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(54) **INTERCONNECTED CAMERA SYSTEM WITH INSERTION CARDS**

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Related U.S. Application Data

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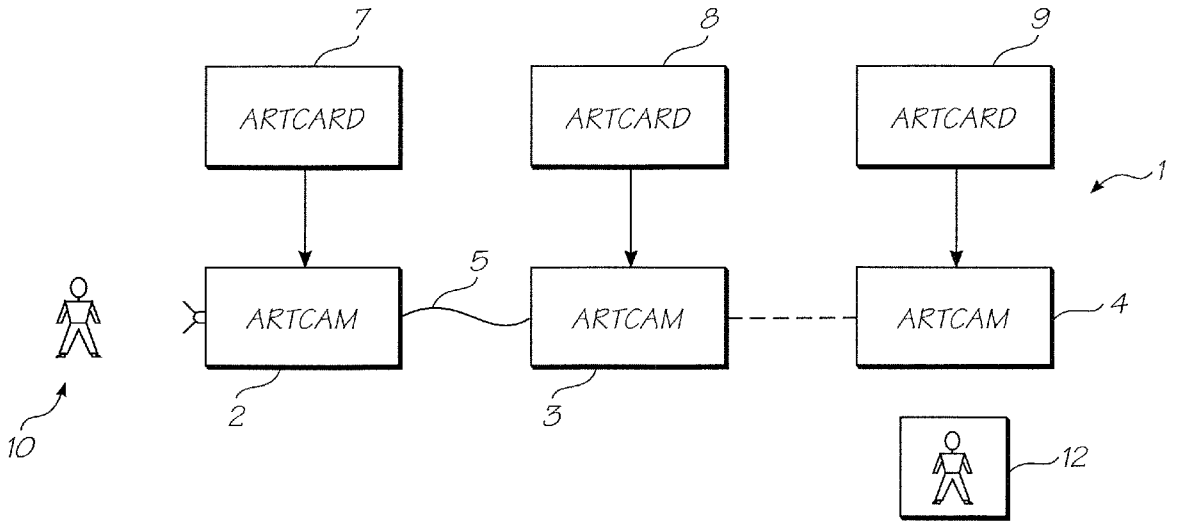
(57) **ABSTRACT**

An interconnected camera system includes a number of cameras interconnected via a data communications protocol. Each camera has an image sensor configured to capture an image. A card is configured to be inserted into each camera. The card has encoded thereon various instructions for the manipulation of the captured image. A processor is configured to manipulate the captured image in accordance with the encoded instructions.



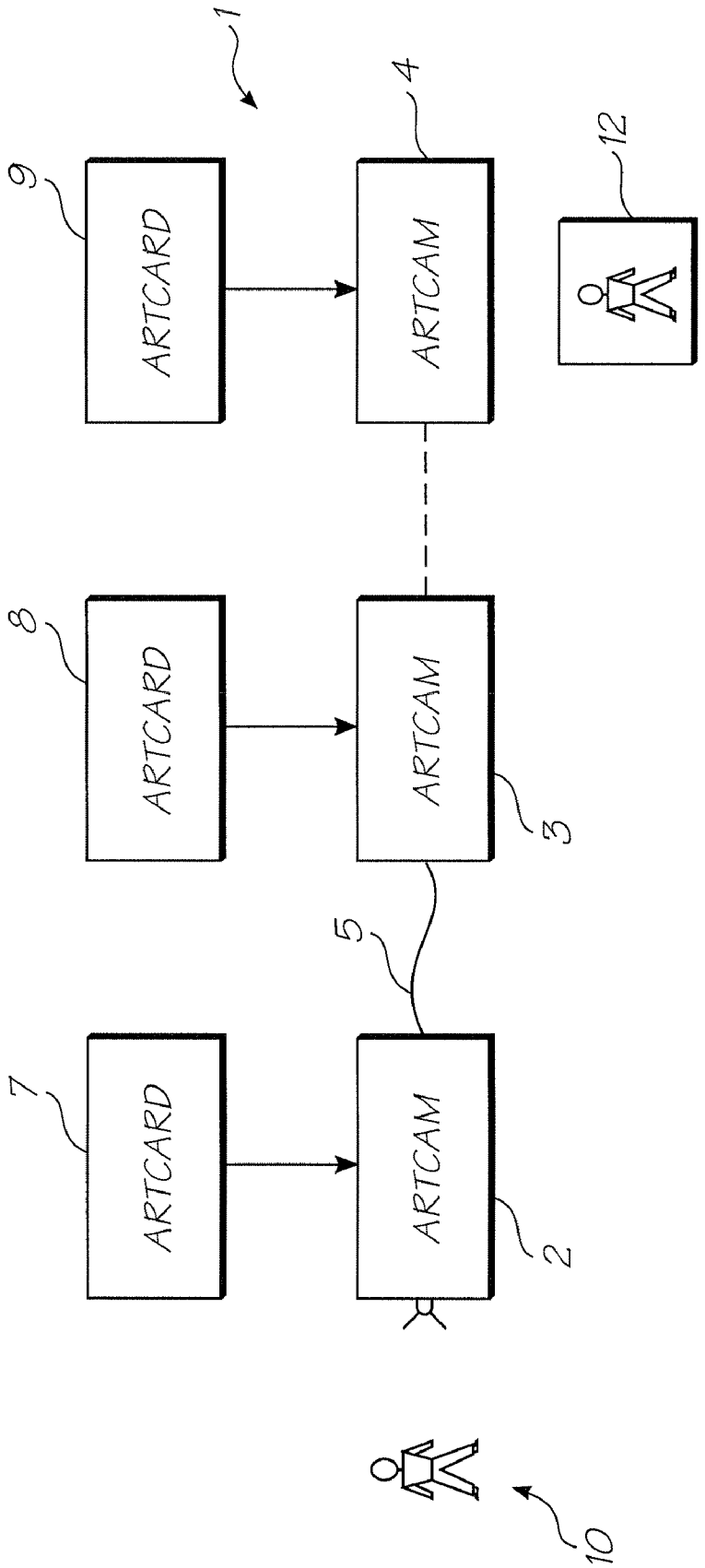

1
4
12
9
ARTCARD
ARTCAM
8
ARTCARD
ARTCAM
3
5
7
ARTCARD
ARTCAM
2
10

FIG. 1

INTERCONNECTED CAMERA SYSTEM WITH INSERTION CARDS

CROSS REFERENCES TO RELATED APPLICATIONS

[0001] This Application is a Continuation of U.S. Ser. No. 10/642,331 filed on Aug. 18, 2003, which is a Divisional Application of U.S. Ser. No. 09/112,757 filed on Jul. 10, 1998, now Issued U.S. Pat. No. 6,624,848 all of which are herein incorporated by reference.

[0002] The following Australian provisional patent applications are hereby incorporated by cross-reference. For the purposes of location and identification, U.S. patent applications identified by their U.S. patent application serial numbers (U.S. Ser. No.) are listed alongside the Australian applications from which the U.S. patent applications claim the right of priority.

CROSS-REFERENCED AUSTRALIAN PROVISIONAL PATENT APPLICATION NO.	US PATENT/ PATENT APPLICATION (CLAIMING RIGHT OF PRIORITY FROM AUSTRALIAN PROVISIONAL APPLICATION)	DOCKET NO.
PO7991	6750901	ART01US
PO8505	6476863	ART02US
PO7988	6788336	ART03US
PO9395	6322181	ART04US
PO8017	6597817	ART06US
PO8014	6227648	ART07US
PO8025	6727948	ART08US
PO8032	6690419	ART09US
PO7999	6727951	ART10US
PO8030	6196541	ART13US
PO7997	6195150	ART15US
PO7979	6362868	ART16US
PO7978	6831681	ART18US
PO7982	6431669	ART19US
PO7989	6362869	ART20US
PO8019	6472052	ART21US
PO7980	6356715	ART22US
PO8018	6894694	ART24US
PO7938	6636216	ART25US
PO8016	6366693	ART26US
PO8024	6329990	ART27US
PO7939	6459495	ART29US
PO8501	6137500	ART30US
PO8500	6690416	ART31US
PO7987	7050143	ART32US
PO8022	6398328	ART33US
PO8497	7110024	ART34US
PO8020	6431704	ART38US
PO8504	6879341	ART42US
PO8000	6415054	ART43US
PO7934	6665454	ART45US
PO7990	6542645	ART46US
PO8499	6486886	ART47US
PO8502	6381361	ART48US
PO7981	6317192	ART50US
PO7986	6850274	ART51US
PO7983	09/113054	ART52US
PO8026	6646757	ART53US
PO8028	6624848	ART56US
PO9394	6357135	ART57US
PO9397	6271931	ART59US
PO9398	6353772	ART60US
PO9399	6106147	ART61US
PO9400	6665008	ART62US
PO9401	6304291	ART63US
PO9403	6305770	ART65US

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CROSS-REFERENCED AUSTRALIAN PROVISIONAL PATENT APPLICATION NO.	US PATENT/ PATENT APPLICATION (CLAIMING RIGHT OF PRIORITY FROM AUSTRALIAN PROVISIONAL APPLICATION)	DOCKET NO.
PO9405	6289262	ART66US
PP0959	6315200	ART68US
PP1397	6217165	ART69US
PP2370	6786420	DOT01US
PO8003	6350023	Fluid01US
PO8005	6318849	Fluid02US
PO8066	6227652	IJ01US
PO8072	6213588	IJ02US
PO8040	6213589	IJ03US
PO8071	6231163	IJ04US
PO8047	6247795	IJ05US
PO8035	6394581	IJ06US
PO8044	6244691	IJ07US
PO8063	6257704	IJ08US
PO8057	6416168	IJ09US
PO8056	6220694	IJ10US
PO8069	6257705	IJ11US
PO8049	6247794	IJ12US
PO8036	6234610	IJ13US
PO8048	6247793	IJ14US
PO8070	6264306	IJ15US
PO8067	6241342	IJ16US
PO8001	6247792	IJ17US
PO8038	6264307	IJ18US
PO8033	6254220	IJ19US
PO8002	6234611	IJ20US
PO8068	6302528	IJ21US
PO8062	6283582	IJ22US
PO8034	6239821	IJ23US
PO8039	6338547	IJ24US
PO8041	6247796	IJ25US
PO8004	6557977	IJ26US
PO8037	6390603	IJ27US
PO8043	6362843	IJ28US
PO8042	6293653	IJ29US
PO8064	6312107	IJ30US
PO9389	6227653	IJ31US
PO9391	6234609	IJ32US
PP0888	6238040	IJ33US
PP0891	6188415	IJ34US
PP0890	6227654	IJ35US
PP0873	6209989	IJ36US
PP0993	6247791	IJ37US
PP0890	6336710	IJ38US
PP1398	6217153	IJ39US
PP2592	6416167	IJ40US
PP2593	6243113	IJ41US
PP3991	6283581	IJ42US
PP3987	6247790	IJ43US
PP3985	6260953	IJ44US
PP3983	6267469	IJ45US
PO7935	6224780	IJM01US
PO7936	6235212	IJM02US
PO7937	6280643	IJM03US
PO8061	6284147	IJM04US
PO8054	6214244	IJM05US
PO8065	6071750	IJM06US
PO8055	6267905	IJM07US
PO8053	6251298	IJM08US
PO8078	6258285	IJM09US
PO7933	6225138	IJM10US
PO7950	6241904	IJM11US
PO7949	6299786	IJM12US
PO8060	6866789	IJM13US
PO8059	6231773	IJM14US
PO8073	6190931	IJM15US
PO8076	6248249	IJM16US
PO8075	6290862	IJM17US
PO8079	6241906	IJM18US

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CROSS-REFERENCED AUSTRALIAN PROVISIONAL PATENT APPLICATION NO.	US PATENT/ PATENT APPLICATION (CLAIMING RIGHT OF PRIORITY FROM AUSTRALIAN PROVISIONAL APPLICATION)	DOCKET NO.
PO8050	6565762	IJM19US
PO8052	6241905	IJM20US
PO7948	6451216	IJM21US
PO7951	6231772	IJM22US
PO8074	6274056	IJM23US
PO7941	6290861	IJM24US
PO8077	6248248	IJM25US
PO8058	6306671	IJM26US
PO8051	6331258	IJM27US
PO8045	6110754	IJM28US
PO7952	6294101	IJM29US
PO8046	6416679	IJM30US
PO9390	6264849	IJM31US
PO9392	6254793	IJM32US
PP0889	6235211	IJM35US
PP0887	6491833	IJM36US
PP0882	6264850	IJM37US
PP0874	6258284	IJM38US
PP1396	6312615	IJM39US
PP3989	6228668	IJM40US
PP2591	6180427	IJM41US
PP3990	6171875	IJM42US
PP3986	6267904	IJM43US
PP3984	6245247	IJM44US
PP3982	6315914	IJM45US
PP0895	6231148	IR01US
PP0869	6293658	IR04US
PP0887	6614560	IR05US
PP0885	6238033	IR06US
PP0884	6312070	IR10US
PP0886	6238111	IR12US
PP0877	6378970	IR16US
PP0878	6196739	IR17US
PP0883	6270182	IR19US
PP0880	6152619	IR20US
PO8006	6087638	MEMS02US
PO8007	6340222	MEMS03US
PO8010	6041600	MEMS05US
PO8011	6299300	MEMS06US
PO7947	6067797	MEMS07US
PO7944	6286935	MEMS09US
PO7946	6044646	MEMS10US
PP0894	6382769	MEMS13US

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0003] Not applicable.

FIELD OF THE INVENTION

[0004] The present invention relates to a data processing method and apparatus and, in particular, discloses a Multi Artcam System.

[0005] The present invention further relates to the field of image processing and to user interface mechanisms for performing image processing.

BACKGROUND OF THE INVENTION

[0006] Recently, in Australia Provisional Patent Specification entitled "Image Processing Method and Apparatus (Art01)" filed concurrently by the present applicant, a system has been proposed known colloquially as "Artcam" which is a digital camera having an integral printer for printing out sensed images in addition to manipulations of the sensed image which are manipulated as a result of the insertion of a "Artcard" having manipulation instructions thereon into the camera.

SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to provide for a multi effect system to provide enhanced image effects.

[0008] In accordance with a first aspect of the present invention, there is provided a camera for creating and displaying a manipulated image, the camera comprising:

[0009] (a) image capture means configured to capture a real image and convert it to captured image data;

[0010] (b) input means configured to receive input image data from a source other than the camera;

[0011] (c) image manipulation means configured to receive the input image data from the input means and manipulate it to form a manipulated image;

[0012] (d) output means configured to receive the manipulated image from the image manipulation means and to output the manipulated image from the camera; and

[0013] (e) display means configured to receive the manipulated image from the image manipulation means and to display the manipulated image.

[0014] Preferably, the input means is configured to receive the input image from an input-image-providing camera.

[0015] Preferably, some or all of the input and output means comprise at least one USB or Firewire port.

[0016] In a preferred form, the output means is configured to output the manipulated image to a manipulated-image-receiving camera.

[0017] It is particular preferred that the display means comprise a printer device, the display means being configured to display the manipulated image by printing it.

[0018] It is also preferred that the camera further comprise a storage-device reader configured to read image manipulation instructions stored on a manipulation-instruction storage-device. In this case, it is preferred that the image manipulation means is configured to generated the manipulated image by manipulating the input image in accordance with image manipulation instructions received from a manipulation-instruction storage-device via the storage-device reader.

[0019] In accordance with a second aspect of the invention, there is provided a plurality of cameras for creating a manipulated image, the plurality of cameras including:

[0020] (a) a primary camera, comprising:

[0021] (i) image capture means configured to capture a real image as a primary captured image;

[0022] (ii) image manipulation means configured to manipulate the primary captured image to form a primary manipulated image;

[0023] (iii) image providing means configured to receive the primary manipulated image from the image

manipulation means and provide the primary manipulated image to a secondary camera; and

[0024] (b) a secondary camera, comprising:

[0025] (i) image capture means configured to capture a real image as a secondary captured image;

[0026] (ii) image receiving means configured to receive the primary manipulated image from the image providing means of the primary camera; and

[0027] (iii) image manipulation means configured to receive the primary manipulated image from the image receiving means and manipulate the primary manipulated image to form a secondary manipulated image.

[0028] Preferably, the secondary camera further comprises display means configured to receive the secondary manipulated image from the image manipulation means and display it. More preferably, the display means comprises a printer device configured to print the secondary manipulated image.

[0029] In accordance with a third aspect of the invention, there is provided a method for forming a manipulated image, the method comprising the steps of:

[0030] (a) providing a primary camera, the primary camera comprising:

[0031] (i) image capture means;

[0032] (ii) image manipulation means; and

[0033] (iii) image providing means; and

[0034] (b) providing a secondary camera, the secondary camera comprising:

[0035] (i) image capture means;

[0036] (ii) image receiving means; and

[0037] (iii) image manipulation means, the primary camera performing the steps of:

[0038] (c) capturing a real image as a captured image using the image capture means;

[0039] (d) manipulating the captured image using the image manipulation means to form a primary manipulated image;

[0040] (e) providing the primary manipulated image to the secondary camera via the image providing means; and

the secondary camera performing the steps of:

[0041] (f) receiving the primary manipulated image from the image providing means of the primary camera via the image receiving means of the secondary camera; and

[0042] (g) manipulating the primary manipulated image using the image manipulation means to form a secondary manipulated image.

[0043] In other aspects, the invention comprises manipulated images from primary or secondary cameras, the images preferably being in printed form,

BRIEF DESCRIPTION OF THE DRAWINGS

[0044] Notwithstanding any other forms which may fall within the scope of the present invention, preferred forms of the invention will now be described, by way of example only, with reference to the accompanying drawings which:

[0045] FIG. **1** illustrates the form of interconnection of the preferred embodiment.

DESCRIPTION OF PREFERRED AND OTHER EMBODIMENTS

[0046] The preferred embodiment is preferably implemented through suitable programming of a hand held camera device such as that described in Australian Provisional Patent Application entitled "Image Processing Method and Apparatus (ART01)" filed concurrently herewith by the present applicant the content of which is hereby specifically incorporated by cross reference.

[0047] The aforementioned patent specification discloses a camera system, hereinafter known as an "Artcam" type camera, wherein sensed images can be directly printed out by an Artcam portable camera unit. Further, the aforementioned specification discloses means and methods for performing various manipulations on images captured by the camera sensing device leading to the production of various effects in any output image. The manipulations are disclosed to be highly flexible in nature and can be implemented through the insertion into the Artcam of cards having encoded thereon various instructions for the manipulation of images, the cards hereinafter being known as Artcards. The Artcam further has significant onboard processing power by an Artcam Central Processor unit (ACP) which is interconnected to a memory device for the storage of important data and images.

[0048] In the preferred embodiment, multiple Artcams as described in the aforementioned patent specification are interconnected via their USB ports so as to provide a cascading of imaging effects. Through suitable programming of the internal computer portions of each Artcam, a cascading of imaging effects can be achieved.

[0049] The preferred arrangement is as illustrated in FIG. **1** wherein a series of Artcams, e.g. **2**, **3**, **4**, are interconnected **5** via their USB ports. Each Artcam **2**, **3**, **4** is provided with a corresponding Artcard **7**, **8**, **9** having a suitable image manipulation program stored thereon. Further, the instructions for utilisation in a network environment can be provided on the Artcard **7**, **8**, **9**. The image **10** sensed by the Artcam **2** is then manipulated by the manipulation program on Artcard **7** with the result being forwarded **5** to Artcam device **3** which applies the image manipulation function provided on Artcard **8** producing a corresponding output which is forwarded to the next Artcam in the series. The chained Artcam has been modified so as to have two USB ports for this purpose. The final Artcam **4** applies its Artcard manipulation stored on Artcard **9** for producing output **12** which is a conglomeration of each of the previous image manipulations.

[0050] The arrangement **1** on FIG. **1** thereby provides the opportunity to apply multiple effects to a single sensed image. Of course, a number of further refinements are possible. For example, each Artcam could print out its own manipulated image in addition to forwarding the image to the next Artcam in the series. Additionally, splitting of paths where one Artcam outputs to two different downstream Artcams which result in different final images being output could also be provided. Additionally, loops, etc., could be utilised.

[0051] It would be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiment without departing from the spirit or scope of the invention as broadly described. The present embodiment is, therefore, to be considered in all respects to be illustrative and not restrictive.

Ink Jet Technologies

[0052] The embodiments of the invention use an ink jet printer type device. Of course many different devices could be used. However presently popular ink jet printing technologies are unlikely to be suitable.

[0053] The most significant problem with thermal ink jet is power consumption. This is approximately 100 times that required for high speed, and stems from the energy-inefficient means of drop ejection. This involves the rapid boiling of water to produce a vapor bubble which expels the ink. Water has a very high heat capacity, and must be superheated in thermal inkjet applications. This leads to an efficiency of around 0.02%, from electricity input to drop momentum (and increased surface area) out.

[0054] The most significant problem with piezoelectric ink jet is size and cost. Piezoelectric crystals have a very small deflection at reasonable drive voltages, and therefore require a large area for each nozzle. Also, each piezoelectric actuator must be connected to its drive circuit on a separate substrate. This is not a significant problem at the current limit of around 300 nozzles per print head, but is a major impediment to the fabrication of pagewide print heads with 19,200 nozzles.

[0055] Ideally, the ink jet technologies used meet the stringent requirements of in-camera digital color printing and other high quality, high speed, low cost printing applications. To meet the requirements of digital photography, new ink jet technologies have been created. The target features include:

[0056] low power (less than 10 Watts)

[0057] high resolution capability (1,600 dpi or more)

[0058] photographic quality output

[0059] low manufacturing cost

[0060] small size (pagewidth times minimum cross section)

[0061] high speed (<2 seconds per page).

[0062] All of these features can be met or exceeded by the ink jet systems described below with differing levels of difficulty. 45 different ink jet technologies have been developed by the Assignee to give a wide range of choices for high volume manufacture. These technologies form part of separate applications assigned to the present Assignee as set out in the table below.

[0063] The ink jet designs shown here are suitable for a wide range of digital printing systems, from battery powered one-time use digital cameras, through to desktop and network printers, and through to commercial printing systems

[0064] For ease of manufacture using standard process equipment, the print head is designed to be a monolithic 0.5 micron CMOS chip with MEMS post processing. For color photographic applications, the print head is 100 mm long, with a width which depends upon the ink jet type. The smallest print head designed is IJ38, which is 0.35 mm wide, giving a chip area of 35 square mm. The print heads each contain 19,200 nozzles plus data and control circuitry.

[0065] Ink is supplied to the back of the print head by injection molded plastic ink channels. The molding requires 50 micron features, which can be created using a lithographically micromachined insert in a standard injection molding tool. Ink flows through holes etched through the wafer to the nozzle chambers fabricated on the front surface of the wafer. The print head is connected to the camera circuitry by tape automated bonding.

[0066] Although the invention has been described with reference to a number of specific examples, it will be appreciated by those skilled in the art that the invention can be embodied in many other forms.

1. An interconnected camera system comprising:

a number of cameras interconnected via a data communications protocol, each camera comprising

an image sensor configured to capture an image;

a card configured to be inserted into the camera , the card carrying encoded instructions for the manipulation of the captured image; and

a processor configured to manipulate the captured image in accordance with the encoded instructions.

2. An interconnected camera system as claimed in claim 1, in which the cameras are interconnected with two connectors on each camera so that a plurality of the cameras can be interconnected in series to provide a cascading of imaging effects.

3. An interconnected camera system as claimed in claim 2, wherein each connector is a USB connector.

4. An interconnected camera system as claimed in claim 2, wherein each card has an image manipulation program stored thereon.

5. An interconnected camera system as claimed in claim 2, wherein each card has instructions for utilization in a network environment stored thereon.

6. An interconnected camera system as claimed in claim 2, in which each camera has a printer and is configured to print out its own manipulated image in addition to forwarding the image to the next camera in the series.

7. An interconnected camera system as claimed in claim 2, wherein each camera is configured so that splitting of paths can be arranged whereby one camera outputs to two different downstream cameras.

* * * * *