

DATA TRANSMISSION SYSTEM AND METHOD

TECHNICAL FIELD

[0001] The present invention relates to data transmission system and method, more particularly relates to a system for securely transmitting data and a method for securely
5 transmitting data.

BACKGROUND

[0002] Supervisory Control and Data Acquisition (SCADA) system is a computer-based automation system. The SCADA system can be applied to data acquisition, data transmission, analysis and application in electrical power, metallurgy, petroleum, chemical,
10 gas, railway and many other fields to achieve facility and equipment monitoring as well as process control.

[0003] Since SCADA system can be applied to critical infrastructure such as energy supply, which relates to national security and public interest, the security of the data transmission of
15 the system is very important in the event where data needs to be transmitted through wireless transmission or the internet, particularly when the data comes from a remote SCADA system or when using a remote operating device to monitor a remote SCADA system.

SUMMARY

20 [0004] Embodiments of the present invention provide a data transmission system and a method that aids in improving data transmission security. A data transmission system in accordance with one embodiment of the present invention includes a first display device disposed at a first end for displaying an original image generated from raw data, a first
25 capturing device for capturing the original image displayed on the first display device to generate a first image copy; an image transmitting device communicatively coupled to the first capturing device for transmitting the first image copy to a second end; an image receiving device disposed at the second end to receive the first image copy; and an image processing device communicatively coupled to the image receiving device for extracting the
30 raw data from the first image copy.

[0005] Preferably, the image processing device includes a second display device communicatively coupled to the image receiving device for displaying the first image copy; a second capturing device for capturing the first image copy displayed by the second display device to generate a second image copy; an image conversion device disposed at a second
5 end and communicatively coupled to the second capturing device to extract the raw data from the second image copy.

[0006] Preferably, the first capturing device is arranged spaced apart from the first display device, and the second capturing device is arranged spaced apart from the second display
10 device.

[0007] Preferably, the first capturing device and the second capturing device each comprises a distortion-free lens such that the first image copy and the second image copy have no non-linear distortion compared to the original image.

[0008] In accordance with one embodiment, the first end is a first closed network and the second end is a second closed network that is communicatively isolated from the first closed network.

[0009] Preferably, the first closed network is in a first geographical location and the second closed network is in a second geographical location that is communicatively isolated from the first geographical location.

[0010] Preferably, the data transmission system further includes an image generating device communicatively coupled to the first display device to generate the original image based on the raw data and to transmit the original image to the first display device.

[0011] Preferably, the data transmission system further includes a data acquisition device disposed at the first end, the data acquisition device is communicatively coupled to the image
30 generating device to transmit acquired raw data to the image generating device.

[0012] Preferably, the data transmission system further comprises an image controller coupled to the first display device, the image controller being configured to display the same original image on the first display device for at least 2 times, wherein the original image
35 displayed for a first time is at a first position on the first display device, and the original

image displayed for a second time is at a second position offset from the first position on the first display device.

5 [0013] Preferably, the image controller is configured to set coordinate parameters corresponding to at least two display positions that are offset from each other for the same original image, so that the original image is displayed once at each corresponding position on the first display device.

10 [0014] Alternatively, the image controller is configured to generate a plurality of display copies of the same original image, each display copy is set with coordinate parameters that determine its display position and is offset from the position of other display copies, so as to display a display copy of the original image at the corresponding position determined according to the respective coordinate parameters.

15 [0015] A data transmission method according to an embodiment of the present invention includes displaying an original image generated from raw data at a first end; capturing the original image to generate a first image copy; transmitting the first image copy to a second end; and extracting the raw data from the first image copy at the second end.

20 [0016] Preferably, the data transmission method further comprises converting the raw data to the original image at the first end before displaying the original image generated from the raw data at the first end.

25 [0017] Preferably, the data transmission method further comprises acquiring the raw data at the first end before converting the raw data to the original image at the first end.

[0018] Preferably, the data transmission method further comprises encrypting the first image copy before transmitting the first image copy.

30 [0019] Preferably, in the data transmission method, extracting the raw data from the first image copy at the second end comprises receiving and displaying the first image copy; capturing the first image copy to generate a second image copy; and converting the second image copy to the raw data.

35 [0020] Preferably, in the data transmission method, displaying the original image generated by the raw data at the first end comprises displaying the same original image at the first end

for at least 2 times, wherein the original image displayed for a first time is at a first position, and the original image displayed for a second time is at a second position offset from the first position.

5 [0021] Preferably, the data transmission method further includes setting coordinate parameters corresponding to at least two display positions that are offset from each other for the same original image, so that the original image is displayed once in sequence at the at least two display positions.

10 [0022] Preferably, the data transmission method further comprises generating a plurality of display copies of the same original image, each display copy being set with coordinate parameters that determine its display position and is offset from position of other display copies, so as to display a display copy of the original image at each of the corresponding position determined according to the respective coordinate parameters.

15 [0023] In accordance with one embodiment, in the data transmission method, the first end is a first closed network, and the second end is a second closed network that is communicatively isolated from the first closed network.

20 [0024] Preferably, in the data transmission method, the first closed network is in a first geographical location, and the second closed network is in a second geographical location that is communicatively isolated from the first geographical location.

[0025] Other aspects, corresponding technical solutions, beneficial effects and advantages
25 of the present invention will be clearly and comprehensively understood from the following detailed description, which illustrates the inventive concept and technical solutions by way of examples.

BRIEF DESCRIPTION OF THE DRAWINGS

30 [0026] Embodiments of the present invention are disclosed below with reference to the accompanying drawings, in which:

[0027] Fig. 1 is a schematic diagram of a data transmission system in accordance with one
35 embodiment of the present invention.

[0028] Fig. 2 is a schematic flow diagram showing data transmission of the data transmission system shown in Fig. 1.

5 [0029] Fig. 3 is a schematic diagram of a data transmission system in accordance with another embodiment of the present invention.

[0030] Fig. 4A is a schematic diagram of a capturing device of a data transmission system in accordance with one embodiment of the present invention.

10 [0031] Fig. 4B is a schematic diagram showing a display status of an original image in accordance with one embodiment of the present invention.

[0032] Fig. 4C is a schematic diagram of an image copy generated by the original image as shown in FIG. 4B in accordance with one embodiment of the present invention.

15 [0033] Fig. 5 is a schematic diagram of a non-linearly distortion or distorted image captured by a conventional camera head.

20 [0034] Fig. 6A is a schematic diagram illustrating an image displayed in multiple times in accordance with one embodiment of the present invention.

[0035] Fig. 6B is a schematic diagram of the image shown in FIG. 6A being captured to generate an initial copy of the image and compensated/corrected to obtain a collated copy of the image.

25 [0036] Fig. 7A is a schematic diagram of a data transmission method in accordance with one embodiment of the present invention.

30 [0037] Fig. 7B is a schematic diagram of a data transmission method in accordance with another embodiment of the present invention.

DESCRIPTION OF THE EMBODIMENTS

35 [0038] As shown in FIG. 1 and FIG. 2, a data transmission system 10 according to an embodiment of the present invention includes a first display device 208 disposed at a first end 200, a first capturing device 210 arranged spaced apart from the first display device 208, an image transmitting device 214 communicatively coupled to, for example, in electrical

signal communication with, the first capturing device 210, an image receiving device 414 in electrical signal communication with the image transmitting device 214, and an image processing device 413 in electrical signal communication with the image receiving device 414. The first display device 208 and the first capturing device 210 are in an electrical signal communication isolation state, which is limited to capturing an image displayed on the first display device 208 via the first capturing device 210.

[0039] The first display device 208 may be an LED display device, a projector, or other device that can display an image. The first capturing device 210 may be a digital camera, a webcam, or other device that can capture and store visual images. The image transmitting device 214 may be a wireless signal transmitter for transmitting an image captured by the first capturing device 210 by way of, for example, video streaming. The image transmitting device 214 and the first capturing device 210 may be independent but electrically coupled devices, or may be an integrated device which has image and/or video capturing and transmitting functions, such as a web camera or a web video camera.

[0040] Preferably, the data transmission system 10 may further include a data acquisition device 202 disposed at the first end 200, a sensor 201 and a data processing device 204 that are respectively communicatively coupled to the data acquisition device 202, and an image generating device 206 that is communicatively coupled to the data processing device 204.

[0041] The data acquisition device 202 may acquire raw data 502 associated with the first end 200, such as temperature data, pressure data, vibration data, etc., via various sensors 201. The data processing device 204 receives and formats the raw data 502 acquired by the data acquisition device 202 to obtain formatted raw data 504 and stores the formatted raw data. The image generating device 206 receives the formatted raw data 504 and converts the formatted raw data 504 into an original image 506 representing the raw data 502, such as a two-dimensional code (QR code), a linear barcode, a PDF417 barcode, or a digital image in other formats, etc. The original image 506 is displayed by the first display device 208.

[0042] Alternatively, the first display device 208 may also obtain and display the original image generated by the raw data through other methods, such as obtaining and displaying the original image through a scanner input method, thereby eliminating the data acquisition device 202, the data processing device 204, and the image generating device 206.

[0043] The first end 200 and the second end 400 may be independent closed networks that are isolated from electrical signal communication with the external environment, such as dedicated local area networks, located at the same or respectively in different geographical
5 locations, and the electrical signal communication is isolated, for example, by operating independently from each other and from the external environment, and other electrical signal communication isolated independent facilities such as power stations, power plants, power grid sub-control centres, power grid general control centres and other facilities.

10 [0044] The first end 200 and the second end 400 may also be open networks that are in electrical signal communication with an external environment. The critical or sensitive data between the first end 200 and the second end 400 can be transmitted with high level of security and confidentiality through the technical solution provided by the embodiments of the present invention.

15 [0045] The first capturing device 210 has a capturing field of view 212. In this embodiment, the first capturing device 210 is disposed outside of the first end 200 and is arranged spaced apart from the first display device 208, for example, at a distance of 0.5 to 1 meter, so that the first display device 208 is located within the capturing field of view 212. Thus, the first
20 capturing device 210 is able to capture the original image 506 displayed by the first display device 208.

[0046] The first capturing device 210 captures the original image 506 displayed by the first display device 208 to generate a first image copy 508. The first image copy 508 is
25 transmitted to the image receiving device 414 via a communication channel 300 through the image transmitting device 214.

[0047] The image processing device 413, which is in electrical signal communication with the image receiving device 414, receives the first image copy 508 transmitted by the image
30 receiving device 414 and, extracts from the first image copy 508 the image data that generates the first image copy 508. Since the first image copy 508 is the same as the original image 506, the image data extracted from the first image copy 508 is the raw data that is used to generate the original image 506, i.e., the formatted raw data 504 as described above.

[0048] The image processing device 413 may further include a data restoration device 404 and a user interface 402 that is in electrical signal communication with the data restoration device 404. The data restoration device 404 converts the formatted raw data 504 into raw data 502 and displays on the user interface 402, thereby completing the transmission of raw data 502 from the first end 200 to the second end 400.

[0049] In accordance with a preferred embodiment, the image processing device 413 includes a second display device 410 that is in electrical signal communication with the image receiving device 414; a second capturing device 408 that is disposed at the second end 400; an image conversion device 406 that is in electrical signal communication with the second capturing device 408; the image restoration device 404 that is in electrical signal communication with the image conversion device 406; and the user interface 402 that is in electrical signal communication with the image restoration device 404. The first image copy 508 is transmitted to the image receiving device 414 via the communication channel 300 through the image transmitting device 214 and is displayed on the second display device 410.

[0050] The second display device 410 is disposed outside of the second end 400 and adjacent to a boundary of the second end 400. The second capturing device 408 is disposed within the second end 400. The second capturing device 408 has a capturing field of view 412. The second capturing device 408 is arranged spaced apart from the second display device 410, for example, at a distance of 0.5 to 1 meter, so that the second display device 408 is located within the capturing field of view 412, thereby allowing the second capturing device 408 to capture the first image copy 508 displayed by the second display device 410 to generate a second image copy 510. The second display device 410 and the second capturing device 408 are in electrical signal communication isolation state, which is limited to capturing an image displayed on the second display device 410 via the second capturing device 408.

[0051] The second display device 410 may be an LED display device, a projector, or other device that can display a visual image. The second capturing device 408 may be a digital camera, a camera head, or other device that can capture visual images. The second image copy 510 generated by the second capturing device 408 is transmitted to the image conversion device 406 via the internal communication network of the second end 400. The

image conversion device 406 is used to convert the second image copy 510 into corresponding formatted image data 504. The data restoration device 404 converts the formatted image data into raw data 502, thereby completing the transmission of the raw data 502 from the first end 200 to the second end 400. The raw data 502 can be displayed on the user interface 402 for purposes such as monitoring the first end 200 from the second end 400, data analysis and subsequent data processing.

[0052] In another embodiment shown in FIG. 3, the first end 200 is located in a first geographical location, such as in country A. The second end 400 is located in another geographical location, such as in Country B. The first capturing device 210 is disposed within the first end 200 and is isolated from electrical signal communication with other facilities of the first end 200, and the first capturing device 210 is limited to capturing an image displayed on the first display device 208 via the first capturing device 210. The image receiving device 414 is in electrical signal communication with the image transmitting device 214. The second display device 410 is disposed within the second end 400 and is in electrical signal communication with the image receiving device 414.

[0053] The first display device 208 is located within the first end 200 and is used for displaying an original image 506 generated from the raw data associated with the first end 200. The first capturing device 210 is located within the first end 200 and is arranged spaced apart from the first display device 208 for capturing the original image 506 displayed by the first display device 208 to generate a first image copy 508. The first image copy 508 is transmitted to the image receiving device 414 provided at the second end 400 via the communication channel 300 and is displayed on the second display device 410 which is in electrical signal communication with the image receiving device 414.

[0054] The second display device 410 is disposed within the second end 400 and is isolated from electrical signal communication with other facilities of the second end 400, and is limited to capturing image displayed on the second display device 410 via the second capturing device 408. The second capturing device 408 is arranged spaced apart from the second display device 410 and is used for capturing the first image copy 508 displayed by the second display device 410 to generate a second image copy 510. The image conversion device 406, which is in electrical signal communication with the second capturing device 408, converts the second image copy 510 into corresponding formatted image data 504. The

data restoration device 404, which is in electrical signal communication with the image conversion device 406, converts the formatted image data 504 into raw data 502, thereby completing the data transmission from the first end 200 to the second end 400. The raw data 502 may be directly displayed on the user interface 402 that is in electrical signal communication with the data restoration device 404 for use in purposes such as monitoring the first end 200 from the second end 400, data analysis, and subsequent data processing.

[0055] During operation of the system, the data acquisition device 202 acquires the raw data associated with the first end 200 via sensors 201, such as temperature data, pressure data, vibration data, etc. The data acquisition device 202 acquires the raw data 502 at a predetermined time interval, such as every millisecond, every second, every minute, etc., and transmits the acquired raw data 502 to the data processing device 204. The data processing device 204 converts the raw data 502 into formatted raw data 504, such as CSV file, DOT file, HTML file, etc., and transmits to the image generating device 206. The image generating device 206 transforms the formatted raw data 504 to generate an original image 506 representing the formatted raw data 504, such as a two-dimensional code (QR code), a linear barcode, a PDF417 barcode, or a data image in other formats. The image generating device 206 may also convert the formatted raw data 504 into a dynamic original image, such as a real-time video image, a dynamic waveform, a dynamic chart, etc. The image generating device 206 may also directly generate the original image 506 from the raw data 502, so as to eliminate the need to format the raw data 502. Thereafter, the original image 506 is displayed at the same time interval via the first display device 208 that is in electrical signal communication with the image generating device 206.

[0056] The first capturing device 210 that is arranged spaced apart from the first display device 208 captures the original image 506 displayed by the first display device 208 to generate a first image copy 508, and then transmits the first image copy 508 to the second display device 410 via the image transmitting device 214 through the network communication channel 300 such as the Internet, a local area network, a virtual private network (VPN, Virtual Private Network), etc. The image transmitting device may also generate an encrypted image using an encryption algorithm so as to improve the security of data transmission. The first capturing device 210 is arranged spaced apart from the first display device 208 and is isolated from electrical signal communication with each other, and is limited to capturing an image displayed on the first display device 208 via the first

capturing device 210. As the displayed original image is data with a read-only attribute, an attempt to invade the first end 200 from outside of the first end 200, rewrite the image, or overwrite the data through the first display device 208 can be effectively prevented.

5 [0057] The second display device 410 receives and displays the first image copy 508. The second capturing device 408, which is arranged spaced apart from the second display device 410, captures the first image copy 508 displayed by the second display device 410 to generate a second image copy 510. The second capturing device 408 is arranged spaced
10 apart from the second display device 410 and is isolated from electrical signal communication with each other, and is limited to capturing an image displayed on the second display device 410 via the second capturing device 408, so that an attempt to invade the second end 400 from outside of the second end 400, rewrite the image, or overwrite the data through the second capturing device 408 can be effectively prevented.

15 [0058] The image conversion device 406 extracts the formatted raw data 504 from the second image copy 510 generated by the second capturing device 408, for example, through two-dimensional code decoding, linear code decoding, optical character recognition (OCR, Optical Character Recognition), etc. to generate formatted raw data 504 e.g., CSV file, DOT file, HTML file, etc. The data restoration device 404 may reinstate the formatted data 504,
20 by restoring the raw data 502, and provide it to the user via the user interface 402, so as to effect data transmission from the first end 200 to the second end 400.

[0059] The first capturing device 210 is arranged spaced apart from the first display device 208 such that the first display device 208 is located within the field of view 212 of the first
25 capturing device 210. Similarly, the second capturing device 408 is located within the field of view 412 of the second display device 410. The separation distance between the first capturing device 210 and the first display device 208, and the separation distance between the second capturing device 408 and the second display device 410 may be configured as a capturing distance that allows the first capturing device 210 to conveniently and accurately
30 capture the original image 506 and generates the first image copy 508, and allows the second capturing device 408 to conveniently and accurately capture the first image copy 508 to generate a second image copy 510, such as at 0.5 meters or 1 meter, etc. In comparison with conventional image reading device, such as a QR code reader, a barcode scanner, etc., the first capturing device 210 and the second capturing device 408 provided by the embodiments

of the present invention have longer image capturing and reading distance and thus can provide a wide range of capturing position configurations, and the capturing distance can be adjusted according to different environmental needs.

5 [0060] In order to increase the image capturing quality and accuracy under the above-mentioned capturing distance conditions, as shown in FIG. 4A, the first capturing device 210 and the second capturing device 408 each includes a distortion-free lens 800, so that the first image copy 508 and the second image copy 510 (FIG. 4C) derived from the image capturing are not non-linearly distorted as compared with the original image 506 (FIG. 4B)
10 displayed on first display device 208, thereby avoiding the generation of non-linear distortion or distorted image 590 (e.g., FIG. 5) by using a conventional camera, which causes the possibility of data restoration failure or error.

[0061] As shown in FIG. 1, FIG. 2, FIG. 3, FIG. 6A and FIG. 6B, preferably, the data
15 transmission system 10 provided by the embodiment of the present invention further includes an image controller 207 coupled to the first display device 208 for repeatedly displaying the same original image 506 on the display device 208. For example, the same original image 506 is repeatedly displayed for two or more times, and particularly starting from the second display, the position of the image 5062 displayed each time is offset relative
20 to the position of the image previously displayed on the first display device 208. For example, for a rectangular two-dimensional image of 1100×1100 image size units, according to the technical solution provided by the embodiment of the present invention, the same image is configured to be repeatedly displayed for three times on the first display device 208, with the upper left corner of the image being the position reference point, the respective
25 coordinates of the reference point being displayed three times are: position 611 (810, 45), position 612 (830, 60), and position 613 (750, 70).

[0062] The image controller 207 is configured to set coordinate parameters corresponding to at least two display positions for the same original image, each of which is offset from
30 each other for the same original image, so that the original image is displayed once at each corresponding position on the first display device 208. Alternatively, the image controller 207 is configured to generate a plurality of display copies 5062 from the same original image, and each display copy is set with coordinate parameters that determine its display position and are offset from the positions of other display copies. The image controller 207

sequentially transmits the plurality of display copies to the first display device 208 such that a display copy 5062 of the original image 506 is sequentially displayed on the first display device 208 at corresponding positions determined by the respective coordinate parameters.

5 [0063] The same original image 506 is sequentially displayed at the offset position on the first display device 208 and a plurality of display copies 5062 of the same original image 506 are generated and sequentially displayed at the offset position on the first display device 208. Accordingly, the first capturing device 210 will also obtain a plurality of initial copies of first image 5082 of the same original image and compare the obtained plurality initial
10 copies of first image 5082. In the case where a defect appears on an initial copy first image 5082 which is not due to the quality of the original image, for example, when some parts of the picture are blurred due to external reasons, missing pixels, etc., which causes the entire captured image fail to be properly restored to the raw data, the quality defect 5083 of an initial copy of the image can be compensated and/or corrected by capturing the original
15 image to obtain another one or multiple copies of the original image at one or more offset positions, and comparing with said another one or multiple copies of the original image, thereby obtaining a collated copy of first image 5084 so as to meet the quality requirements and can be restored to the correct raw data.

20 [0064] Additionally, or alternatively, the data transmission system 10 provided by the embodiment of the present invention further includes an image controller 407 coupled to the second display device 410 for continuously and repeatedly displaying on the second display device 410 as described above the initial copy of first image 5082, or alternatively generates multiple copies of the initial copy of first image 508 and sequentially displaying the multiple
25 copies. Similarly, the quality defect of an initial copy of the image can be compensated and/or corrected by capturing the original image to obtain another one or multiple copies of the original image at one or more offset positions, and comparing with said another one or multiple copies of the original image, thereby obtaining the collated copy of first image 5084 so as to meet the quality requirements and can be restored to the correct raw data.

30 [0065] As shown in FIG. 7A, a data transmission method 700 according to an embodiment of the present invention includes: displaying an original image generated by raw data at a first end, as shown in block 706; capturing the displayed original image to generate a first image copy, as shown in block 710; transmitting the first image copy to a second end, as

shown in block 716, and extracting the raw data from the first image copy at the second end, thereby realizing the transmission of the raw data from the first end to the second end, as shown in block 720.

5 [0066] Preferably, as shown in FIG. 7B, the data transmission method 700 further includes: before displaying the original image, acquiring the raw data at the first end, as shown in block 702; and converting the acquired raw data at the first end to an image, as shown in block 704. In the data transmission method 700, displaying the original image generated from the raw data at the first end, as shown in the block 706, further includes repeatedly
10 displaying the same image at a position offset from a first display position of the original image, as shown in block 708. The data transmission method 700 further includes encrypting the first image copy prior to transmitting the first image copy to the second end, as shown in block 714. Preferably, extracting the raw data from the first image copy at the second end further includes displaying the first image copy, as shown in block 722; taking the first image
15 copy at the second end to generate a second image copy, as shown in block 724; and restoring the second image copy to the raw data, as shown in block 726.

[0067] The present application provides a clear and complete disclosure of the present general inventive concept and technical solutions through the above description of the
20 embodiments and the accompanying drawings. The scope of the invention should not be construed as being limited by the specific embodiments described herein. Various changes, substitutions and/or modifications of the present invention in its general concept and the corresponding embodiments of the present invention are to be understood by those skilled in the art as falling within the scope of the protection as defined by the appended claims.

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CLAIMS

1. A data transmission system comprising:
 - a first display device disposed at a first end for displaying an original image generated from raw data;
 - a first capturing device for capturing the original image to generate a first image copy;
 - an image transmitting device communicatively coupled to the first capturing device for transmitting the first image copy;
 - an image receiving device communicatively coupled to the image transmitting device for receiving the first image copy; and
 - an image processing device communicatively coupled to the image receiving device for extracting the raw data from the first image copy.
2. The data transmission system according to claim 1, wherein the image processing device comprises:
 - a second display device communicatively coupled to the image receiving device for displaying the first image copy;
 - a second capturing device for capturing the first image copy displayed by the second display device to generate a second image copy; and
 - an image conversion device disposed at a second end and communicatively coupled to the second capturing device to extract the raw data from the second image copy.
3. The data transmission system according to claim 1 or 2, wherein the first capturing device is arranged spaced apart from the first display device, and/or the second capturing device is arranged spaced apart from the second display device.
4. The data transmission system according to claim 1 or 2, wherein the first capturing device comprises a distortion-free lens such that the first image copy has no non-linear distortion compared to the original image, and/or the second capturing device

includes a distortion-free lens such that the second image copy has no non-linear distortion compared to the original image.

- 5 5. The data transmission system of claim 2 wherein the first end is a first closed network
 and the second end is a second closed network that is communicatively isolated from
 the first closed network.
- 10 6. The data transmission system of claim 5 wherein the first closed network is in a first
 geographical location and the second closed network is in a second geographical
 location that is communicatively isolated from the first geographic location.
- 15 7. The data transmission system according to claim 1, further comprising an image
 generating device communicatively coupled to the first display device for generating
 the original image based on the raw data and transmitting the original image to the
 first display device.
- 20 8. The data transmission system according to claim 7, further comprising a data
 acquisition device arranged at the first end, wherein the data acquisition device is
 communicatively coupled to the image generating device to transmit acquired raw
 data to the image generating device.
- 25 9. The data transmission system according to claim 1, further comprising an image
 controller coupled to the first display device, the image controller being configured
 to display an original image on the first display device for at least two times, wherein
 the original image displayed for a first time is at a first position on the first display
 device, and the original image displayed for a second time is at a second position
 offset from the first position on the first display device.
- 30 10. The data transmission system according to claim 9, wherein the image controller is
 configured to set coordinate parameters corresponding to at least two display
 positions that are offset from each other for the same original image, so that the
 original image is displayed once at each corresponding position on the first display
 device.

11. The data transmission system according to claim 9, wherein the image controller is configured to generate at least two display copies of the original image, each display copy is set with a coordinate parameter that determines its display position and is offset from the position of other display copy, so that a display copy of the original image is displayed in sequence on the first display device in accordance with the respective position determined by the respective coordinate parameters.
12. A data transmission method comprising:
- displaying an original image generated from raw data at a first end;
 - capturing the original image to generate a first image copy;
 - transmitting the first image copy to a second end; and
 - extracting the raw data from the first image copy at the second end.
13. The data transmission method according to claim 12, further comprising converting the raw data to the original image at the first end before displaying the original image generated from the raw data at the first end.
14. The data transmission method according to claim 12, further comprising acquiring the raw data at the first end before converting the raw data to the original image at the first end.
15. The data transmission method according to claim 12, further comprising encrypting the first image copy before transmitting the first image copy.
16. The data transmission method according to claim 12, wherein extracting the raw data from the first image copy at the second end comprises:
- receiving and displaying the first image copy;
 - capturing the first image copy to generate a second image copy; and
 - converting the second image copy to the raw data.
17. The data transmission method according to claim 12, wherein displaying the original image generated from the raw data at the first end comprises:
- displaying the original image at the first end for at least two times, wherein the original image displayed for a first time is at a first position, and the original image displayed for a second time is at a second position offset from the first position.

18. The data transmission method according to claim 17, further comprising setting coordinate parameters corresponding to at least two display positions that are offset from each other for the same original image, so that the original image is displayed once in sequence at each of the at least two display positions.
19. The data transmission method according to claim 12, further comprising generating a plurality of display copies of the original image, each display copy being set with coordinate parameters that determine its display position and is offset from position of other display copies, so as to display a display copy of the original image at each of the corresponding position determined according to the respective coordinate parameters.
20. The data transmission method according to claim 12, wherein the first end is a first closed network, and the second end is a second closed network that is communicatively isolated from the first closed network.
21. The data transmission method according to claim 20, wherein the first closed network is in a first geographical location, and the second closed network is in a second geographical location that is communicatively isolated with the first geographic location.
22. The data transmission method according to claim 12, wherein transmitting the first image copy to the second end comprises transmitting the first image copy to a display device disposed outside of the second end.
23. The data transmission method according to claim 12, wherein transmitting the first image copy to the second end comprises transmitting the first image copy to a display device disposed within the second end.
24. The data transmission method according to claim 17, further comprising:
capturing the original image displayed at least two times at the first end to generate at least two initial copies of first image, and
comparing the at least two initial copies of the first image, compensating and/or correcting the initial copy of the first image to obtain a collated copy of first image.

25. The data transmission method according to claim 19, further comprising:

capturing the displayed plurality of display copies to generate a plurality of initial copies of first image, and

5 comparing the plurality of initial copies of the first image, compensating and/or correcting the initial copy of the first image to obtain a collated copy of first image.