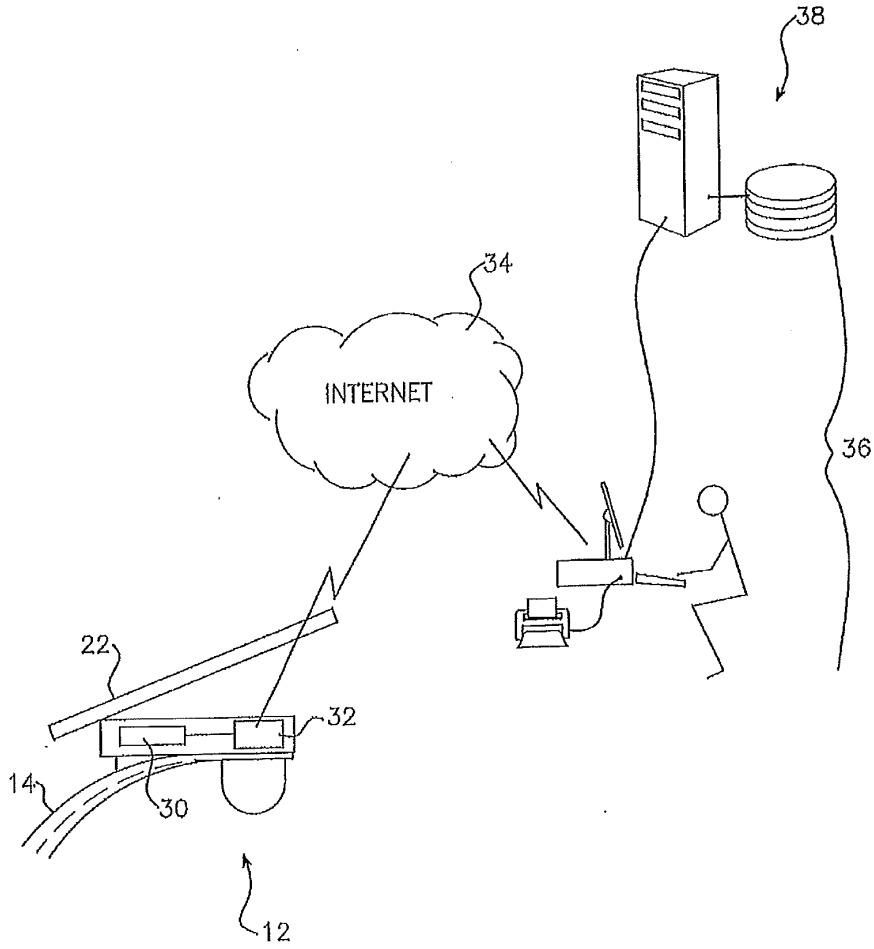
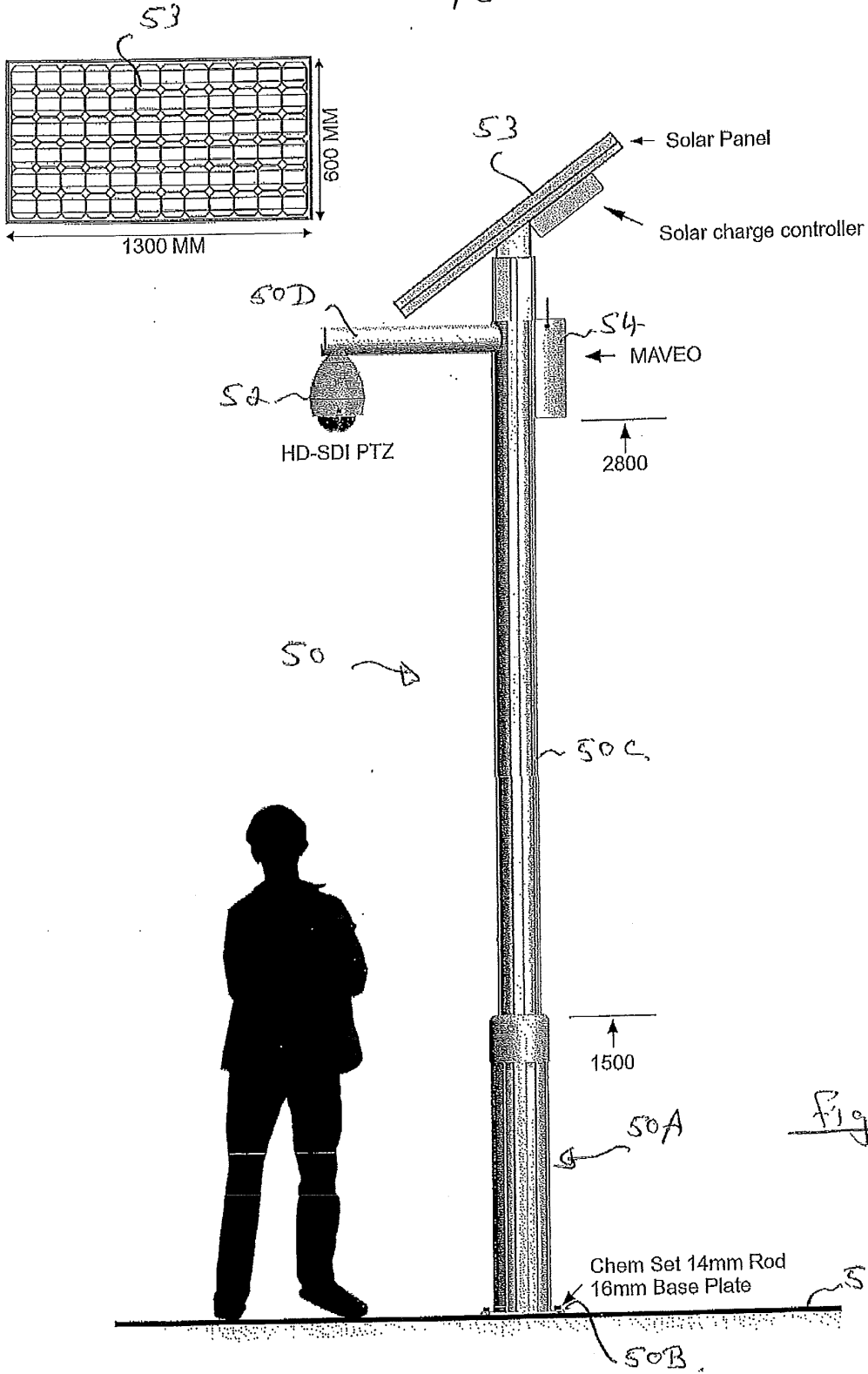


Fig. 2

3/6



46

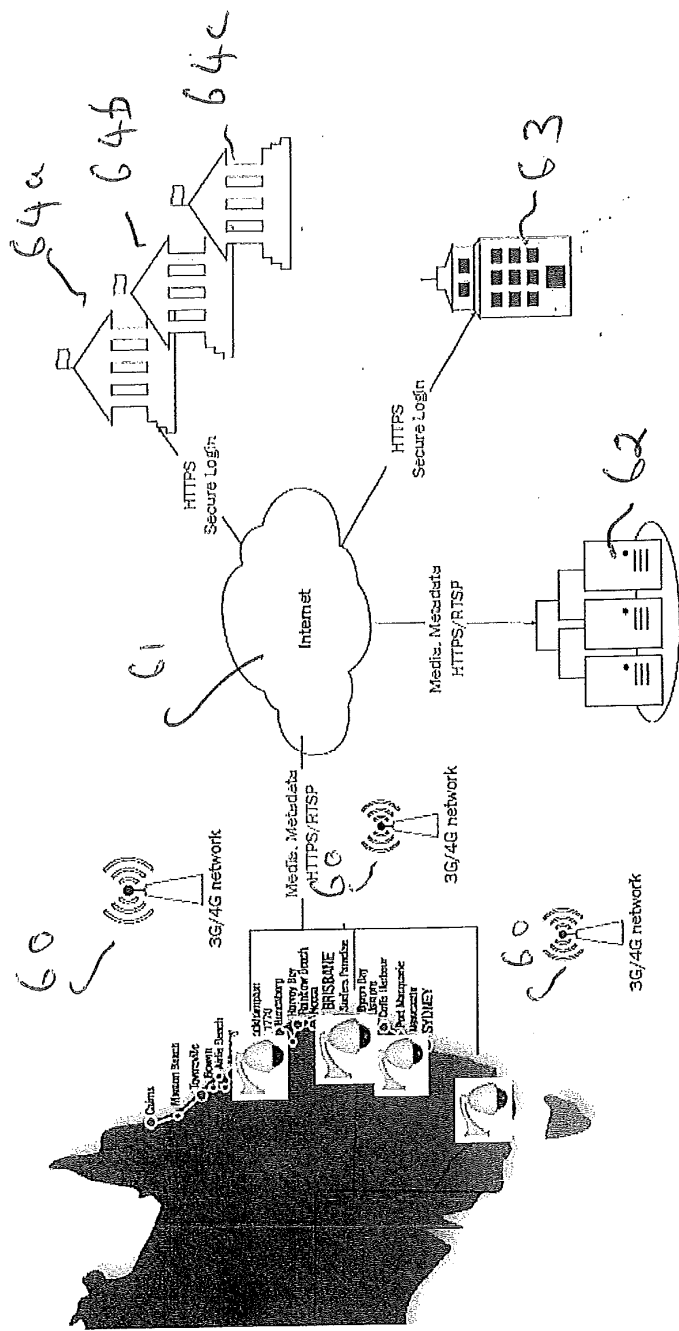


Fig 4

Parking Compliance Functional Process Flow

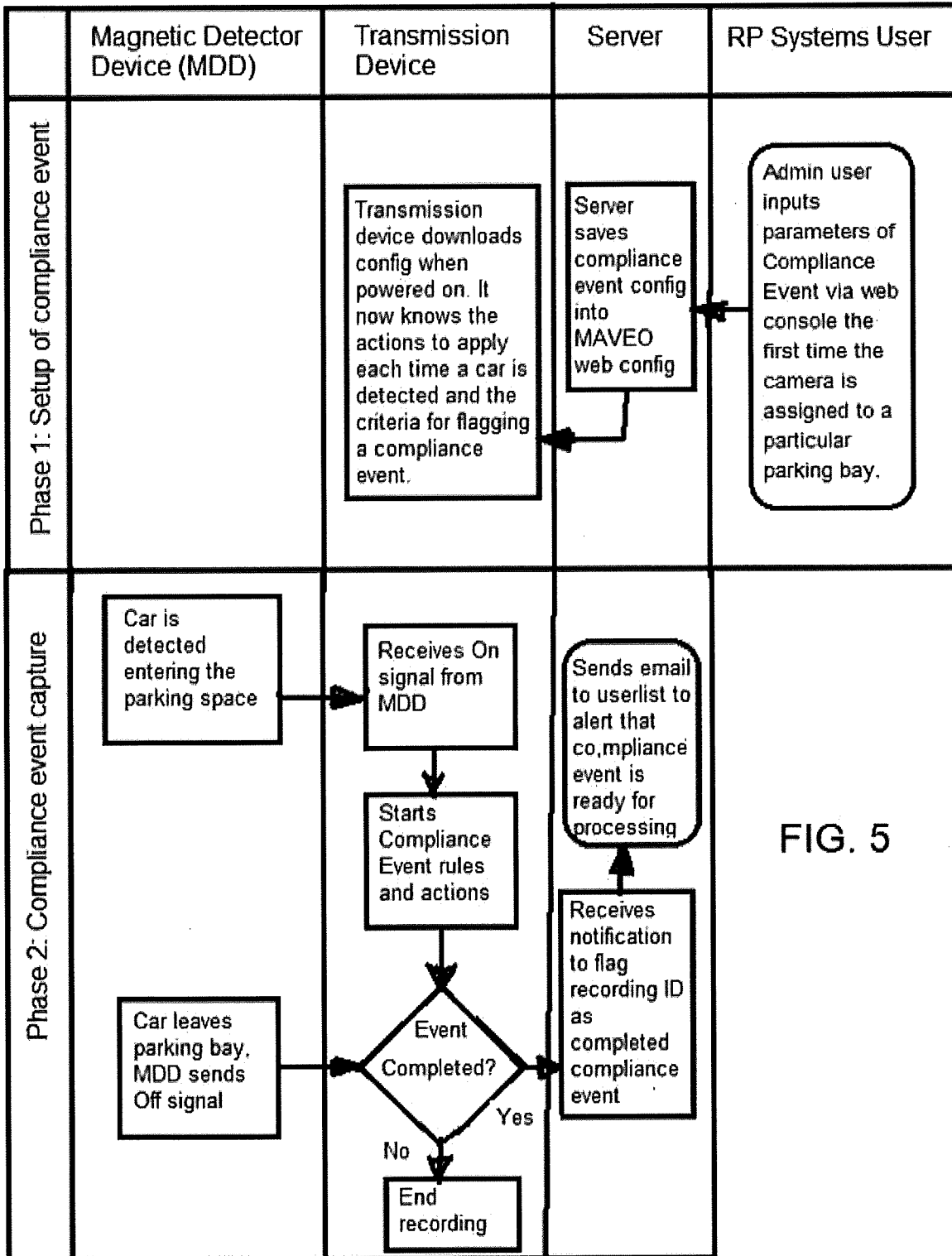


FIG. 5

Title

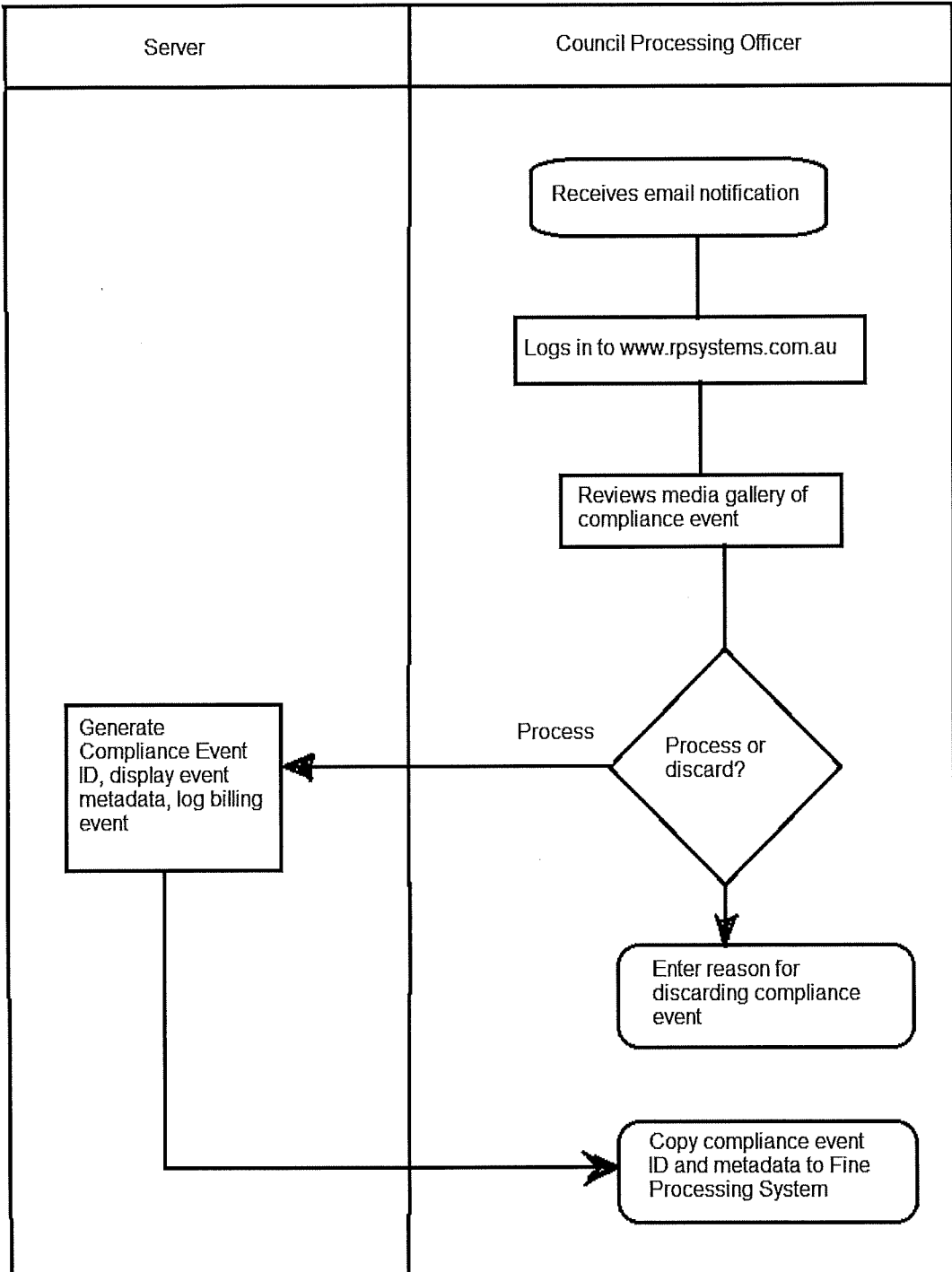


FIG. 6