INTERFACE CARD WITH AN ELECTRONIC CAMERA AND METHOD OF USE THEREFOR

Technical Field of the Invention

This invention relates generally to interface cards used in conjunction with personal communication devices.

Background of the Invention

Personal communicators are a relatively recent development in the telecommunications world. A personal communicator is basically a handheld portable wireless-device which may include a display, one or more user input devices such as a touch sensitive keyboard or stylus and pressure sensitive writing tablet, a processing unit, memory, and an RF communications link.

An example of a personal communicator is the Motorola Envoy. This device operates based on a Motorola Dragon 68349 processor running at 16MHz. It has 1MBytes of dynamic RAM and 4MBytes of ROM. It display screen is a 3X4.5" reflective liquid crystal display device with a resolution of 105 dots per inch. The device is small enough to be held in a single hand and weighs less than two pounds. Power to the unit is supplied by Nickel-Cadmium batteries.

Personal communicators, in general, are capable of sending and receiving messages, telephone calls and fax transmissions. Further, these devices are capable of performing other functions one normally associates with a computer such as creating and

editing text documents, performing spreadsheet calculations, etc.

Many personal communicators have one or more expansion slots for receiving expansion cards. Examples of expansion cards include memory cards, fax/modem cards, and ethernet interface cards. These cards typically conform to the Personal Computer Memory Card International Association (PCMCIA) standards. These standards provide for three types of cards (Types I, II, and III).

FIG. 1 shows a top view of a typical PCMCIA card. Card 2 includes a substrate area 4 along with interconnect area 6. Cards conforming to these standards connect to a personal communicator by a connector inside a card slot in the personal communicator. Details of the PCMCIA standards which include the physical characteristics of the card and connector as well as the communication protocol between a device and the card are presented in PCMCIA PC Card Standard Release 2.01 available from PCMCIA.

FIG. 2 presents an end view of a type I PCMCIA card. Dimensions of card 2 in type I format are shown.

FIG. 3 presents an end view of a type II PCMCIA card. Dimensions of card 2 in type II format are shown.

FIG. 4 presents an end view of a type III PCMCIA card. Dimensions of card 2 in type III format are shown.

While personal communicators have many advantageous features, these devices cannot independently capture an image. Images must be

captured by an independent unit and imported into the personal communicator.

Summary of the Invention

There is a growing need for a small device, which interfaces to a variety of communication devices, that supports:

1) the transfer of image data from remote locations to a variety of communication devices;

2) a mechanical configuration based upon an industry standard which is easy to remove and is interchangeable among a variety of communication devices;

3) electrical configurations based upon an industry standard that support a set of features; and

4) low cost method and system for portable visual communication from person-to-person or one or more persons to many persons.

It is thus an advantage of the present invention to provide an interface card for a personal communicator which captures at least one image by generating a plurality of image data and transferring the image data to the personal communicator.

In an interface card, linkable to a personal communicator using a communications link, the present invention provides a method of capturing at least one image. The method comprises the steps of generating a plurality of data of at least one image using an electronic camera, and transferring the image data to the personal communicator via the communications link.

The present invention also provides an interface card for use with a personal communicator. The interface card includes an electronic camera, capable of capturing at least one image and generating a plurality of image data. The interface card also includes an interface circuit, responsive to the image data and linkable to the personal communicator, for transferring the image data to the personal communicator.

The present invention further provides an interface card for the personal communicator. The interface card includes a card body and a head attached to the card body. An electronic camera, capable of capturing at least one image and generating a plurality of image data, is integrated into the head. An interrogation means, coupled to the communication link, determines if the interface card is linked to the personal communicator. An interface circuit, responsive to the image data and linkable to the personal communicator is provided to transfer the image data to the personal communicator only after it is determined that the interface card is linked to the personal communicator.

Brief Description of the Drawings

The invention is pointed out with particularity in the appended claims. However, other features of the invention will become more apparent and the invention will be best understood by referring to the following detailed description in conjunction with the accompanying drawings in which:

FIG. 1 shows a top view of a typical PCMCIA card.

FIG. 2 presents an end view of a typical type I PCMCIA card.

FIG. 3 presents an end view of a typical type II PCMCIA card.

FIG. 4 presents an end view of a typical type III PCMCIA card.

FIG. 5 shows a block diagram representation of an interface card of one embodiment of the present invention.

FIG. 6 shows a flow chart representation of a method of capturing an image used in conjunction with the interface card of FIG. 5.

FIG. 7 shows a pictorial diagram of the interface card used in one embodiment of the present invention.

FIG. 8 shows a combination schematic/block diagram representation of the electronic camera used in one embodiment of the present invention.

FIG. 9 shows a pictorial view of an interface card used in a further embodiment of the present invention.

FIG. 10 presents a pictorial view of the interface card used in one embodiment of the present invention.

FIG. 11 shows a pictorial view of an alternative embodiment of the interface card in accordance with the present invention.

FIG. 12 shows a pictorial view of an interface card used in accordance with an additional embodiment of the present invention.

FIG. 13 shows a block diagram representation of a further embodiment of the present invention.

FIG. 14 shows a flow chart representation of a method of operation of the interface card shown in FIG. 13.

FIG. 15 shows a block diagram representation of a further embodiment of an interface card in accordance with the present invention.

FIG. 16 shows a flow chart representation of a method of operation of the interface card of FIG 15.

FIG. 17 shows a block diagram representation of an alternative embodiment of the interface card in accordance with the present invention.

FIG. 18 shows a flow chart representation of the method of operation of the interface card of FIG. 17 in accordance with the present invention.

FIG. 19 shows a block diagram representation of an additional embodiment of an interface card used in accordance with the present invention.

FIG. 20 shows a flow chart representation of a method of operating an interface card shown in FIG. 19 in accordance with one embodiment of the present invention.

FIG. 21 shows a block diagram representation of an additional embodiment of an interface card used in accordance with the present invention.

FIG. 22 shows a flow chart representation of the operation of the interface card 10 shown in conjunction with FIG. 21.

Detailed Description of the Preferred Embodiment

It will be understood by one of ordinary skill in the art that the methods and system described herein could be implemented in hardware or in software or any combination thereof. Further, one

of ordinary skill in the art will ready recognize that any and all of the described embodiments of the present invention may be provided with a source of power, such as a battery or similar energy storage device, in a form integral to the embodiment of the invention.

FIG. 5 shows a block diagram representation of an interface card of one embodiment of the present invention. Interface card 10 includes an electronic camera 12 for generating a plurality of data of at least one visual image. This visual image data is transferred to interface circuit 14 via line 16. In a preferred embodiment of the present invention, this transfer is effectuated electronically. However, one of ordinary skill in the art will recognize that other forms of transmission such as optical transmission could also be used. Interface circuit 14 is in turn capable of transferring the image data to a personal communicator via a communications link connected to interface circuit 14 via connection 18.

FIG. 6 shows a flow chart representation of a method of capturing an image used in conjunction with the interface card of FIG. 5. The method starts by generating a plurality of data of at least one visual image using an electronic camera as shown in box 20. Next, regarding box 22, the image data is transferred to a personal communicator via a communications link.

FIG. 7 shows a pictorial diagram of the interface card used in one embodiment of the present invention. Interface card 10 includes card body 30 and head 32. An electronic camera 34 is mounted in head 32. Interface card 10 slides into receptacle

38 of personal communicator 36 shown in phantom. In a preferred embodiment, interface card 10 conforms to PCMCIA standards and is manufactured using methods well known to those with ordinary skill in the art. However, one of ordinary skill in the art will recognize that other connectors between the interface card and the personal communicator are possible. When interface card 10 is attached to personal communicator 36, head 32 and likewise electronic camera 34 is exposed.

In operation of interface card 10, card 10 is inserted into personal communicator 36. At least one image is captured using electronic camera 34 and is transferred to personal communicator 36 for transfer elsewhere. In one embodiment of the present invention, interface card 10 is physically connected to personal communicator 36 via a connector which conforms with PCMCIA standards with the power to the interface card 10 being supplied by personal communicator 36.

The interface card of one embodiment of the present invention provides a port into an information database. Image data is captured by the electronic camera. The images which produce the image data could be of documents, objects, scenes, people, etc. Once transferred to a personal communicator, these image data could be processed to filter the data, to extract features from the data for use in pattern recognition, to perform functions related to editing the data by the user, or to compress the data for storage or transmittal.

The resultant created database produced from the image data could be local, that is, resident in the memory of the personal communicator. Further,

the database could be remotely located such that it is in communication with the primary communications link of the personal communicator, (as opposed to the communications link between the interface card and the personal communicator). In either case, the personal communicator could be equipped with a user interface which allows data to be appended to the captured image data for the purposes of search and retrieval.

The applications of the system formed by the interface card described above and a personal communicator are numerous and far-reaching. This system could be used in a business environment to capture images of documents, either for direct storage and transmittal or for character recognition processing. In effect, the system could operate as a scanner or as a facsimile machine. In a similar fashion, the system could be used to capture and interpret bar codes used to identify goods or services or to provide additional information relating to tagged goods or services.

This system could also be used as a visual communication system if the personal communicator provides a display device and a video/audio link. The captured image data, in the form of still or video images of a first user, along with audio information received by the personal communicator, could be transmitted/broadcasted to one or more other users. Further, the audio and video images of the other users, could be displayed by the personal communicator to complete the visual communication connection.

In the consumer realm, the system, which includes the interface card described above and the

personal communicator, could be used as a general imaging device such as an electronic camera. Using an input device of the personal communicator, a user could select and capture images in a manner similar to other photography. These images could be stored by the personal communicator or transmitted by the personal communicator to a storage location for later retrieval.

For example, a user on a trip to Disney World could take pictures of their family enjoying the various attractions. The electronic camera on the interface card would supply video data to the personal communicator. These images would be displayed to the user via a display device on the personal communicator. The individual shots could be selected by the user grabbing a video frame by pressing an appropriate button at the moment the desired image appears on the display device. Once the image (now a still image) is grabbed, the user could review the image and delete it if the image was unsatisfactory or possibly edit the image, and/or append information to it. The appended information could be the time and date or other information such as the parties in the picture, the quality of the image and/or other notations. The image could then be stored in the memory of the personal communicator.

If the user took more pictures and the personal communicator memory began to reach its capacity, one or more of the stored images could be transmitted by the personal communicator via a cellular telephone link or other RF link to a remote storage site where they could be transferred to a storage media for later retrieval by the user.

Other applications of the interface card and personal communicator system in the fields of medical treatment and diagnosis, education, and entertainment are far to numerous to mention.

FIG. 8 shows a combination schematic/block diagram representation of the electronic camera used in one embodiment of the present invention. Electronic camera 34 includes lens 40 which focuses at least one image onto CCD sensing element 42 which is driven by driver circuitry 44. The output of CCD sensor 42 is a set of two-dimensional image data which represents a two-dimensional array of pixels in either black and white or color format.

While a standard convex lens is used in a preferred embodiment of the present invention, one with ordinary skill in the art will recognize that other lens configurations could be used. For example, a fisheye or hemispherical lens could be used to capture a wide field of view. In addition, a no-lens configuration is also possible.

Further, one with ordinary skill in the art will realize that there are several alternatives to the use of CCD array based sensing elements.

While the various embodiments of the present invention have been described in terms of a single electronic camera with a single lens, one of ordinary skill in the art will recognize that two or more cameras could be used.

FIG. 9 shows a pictorial view of an interface card used in a further embodiment of the present invention. In this embodiment of interface card 10, reference numerals 32, 34, 36, and 38 refer to the features described in FIG. 7. The difference between the embodiment of FIG. 7 and the embodiment

of FIG. 9 is the incorporation of two electronic cameras 34 in the embodiment of FIG. 9. This two-camera interface card could be used to capture at least one stereoscopic image with apparent "depth".

Further, stereoscopic images could likewise be created with a single camera embodiment where two or more images are captured with the camera at an offset in position. For instance, a mouse or trackball, physically attached to the personal communicator could provide an input to the personal communicator to grab two or more frames at an offset calculated by processing the trackball or mouse coordinates. In this fashion, a user could align the personal communicator for a stereoscopic "shot" on a planar surface. Sweeping the personal communicator across the planar surface would trigger the capturing of the image data necessary for capturing the stereoscopic image. In a similar fashion, a key input from a user could be used to designate the alignment of the camera in each of two physical locations for generating the two shots necessary for the stereoscopic image.

FIG. 10 presents a pictorial view of the interface card used in one embodiment of the present invention. In this embodiment, head 32 containing electronic camera assembly 34 pivots with respect to card body 30. Thus, when interface card 10 is attached to a personal communicator, the camera 34 can be oriented to capture the desired image even if the personal communicator is in a stationary position. For instance, a user may wish to capture his own image while the personal communicator is placed face up on a desk in front of her. In this case, the head unit 32 could be pivoted such that

camera assembly 34 faces the upper torso of the user.

FIG. 11 shows a pictorial view of an alternative embodiment of the interface card in accordance with the present invention. Head 32 containing electronic camera 34 of interface card 10 pivots about card body 34 nearer the edge 40 of card body 30. The pivoting of head 32 and camera assembly 34 in this manner could allow personal communicator 36 to remain flat on a surface while head 32 and camera assembly 34 are pivoted. It should also be noted that the head 32 could also be detachable from the card body 34 while tethered to the card body via come physical connection such as a flexible wire or other non-physical connection. This could allow greater flexibility in the placement and orientation of the electronic camera while the card body is allowed to be stationary.

FIG. 12 shows a pictorial view of an interface card used in accordance with an additional embodiment of the present invention. In this embodiment, an existing interface card 54 equipped with connector 50 is connected to neck 52 with pivotably mounted head 32 containing camera 34. This configuration allows existing interface card 34 to be upgraded to include the features of interface card 10 in accordance with the present invention. Further, the head 32 containing camera 34 could be a self-sustaining unit which could be clipped-on or otherwise attached to a user for more portable use.

FIG. 13 shows a block diagram representation of a further embodiment of the present invention. In this embodiment, interface card 10 includes electronic camera 12 coupled to interface circuit 14

as has been previously described. Further, memory device 60, coupled to interface circuit 14, is provided.

Memory device 60, can be used to store the image data produced by electronic camera 12 prior to transfer of the image data by interface circuit 14. Thereby, the transfer of image data from interface card 10 to the personal communicator can be effectuated at a convenient time for the personal communicator which could be busy executing other functions. Further, memory device 60 could serve as a buffer for interface device 14 if the transfer of image data is interrupted, or if the transfer of image data proceeds more slowly than the acquisition of image data from electronic camera 12.

Alternatively, interface card 10 could be portable with its own source of power. Images could be captured and stored while interface card 10 is unlinked or disconnected from the personal communicator. The captured images could be transferred to the personal communicator when the link is restored. This embodiment of the present invention allows the user further flexibility in operation of the interface card and personal communicator system such that only the interface card is required to capture an image.

FIG. 14 shows a flow chart representation of a method of operation of the interface card shown in FIG. 13. A plurality of image data is generated using an electronic camera as shown in box 70. The image data is stored in a memory device as shown in box 72. Further, the image data is transferred to a personal communicator via a communications link as shown in box 74.

FIG. 15 shows a block diagram representation of a further embodiment of an interface card in accordance with the present invention. Electronic camera 12 and interface circuit 14 operate as previously described. In addition, transmitter 82 is interposed between interface circuit 14 and the communications link in order to transmit the image data generated by electronic camera along the communications link. More particularly, in this embodiment of the present invention, the communications link may comprise a radio frequency (RF) link, an ultrasonic link, an optical link such as an infrared link or a link using lightwaves in another portion of the spectrum, or other similar mode of communication. In this fashion, the interface card need only be "tethered" rather than physically attached to the personal communicator during operation and data transfer. Transmitter 82 serves to encode and/or modulate the image data generated by electronic camera 12 in accordance with the requirements of the communications link.

Interrogator 80, coupled to interface circuit 14, is further provided. This interrogator 80 serves to determine if the interface card is linked to the personal communicator, before the image data is transferred.

Given the nature of many communication links, it might be necessary to initiate the link before the data can be transferred from the interface circuit to the personal communicator. Therefore, interrogator 80 serves to determine whether the link is in fact active before the transfer of data is initiated. In one embodiment of the present invention, transmitter 82 attempts to initiate the

communications link between interface circuit 14 and the personal communicator upon a request from the interface circuit 14 to initiate such a link. It should be noted, that the initiation of the link between interface circuit 14 and the personal communicator could require a physical action such as aligning an optical transmitter to an optical receiver in order to establish the link. If this is the case, an indicator could be provided on interface card 10 to inform the user that such a physical action is required.

This embodiment of the present invention is particularly advantageous for situations where the interface card is not physically connected to the personal communicator, whether interface card 10 is at a separate but proximate location to the personal communicator. In this case, the communications link between the interface card and the personal communicator can be effectuated without a physical connection. For instance, at a meeting, the personal communicator could be placed on a table while the interface card in held by the user so as to allow the user to easily scan the room with the camera.

It should be noted, that the transmitter 82 and corresponding communications link need not be of the high power, high capacity type required by a personal communicator. This is due to the proximate location between the interface card 10 and personal communicator at the time that the link is established and the data is transferred.

FIG. 16 shows a flow chart representation of a method of operation of the interface card of FIG 15. The method begins by generating a plurality of image

data using an electronic camera capable of capturing at least one image as shown in box 90. It is then determined if the interface card is linked to the personal communicator as shown by decision box 92. If a link exists, the image data is transmitted to the personal communicator over the communications link as shown in box 96. If, however, the interface card is not linked to the personal communicator, the image data is stored in the memory device as shown in box 94 until such time as the image data can be transferred.

FIG. 17 shows a block diagram representation of an alternative embodiment of the interface card in accordance with the present invention. Interface card 10 includes electronic camera 12 and interface circuit 14 as previously described. Further, display device 100 coupled to electronic camera 12, is further provided. Display device 100 receives the image data from electronic camera 12 and displays the image or images to a user. This allows a user to monitor the image being seen by electronic camera 12 so as to check the proper alignment of electronic camera.

It should be recognized, that electronic camera 12 could generate image data in either a continuous running/video format or in a still image format. If camera 12 is intended to generate a still image, it would be advantageous for display device 100 to provide a continuous running or video image display to the user in order for the user to select a particular still image to be captured. For example, interface card 10 could be provided with an input device consisting of a simple switch. A user could monitor the image or images received by electronic

camera 12 using display device 100 until the appropriate visual image is reached. At this point, the user could activate the input device to signify to the electronic camera 12 and interface circuit 14 that this particular frame of the video image should be grabbed for purposes of possible storage and transfer.

One with ordinary skill in the art should also recognize that a dedicated memory device may be necessary to buffer the data from electronic camera 12 prior to its display on display device 100. This memory device could be integrated into interface card 10 in a manner similar to the embodiment of FIG. 13. Conversely, the memory device could be interposed between the electronic camera 12 and the display device 100.

FIG. 18 shows a flow chart representation of the method of operation of the interface card of FIG. 17 in accordance with the present invention. The method starts by generating a plurality of data of at least one image using an electronic camera as shown in box 110. The image data is transferred to the personal communicator via the communication link as shown in box 112. Further, the image data is displayed using a display device as shown in box 114.

FIG. 19 shows a block diagram representation of an additional embodiment of an interface card used in accordance with the present invention. Interface card 10 includes electronic camera 12 and interface circuit 14 as previously described. Further, controller 122, coupled to the electronic camera 12 and interface circuit 14 is provided along with input device 120 coupled to controller 122. Input

device 120 is responsive to the actions of a user so as to produce an input signal which is fed to controller 122. Controller 122, is capable of controlling one or more functions of the interface card in response to the input signal. For example, input device 120 could be a switch which is used to control electronic camera 12 and interface circuit 14 so as to grab a still image as described in conjunction with the interface card of FIG. 12. Further, other functions of the interface card could likewise be controlled in accordance with the present invention.

FIG. 20 shows a flow chart representation of a method of operating an interface card shown in FIG. 19 in accordance with one embodiment of the present invention. The method starts by generating a plurality of data of at least one image using an electronic camera as shown in box 130. Regarding box 132, an input signal is received from a user using an input device. Regarding box 134, one or more functions of the interface card are controlled in response to the input signal. Further, the image data is transferred to the personal communicator via the communications link as shown in box 136.

FIG. 21 shows a block diagram representation of an additional embodiment of an interface card used in accordance with the present invention. Interface card 10 includes electronic camera 12 and interface circuit 14 as previously described. In this embodiment, interface 10 further includes a processor 140 for processing the image data prior to transfer. Processor 140 is coupled to interface circuit 14, electronic camera 12 and further coupled to a memory device 142. Memory device 142 serves as

a means for storing image data generated by electronic camera 12 and could serve as a buffer for the processing performed by processor 140. Such processing could include filtering of the image data, compression of the image data to allow more easy transfer, electronic zoom of a portion of the image, correction of the image for optical or other forms of distortion, pan or tilt of the image or other visual effects, stabilization of an image taken from a moving camera, or possibly feature extraction relating to pattern recognition to be performed on the image data.

FIG. 22 shows a flow chart representation of the operation of the interface card 10 shown in conjunction with FIG. 21. The method starts by generating a plurality of data of at least one image using an electronic camera as shown in box 150. The image data is processed using a processor as shown in box 152. The image data is then transferred to the personal communicator via the communications link as shown in box 154.

Summary

Thus there has been described herein a concept, as well as several embodiments including a preferred embodiment, of an interface card and a method of use therefor which captures a plurality of image data and transfers the image data to a personal communicator.

It will be apparent to those skilled in the art that the disclosed invention may be modified in numerous ways and may assume many embodiments other

than the preferred form specifically set out and described above.

Accordingly, it is intended by the appended claims to cover all modifications of the invention which fall within the true spirit and scope of the invention.

What is claimed is:

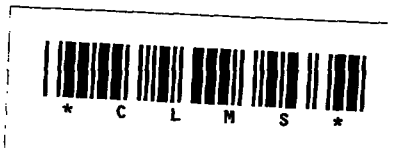


Claims

1. An interface card for use with a personal communicator, the interface card comprising:

an electronic camera, capable of capturing at least one image and generating a plurality of image data; and

an interface circuit, responsive to the image data and linkable to the personal communicator, for transferring the image data to the personal communicator.



2. The interface card of claim 1 further comprising:

a card body;

a head attached to the card body wherein the electronic camera is integrated into the head.

3. The interface card of claim 1 further comprising:

an interrogator, coupled to the interface circuit, for determining if the interface card is linked to the personal communicator such that the image data is transferred only after it is determined that the interface card is linked to the personal communicator.

4. The interface card of claim 1 wherein interface circuit includes:

a transmitter for transmitting the image data over the communications link.

5. The interface card of claim 1 wherein the interface card includes a physical connector conforming to the PCMCIA PC card standard.

6. The interface card of claim 1 further comprising:

a memory device for storing the image data.

7. The interface card of claim 1 further comprising:

a processor, coupled to the electronic camera and the interface circuit for processing the image data prior to transferring the image data.

8. The interface card of claim 2 further comprising:

a pivot joint for coupling the head to the card body so as to capture images from a set of head different orientations, even if the card body is in a stationary position.

9. The interface card of claim 1 further comprising:

a display device, coupled to the electronic camera, for displaying one or more of the plurality of image data.

10. The interface card of claim 1 further comprising:

an input device for generating an input signal from a user; and

a controller, coupled to interface circuit and responsive to the input signal, for controlling one or more functions of the interface card in response to the input signal.