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(56) Documents Cited
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(54) Abstract Title
Wireless CCTV system

(57) A camera (120) for use in a closed circuit television (CCTV) system comprising a modem (100) coupled to the camera (120) to receive control data (180) for the camera (120) via a wireless network and to transmit display data (170) generated by the camera over the wireless network.

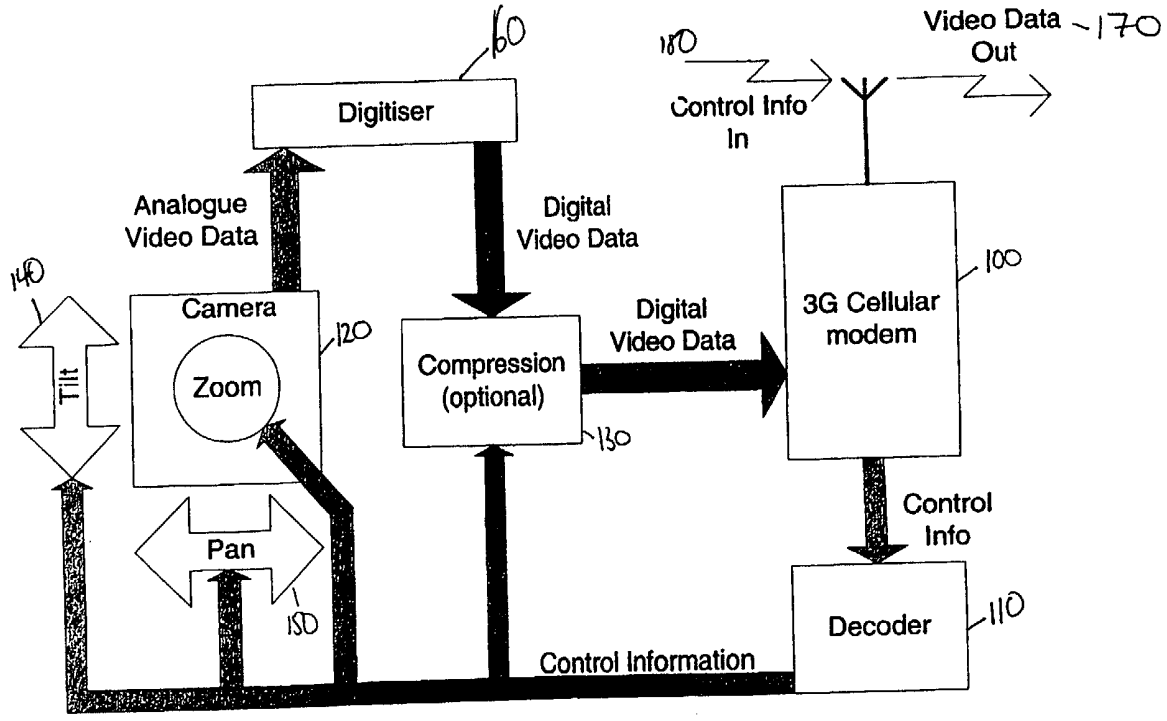

Figure 2 · Remote CCTV unit

GB 2 384 933 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

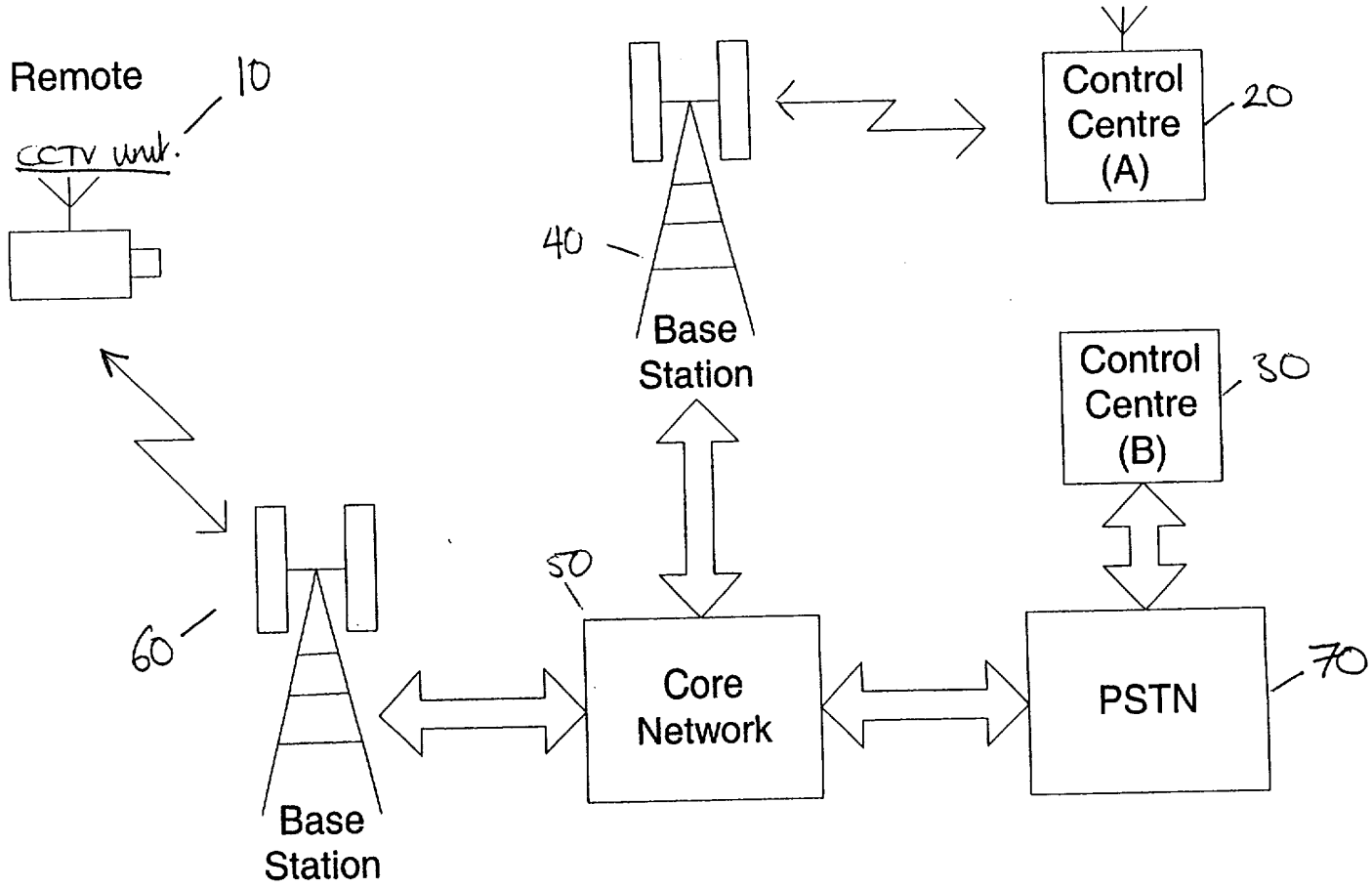

Figure 1 : Remote CCTV System

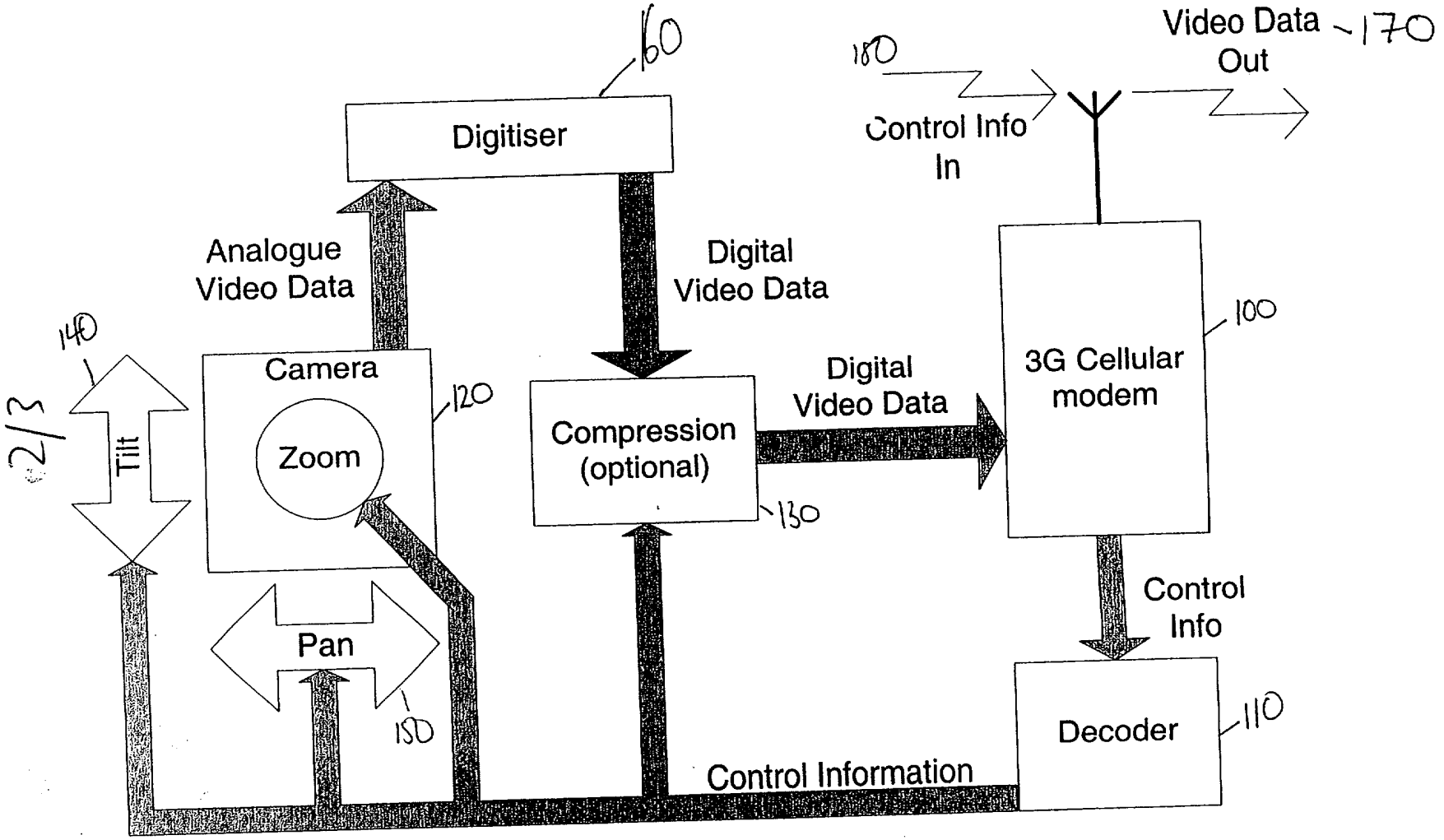

Figure 2 · Remote CCTV unit

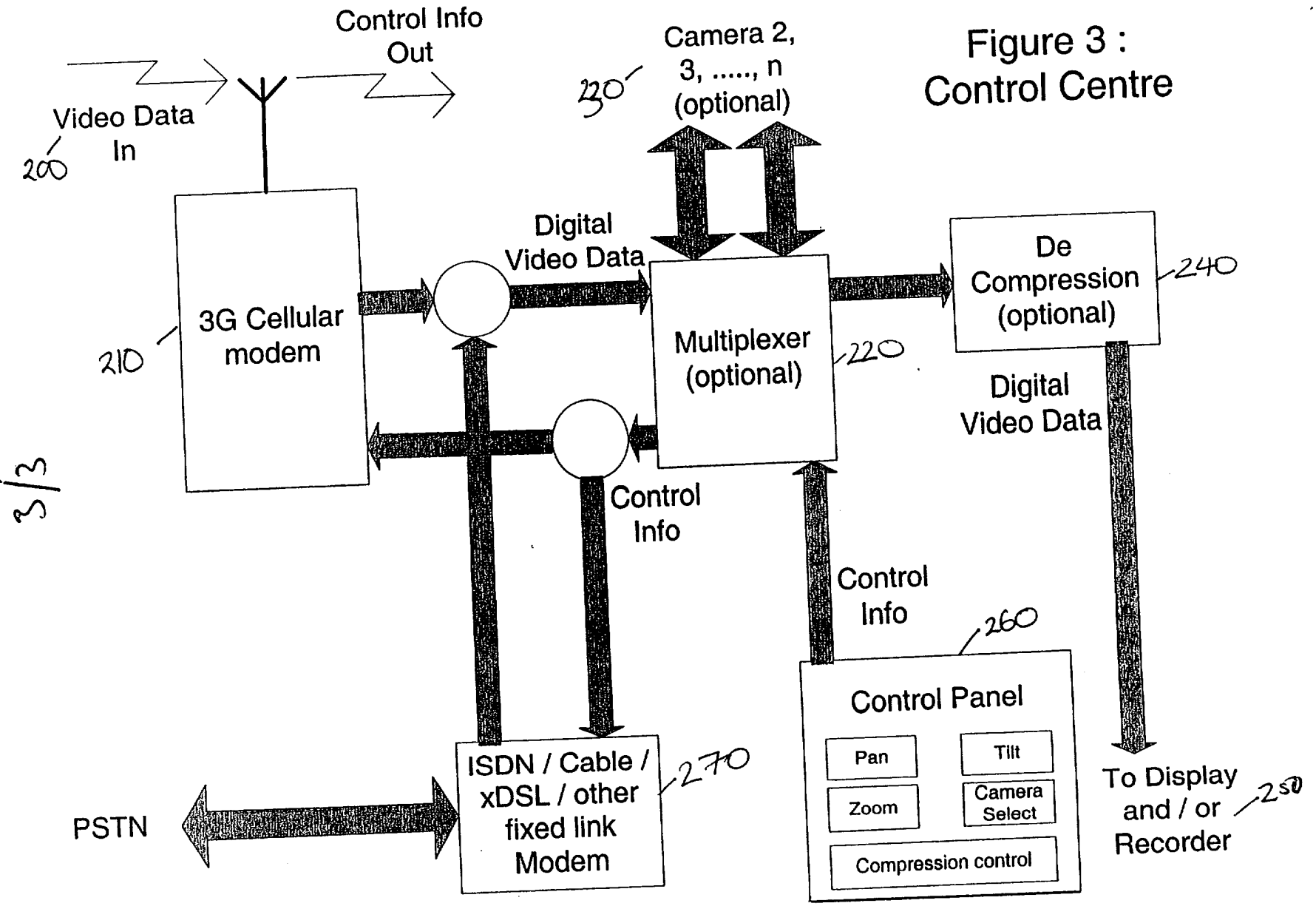

Figure 3 : Control Centre

3/3

Wireless CCTV System

The present invention relates to a wireless closed circuit television (CCTV) system and in particular to a system which receives and transmits CCTV signals across a cellular network.

CCTV systems are regularly used for crime prevention and general monitoring purposes. Typically CCTV units are positioned at a high level in town centres, to provide maximum area coverage, and at other locations. The major costs of a CCTV system are the CCTV equipment, installation and operating costs. Of these, the most significant cost is installation which involves running dedicated cables between cameras and control centres. The expense and disruption caused by installing the systems has prevented CCTV systems being installed in many locations.

Previously, the bandwidth available on cellular communication networks has been too limited to be useful for video transmission. We have appreciated that with the development of the 2.5 and third generation networks bandwidth availability has increased to the point where video information can be transmitted.

A further advantage of the 2.5 and third generation (3G) systems is that they support asymmetric channel allocation. This is particularly useful for CCTV applications since large amounts of data will primarily be directed from the camera unit to the base station (in the uplink direction). Only low rate signalling will be directed from the base station to the camera unit (in the downlink direction).

An asymmetric application with a high uplink data rate is also advantageous from a network point of view since many of the applications for 3G have an asymmetric data rate in favour of the downlink. Typically this will involve passing large files, for example video or internet, from the base station to the mobile unit. Since the third generation systems have the same bandwidth available in the uplink and downlink directions, introducing a new device with an asymmetry opposite to the majority helps to maximise network usage.

Embodiments of the present invention provide a remote CCTV unit comprising a conventional CCTV camera connected to a cellular communications device for sending signals to and from the CCTV camera over a cellular network. The only required external wiring is the power supply.

Since the only external wiring required for the CCTV unit is the power supply installation costs are greatly reduced in comparison to units which require installation of transmission cabling. Most CCTV units are deployed at high level in town centres, and high level sites where power supplies already exist through streetlights and buildings. It would be possible to use the power supplies from these locations to power wireless CCTV units and thus allow deployment of CCTV units in many locations that were previously too expensive to cover.

For low usage applications (eg motion sensing alarms) a mains power supply may not be required. The entire system could be powered by battery or by solar electricity. This would facilitate deployment in truly remote locations.

The present invention is defined in its various aspects in the appended claims, to which reference should now be made.

Preferred embodiments of the present invention will now be described in detail, by way of example with reference to the accompanying drawings in which;

Figure 1 shows a CCTV system;

Figure 2 shows the data paths within the remote CCTV unit of figure 1; and,

Figure 3 shows the data paths within the control centre of figure 1.

Figure 1 shows an embodiment of a remote CCTV system. The system includes one remote CCTV unit 10 although further embodiments can include multiple remote CCTV units. The remote CCTV unit can be controlled by multiple control centres (20, 30). The control centres (20, 30) can receive and transmit signals to the remote CCTV unit using wireless or fixed line telephone networks or other communication networks. Fixed line networks typically comprise optical and electrical cables. The remote CCTV unit 10 can only transmit and receive signals over a wireless network. Typically a cellular network will be used although further embodiments of the system transmit and receive signals using different wireless networks.

Any signals from the control centre (20, 30) which are not transmitted on the cellular network are transferred onto the core cellular network 50 between the control centre and the CCTV unit 10. The control centres transmit commands to control multiple functions of the remote CCTV unit including the angle and direction of the camera and the zoom function. Signals can be transmitted over the cellular or fixed line networks using circuit based or packet based systems. In a circuit based system there is a permanent connection between the modem and the base station. In contrast, in a packet based system a

connection between modem and the base station is only established when data is transmitted.

In preferred embodiments of the remote system the data is carried entirely over the cellular network. However, for security, commercial or coverage reasons it may be appropriate to have the control centre connected into the cellular system using fixed telephone links.

Control centre A 20 transmits control signals to a base station 40. The base station then uses a core cellular network 50 to transmit the commands to the remote CCTV unit 10 via a base station 60. The base station 60 may be the same or a different base station from base station 40. Video and/or audio signals are transmitted from the remote CCTV unit 10 to the base station 60 using the core network 50. The signals are then transmitted back to the control centre A 20 from a base station 40.

Control signals may also be transmitted via fixed line public switched telephone networks (PSTN). Control centre B 30 transmits and receives signals via a fixed line PSTN telephone network 70. The signal is transferred onto the core cellular network 50 and then transmitted to the remote CCTV camera 10 via base station 60. When receiving signals from the remote CCTV camera the signals are received by the base station 60 and transferred onto the core cellular network 50. The signals are then further transmitted to the control centre B via the fixed line PSTN 70.

Each remote camera has an associated unique numeric address or internet protocol (IP) address in the case of packet switched systems. Communication is established between the control centre and the remote camera by dialing the appropriate number or address from the control centre. The remote camera may then require authentication

of the incoming connection. Typically a simple password system could be used or a password based on a security algorithm with keys known to both the remote and central location.

In certain embodiments of the system public access to the remote cameras is desirable. In these embodiments the password protection can be disabled. Increased security levels can be achieved by making the video feed available from the control centre for example as a webcast.

Figure 2 shows the data paths within the remote CCTV unit. Control signals 180 are transmitted from the control centre to the remote CCTV unit and received by a 3G cellular modem 100. Typically the control data arrives over the cellular network on a low bandwidth link. The cellular modem is responsible for negotiating with the network to establish connections of the necessary bandwidth. The cellular modem can also re-establish connections if the required bandwidth changes. Such connections can be circuit or packet switched. Packet switched is the preferred solution for efficiency of bandwidth utilisation. The cellular modem is also responsible for authenticating the incoming connections to ensure that only authorised persons can access the remote camera.

The signal is forwarded from the 3G cellular modem 100 to a decoder 110 where the signal is decoded. After decoding the control signal the decoded signals are used to control a camera 120, a mechanism controlling the position of the camera and a video compression module 130. The position of the camera may be changed by varying the angle of tilt 140 or by panning the camera 150. The camera may also include IR or standard lighting which can also be controlled through the control transmission, as can other camera functions.

The compression module 130 provides control of the frame rate, compression ratio, image size, start/stop data, and, under certain compression schemes such as wavelet, high resolution area selection.

Further embodiments of the remote CCTV unit do not include a compression unit since the 3G network has sufficient bandwidth to send raw digitised signals from certain varieties of camera.

The analogue video data output from the camera 120 is directed to a digitiser 160 where it is converted into a digital video signal. The digital signal is then forwarded to the 3G cellular modem 100 via the video compression unit 130. The 3G cellular modem 100 transmits the video data at 170 to the base station to be received by the control units.

The remote CCTV can be arranged to be capable of initiating a transmission to the control centre. For example the system can be used in a motion sensing system as part of an alarm application. In this case the camera need not be active until it senses movement. The remote unit initiates communications with a pre-defined control centre when motion is detected. Since only selected control centres are advised when an alarm is triggered, access to the information is restricted and therefore the security of the system is increased. The password system may also be run if further verification is required.

Figure 3 shows the data path within a control centre which can operate on either a cellular or fixed line network. Further embodiments may operate exclusively on either a fixed line or cellular network. Video data transmitted via the cellular network 200 is received by a 3G cellular modem 210. Data transmitted via a PSTN fixed line telephone network is received by a fixed line modem 270.

The received data is then forwarded to a multiplexer 220. The multiplexer can receive signals from multiple remote units 230. The output signal from the multiplexer is directed to the decompression module 240 and the decompressed digital video data is transmitted to the display or recorder 250. If the data received is not compressed then the decompression module is not required.

The cameras are controlled using the control panel 260. The control panel can select the active camera and control the field of view of the camera. The control commands are entered on the control panel 260 and forwarded to the multiplexer which determines to which camera the operating instructions are to be sent. Signals transmitted by cellular networks are directed to the 3G cellular modem 210 and signals transmitted via the fixed lines are directed to the fixed line modem 270.

In standard fixed line CCTV systems, for example those used for security surveillance, a single control console and monitor are connected to many cameras through the multiplexer. The multiplexer is used to control which camera is connected to the monitor or recorder at any time. The number of cameras monitored by security staff or recorded is a subset of the available cameras. Typically one camera will be monitored for a period of time and then the multiplexer will switch to the next camera in the sequence.

In a simple embodiment the system includes a set of telecom interface electronics connected to the multiplexer for each camera. Each camera is constantly active and data from each camera is constantly transmitted to the multiplexer. The multiplexer controls which data stream is transmitted to the display. This system maintains compatibility with all standard CCTV systems although

multiple data streams which are transmitted to the control centre are not viewed.

In more efficient embodiments the telecom links are only active when selected by the control centre. An activating signal is sent to the selected camera. On receiving the signal the camera will commence transmission of data to the control centre. The connection can be terminated when the camera receives a termination signal or after a predetermined time period of inactivity. One possible drawback of this system is a dialling delay after selecting the camera although this does not apply if the connection is packet switched.

In a further embodiment the system includes one set of interface electronics permanently connected to a packet switched network. When no remote camera is selected there is no network traffic beyond that required to maintain the connection. The multiplexer is redesigned to store the IP addresses of each of the remote cameras. When a camera is selected by the control centre, a connection is made to the appropriate IP address over the packet network. When a different camera is selected, the existing IP connection is terminated and the new address accessed. This system enables multiple cameras to be accessed using a single set of electronics and so this system can be used in larger control centres where there are multiple console or monitor sets.

Claims

1. A camera for use in a closed circuit television (CCTV) system comprising a modem coupled to the camera to receive control data for the camera via a wireless network and to transmit display data generated by the camera over the wireless network.

2. A camera according to claim 1 wherein the wireless network is a cellular network.

3. A camera according to claim 1 or 2 wherein the modem is a cellular modem.

4. A camera according to claim 1, 2 or 3 wherein the modem receives control data and transmits display data via the network using a packet based system.

5. A camera according to claim 1, 2 or 3 wherein the modem receives control data and transmits display data via the network using a circuit based system.

6. A camera according to claim 1, 2, 3, 4 or 5 wherein the camera includes a compression module for compressing display data generated by the camera.

7. A camera according to claim 1, 2, 3, 4, 5 or 6 wherein the camera includes a decoder for decoding control data received from the wireless network.

8. A camera according to claim 1, 2, 3, 4, 5, 6 or 7 wherein the camera includes a digitiser to digitise the video signal.

9. A camera according to any preceding claim wherein the camera includes a microphone.

10. A camera according to claim 9 wherein the modem transmits audio output from the microphone over the wireless network.

11. A camera as claimed in claim 1 substantially as herein described, with reference to the figures.

12. A control unit for a CCTV system comprising;
a control panel for entering control data for a remote camera,
a modem for transmitting the control data over a communication network to the remote camera and for receiving display data from the remote camera over the communication network,
a means for displaying received data,
and a means for selecting which data is displayed.

13. A control unit according to claim 12 wherein the communication network is a telephone network.

14. A control unit according to claim 12 or 13 wherein the communication network is a cellular network.

15. A control unit according to claim 12, 13 or 14 wherein the modem is a cellular modem.

16. A control unit according to claims 12, 13, 14 or 15 wherein the control unit includes a fixed line modem which can receive and transmit data signals over a PSTN line.

17. A control according to claims 12, 13, 14, 15 or 16 wherein the control unit includes a decompression module for decompressing the display data received from the remote camera.

18. A control unit according to claim 12, 13, 14, 15, 16 or 17 wherein the control unit can receive audio data.

19. A control unit as claimed in claim 12 substantially as herein described, with reference to the figures.

20. A method for operating a camera in a CCTV system comprising the steps of;
receiving control data for the camera via a wireless network using a modem which is coupled to the camera, and transmitting display data generated by the camera across the wireless network using the modem.

21. A method according to claim 20 wherein the wireless network is a cellular network.

22. A method according to claim 20 or 21 wherein the modem is a cellular modem.

23. A method according to claim 20, 21 or 22 wherein control data is received and display data is transmitted via the wireless network using a packet based system.

24. A method according to claim 20, 21 or 22 wherein control data is received and display data is transmitted via the wireless network using a circuit based system.

25. A method according to claim 20, 21, 22, 23 or 24 including the step of compressing display data generated by the camera.

26. A method according to claim 20, 21, 22, 23, 24 or 25 including the step of decoding encoded control data received from the cellular network.

27. A method according to claim 20, 21, 22, 23, 24, 25 or 26 including the step of digitising the video signal.

28. A method according to claim 20, 21, 22, 23, 24, 25, 26 or 27 wherein the camera includes a microphone.

29. A method according to claim 28 including the step of transmitting audio output from the microphone over the cellular network.

30. A method as claimed in claim 20 substantially as herein described, with reference to the figures.

31. A method for operating a control unit for a CCTV system comprising the steps of;
entering control data for a remote camera on a control panel,
transmitting the control data across a communication network to the remote camera,
receiving display data from the remote camera over the communication network,
selecting which display data should be displayed, and
displaying the display data.

32. A method according to claim 31 wherein the communication network is a telephone network.

33. A method according to claim 31 or 32 where in the network is a cellular network.

34. A method according to claim 31, 32, 33 wherein the modem is a cellular modem.

35. A method according to claim 31, 32, 33, or 34 wherein the modem is a fixed line modem which can receive and transmit data signals over a PSTN line.

36. A method according to claim 31, 32, 33, 34 or 35 including the step of decompressing compressed display data received from the remote camera.

37. A method according to claim 31, 32, 33, 34, 35 or 36 wherein the control unit can receive audio data.

38. A method as claimed in claim 31 substantially as herein described, with reference to the figures.

Amendments to the claims have been filed as follows

Claims

1. A camera for use in a closed circuit television (CCTV) system comprising a modem coupled to the camera to receive control data for the camera via a wireless network and to transmit display data generated by the camera over the wireless network.

2. A camera according to claim 1 wherein the wireless network is a cellular network.

3. A camera according to claim 1 or 2 wherein the modem is a cellular modem.

4. A camera according to claim 1, 2 or 3 wherein the modem receives control data and transmits display data via the network using a packet based system.

5. A camera according to claim 1, 2 or 3 wherein the modem receives control data and transmits display data via the network using a circuit based system.

6. A camera according to claim 1, 2, 3, 4 or 5 wherein the camera includes a compression module for compressing display data generated by the camera.

7. A camera according to claim 1, 2, 3, 4, 5 or 6 wherein the camera includes a decoder for decoding control data received from the wireless network.

8. A camera according to claim 1, 2, 3, 4, 5, 6 or 7 wherein the camera includes a digitiser to digitise the video signal.

9. A camera according to any preceding claim wherein the camera includes a microphone.

10. A camera according to claim 9 wherein the modem transmits audio output from the microphone over the wireless network.

11. A camera as claimed in claim 1 substantially as herein described, with reference to the figures.

12. A control unit for a CCTV system comprising;
a control panel for entering control data for a remote camera,
a modem for transmitting the control data over a communication network to the remote camera and for receiving display data from the remote camera over the communication network,
a means for displaying received data,
a means for selecting which data is displayed
and a means for providing public access to the selected data.

13. A control unit according to claim 12 wherein the control unit transmits control data and receives display data over the network using a packet based system.

14. A control unit according to claim 12 or 13 wherein the communication network is a telephone network.

15. A control unit according to claim 12, 13 or 14 wherein the communication network is a cellular network.

16. A control unit according to claim 12, 13, 14 or 15 wherein the modem is a cellular modem.

17. A control unit according to claims 12, 13, 14, 15 or 16 wherein the control unit includes a fixed line modem which can receive and transmit data signals over a PSTN line.

18. A control according to claims 12, 13, 14, 15, 16 or 17 wherein the control unit includes a decompression module for decompressing the display data received from the remote camera.

19. A control unit according to claim 12, 13, 14, 15, 16, 17 or 18 wherein the control unit can receive audio data.

20. A control unit as claimed in claim 12 substantially as herein described, with reference to the figures.

21. A method for operating a camera in a CCTV system comprising the steps of;
receiving control data for the camera via a wireless network using a modem which is coupled to the camera, and
transmitting display data generated by the camera across the wireless network using the modem.

22. A method according to claim 21 wherein the wireless network is a cellular network.

23. A method according to claim 21 or 22 wherein the modem is a cellular modem.

24. A method according to claim 21, 22 or 23 wherein control data is received and display data is transmitted via the wireless network using a packet based system.

25. A method according to claim 21, 22 or 23 wherein control data is received and display data is transmitted via the wireless network using a circuit based system.

26. A method according to claim 21, 22, 23, 24 or 25 including the step of compressing display data generated by the camera.

27. A method according to claim 21, 22, 23, 24, 25 or 26 including the step of decoding encoded control data received from the cellular network.

28. A method according to claim 21, 22, 23, 24, 25, 26 or 27 including the step of digitising the video signal.

29. A method according to claim 21, 22, 23, 24, 25, 26, 27 or 28 wherein the camera includes a microphone.

30. A method according to claim 29 including the step of transmitting audio output from the microphone over the cellular network.

31. A method as claimed in claim 21 substantially as herein described, with reference to the figures.

32. A method for operating a control unit for a CCTV system comprising the steps of;
entering control data for a remote camera on a control panel,
transmitting the control data across a communication network to the remote camera,
receiving display data from the remote camera over the communication network,
selecting which display data should be displayed, and
providing public access to the displayed data.

33. A method according to claim 32 wherein the steps of transmitting control data and receiving display data are performed using a packet based system.

34. A method according to claim 32 or 33 wherein the communication network is a telephone network.

35. A method according to claim 32, 33 or 34 where in the network is a cellular network.

36. A method according to claim 32, 33, 34 or 35 wherein the modem is a cellular modem.

37. A method according to claim 32, 33, 34, 35 or 36 wherein the modem is a fixed line modem which can receive and transmit data signals over a PSTN line.

38. A method according to claim 32, 33, 34, 35, 36 or 37 including the step of decompressing compressed display data received from the remote camera.

39. A method according to claim 32, 33, 34, 35, 36, 37 or 38 wherein the control unit can receive audio data.

40. A method as claimed in claim 32 substantially as herein described, with reference to the figures.

INVESTOR IN PEOPLE

Application No: GB 0202390.1 **Examiner:** Jeremy Cowen
Claims searched: 1,12,20,31 **Date of search:** 30 July 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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H4L RAX

Int Cl (Ed.7): H04N 7/18

Other: WPI,EPODOC,PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2253534 A	(Advanced Technology Ind Ltd) - see para 3, page 3 and modem 18	1,2,12-14,20,21,31-33 at least
X	WO 01/06791 A1	(Gonzalez) - see abstract	1,2,12-14,20,21,31-33 at least
X	WO 01/03437 A1	(Cleardata Corporation) - see lines 3-8, pg 5 and modulator (see claim 1)	1,12,20,31 at least
X	WO 97/19558 A1	(Sensormatic Electronics Corp) - see abstract	1,12,20,31 at least
X	US 5886738	(Detection Dynamics Inc) - see abstract & figure 5	1,12,20,31 at least

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