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(54) Title: DIGITAL CAMERA APPARATUS FURTHER HAVING FUNCTION FOR ACTING AS USB HOST AND DATA TRANSMISSION METHOD THEREOF

![Diagram of camera apparatus]

(57) Abstract: A digital camera device having a universal serial bus (USB) host function and a data transmission method therefor are provided. The digital camera device is realized by providing a host function to a usual digital PC camera device. The digital camera device determines a type of USB system for an image processing apparatus connected to the digital camera device and automatically sets an operating mode according to the determined result so that it can communicate with the image processing apparatus. Since the digital camera device can perform direct one-to-one USB communication with the image processing apparatuses, a user can conveniently manipulate images picked up by the digital camera device regardless of a place and the type of USB system for the image processing apparatus.
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DIGITAL CAMERA APPARATUS FURTHER HAVING FUNCTION FOR ACTING AS USB HOST AND DATA TRANSMISSION METHOD THEREOF

5 Technical Field

The present invention relates to a digital camera device having a universal serial bus (USB) host function and a data transmission method therefor, and more particularly, to a digital camera device provided with a USB host function so that the digital camera device can communicate with a portable information terminal as well as a personal computer, and a data transmission method for the digital camera device.

Background Art

With radical development of communication and information processing technology, portable information terminals, such as a notebook personal computer (PC), a personal digital assistant (PDA), a personal handy-phone system (PHS), and a portable phone, have been widely used in various fields as indispensable modern instruments of an information society.

Development of technology of portable information terminals and communication speed provokes users to desire to watch or edit images picked up by a digital camera device, or transmit or receive the images through electronic mail (e-mail) using a portable information terminal.

In order to fulfill this desire, it is immediately necessary to develop technology for smoothly connecting a portable information terminal to a peripheral apparatus, which lags behind portable information terminals in technological development. RS-232, Infrared Data Association (IrDA), and Compact Flash Association (CFA) are techniques for connecting a conventional portable information terminal to a peripheral apparatus.

These connection techniques have low transmission speed or require many connection pins.
A transmission method not requiring many connection pins is usually referred to as a serial communication method. For example, RS-232 communication methods and USB communication methods are serial communication methods. RS-232 communication methods are easily implemented but have low transmission speed. In the meantime, USB serial communication methods have been developed by PC-related companies and telephone companies in order to integrate various and complex connection techniques used for current PC systems through a single serial bus. Since USB communication methods support high transmission speed (a maximum of 12 Mbps (bit per second)) and allow a maximum of 127 peripheral devices to be connected to a PC, they have been settled as representative connection techniques for PCs.

Recently, many portable information terminals also employ USB communication methods for connection to a PC. USB communication methods have been developed for the purpose of smoothly connecting peripheral devices to a PC. Accordingly, in USB communication methods, a PC issues a command, and a peripheral device connected to the PC just operates in response to the command. In other words, the PC and the peripheral device are in a host-slave relationship.

Accordingly, difference in a USB communication method between a PC and a peripheral device leads a serious problem. In other words, it is impossible to connect a portable information terminal provided with a USB slave to a peripheral device provided with a USB slave without intervention of a PC. For example, a digital camera device, i.e., a peripheral device provided with a USB slave, cannot be connected to a portable phone, i.e., a portable information terminal provided with a USB slave.

Moreover, because a conventional digital PC camera device provided with a USB slave cannot access a portable phone provided with a USB slave, users’ desire to watch, edit, or store images picked up by
the digital PC camera device using the portable phone cannot be satisfied.

**Disclosure of the Invention**

The present invention provides a digital camera device having a universal serial bus (USB) host function so that it can perform direct one-to-one USB communication with a portable information terminal provided with a USB as well as a personal computer (PC) provided with a USB.

The present invention also provides a data transmission method for a digital camera device having a USB host function, by which a type of USB system for a PC or portable information terminal connected to the digital camera device is determined, and an operating mode of the digital camera device is automatically set according to the result of the determination, so that the digital camera device can perform data communication with the PC and the portable information terminal.

According to an aspect of the present invention, there is provided a digital camera device capable of performing data communication with an image processing apparatus through a USB method. The digital camera device includes a lens unit for inputting an image; a sensor unit, which is installed to face the lens unit and acquires the image input through the lens unit according to a control signal; a connection unit including a connector connected to the image processing apparatus; a signal processing unit, which determines a type of USB system for the image processing apparatus according to whether a USB system type identification signal is transmitted from the image processing apparatus within a predetermined period of time after the image processing apparatus is connected to the connection unit, and outputs the determined result; and a central processing unit, which sets the digital camera device into a predetermined operating mode according to the determined result output from the signal processing unit, and if a
predetermined command signal is transmitted from the image processing apparatus, outputs the control signal for image acquirement to the sensor unit, receives the acquired image from the sensor unit, performs a predetermined process on the image, and transmits the processed image to the image processing apparatus.

According to another aspect of the present invention, there is provided a method of transmitting data from a digital camera device to an image processing apparatus connected to the digital camera device. The method includes (a) determining whether a USB system type identification signal is received from the image processing apparatus within a predetermined period of time after the digital camera device is supplied with power from the image processing apparatus; (b) setting the digital camera device into a USB host mode when the USB system type identification signal is not received within the predetermined period of time; (c) configuring a USB system type for the image processing apparatus and then transmitting a command request signal to the image processing apparatus; and (d) receiving a command signal corresponding to the command request signal from the image processing apparatus and transmitting predetermined data generated by performing a predetermined fundamental operation according to the command signal to the image processing apparatus.

Brief Description of the Drawings

FIG. 1 is a functional block diagram of a digital camera device having a universal serial bus (USB) host function according to the present invention.

FIGS. 2A and 2B are timing diagrams of signals input to a connection unit of a digital camera device according to the present invention.

FIG. 3 is an exploded perspective view of a digital camera device having a USB host function according to the present invention.
FIG. 4 is a diagram showing types of signal sources constituting a connection unit of a digital camera device having a USB host function according to the present invention.

FIG. 5 is a functional block diagram of a digital camera device having a USB host function in a USB host mode according to the present invention.

FIGS. 6A and 6B are flowcharts of a data transmission method for a digital camera device having a USB host function according to the present invention.

FIGS. 7A and 7B are flowcharts of a procedure in which a digital camera device having a USB host function according to the present invention performs an operation in response to a received command signal.

FIG. 8 is a diagram showing a data flow during interrupt transmission defined in USB standards.

FIG. 9 is a diagram of the structure of command data used in interrupt transmission.

FIG. 10 is a flowchart of an operation performed by a portable phone communicating with a digital camera device having a USB host function according to the present invention.

FIG. 11 is a diagram showing the flow of image data in bulk USB transmission.

**Best mode for carrying out the Invention**

Hereinafter, a digital camera device having a universal serial bus (USB) host function and a data transmission method therefor according to embodiments of the present invention will be described in detail with reference to the attached drawings.

FIG. 1 is a functional block diagram of a digital camera device having a USB host function according to the present invention. Referring to FIG. 1, a digital camera device 100 includes a lens unit 101,
a sensor unit 102, a central processing unit 103, a connection unit 104, and an operating unit 105.

The digital camera device 100 also includes a memory unit (not shown) storing picked-up images and a signal processing unit (not shown). The signal processing unit analyzes the state of predetermined signals including a power signal, which are transmitted from an image processing apparatus connected through the connection unit 104, so as to determine a type of USB system for the image processing apparatus and transmits the result of the determination to the central processing unit 103. The signal processing unit can be provided within the central processing unit 103. The operating unit 105 of the digital camera device 100 is a snapshot switch for acquiring a still image in response to a user's request. Here, it is assumed that the image processing apparatus generally indicates a personal computer (PC) or a portable information terminal (for example, a portable phone or a personal digital assistant (PDA)).

When a user connects the digital camera device 100 to a predetermined image processing apparatus in order to transmit an image picked up by the digital camera device 100 to the image processing apparatus, the central processing unit 103 of the digital camera device 100 supplied with a power through the connection unit 104 initializes peripheral circuits including the sensor unit 102 and previous image transmission routines, and waits for an input signal from the image processing apparatus.

After the power is supplied through the connection unit 104, the signal processing unit determines a type of a USB system for the image processing apparatus according to whether a USB system type identification signal is transmitted from the image processing apparatus within a predetermined period of time, and transmits the result of the determination to the central processing unit 103.
In other words, if the USB system type identification signal is transmitted from the image processing apparatus within the predetermined period of time, the signal processing unit determines the type of USB system for the image processing apparatus as a USB host mode. Conversely, if the USB system type identification signal is not transmitted from the image processing apparatus within the predetermined period of time, the signal processing unit determines the type of USB system for the image processing apparatus as a USB slave mode.

The image processing apparatus can be divided into a USB host terminal (for example, a PC) provided with a USB host and a USB slave terminal (for example, a portable phone) provided with a USB slave. Usually, when a USB host terminal provided with a USB host is connected to a digital camera device, the USB host terminal supplies a power to the digital camera device and then transmits a USB system type identification signal to the digital camera device within a predetermined period of time. In the meantime, when a USB slave terminal provided with a USB slave is connected to a digital camera device, the USB slave terminal supplies a power to the digital camera device but does not transmit a USB system type identification signal to the digital camera device within a predetermined period of time.

Accordingly, after being supplied with a power from an image processing apparatus, the signal processing unit of the digital camera device 100 of the present invention determines a type of USB system for the image processing apparatus according to whether a USB system type identification signal is transmitted from the image processing apparatus within a predetermined period of time. A procedure in which the signal processing unit of the digital camera device 100 determines types of USB systems for image processing apparatuses connected to the digital camera device 100 according to the state of input signals, i.e.,
USB system type identification signals, will be described later with reference to FIGS. 2A and 2B.

When the signal processing unit determines the type of USB system for an image processing apparatus as a USB host mode, the central processing unit 103 of the digital camera device 100 sets the digital camera device 100 into a USB slave mode. Conversely, when the type of USB system for an image processing apparatus is determined as a USB slave mode, the central processing unit 103 sets the digital camera device 100 into a USB host mode. Thereafter, the central processing unit 103 operates in response to command signals transmitted from the image processing apparatus through the connection unit 104.

In response to control signals transmitted from the central processing unit 103, the sensor unit 102 senses an image formed through the lens unit 101 and transmits it to the central processing unit 103. Here, a complementary metal-oxide semiconductor (CMOS) image sensor or charge coupled device (CCD) image sensor may be used for the sensor unit 102.

The connection unit 104 is composed of four signal sources, i.e., a power supply 104a, a ground 104b, and USB signal sources 104c and 104d, for USB connection defined in USB standards. The four signal sources for USB connection defined in the USB standards are a power supply, a ground, D+, and D-. D+ and D- are the names of two USB signal sources defined in the USB standards.

FIGS. 2A and 2B are timing diagrams of signals input to the connection unit 104 of the digital camera device 100 according to the present invention. FIG. 2A is a timing diagram showing the initial state of input signals for operating the digital camera device 100 in a USB slave mode.

As shown in FIG. 2A, when a square signal having a predetermined interval of 1 msec (i.e., a USB system type identification
signal) is input through the two USB signals 104c and 104d within a predetermined period of time $\Delta t$ after the digital camera device 100 is supplied with a power from an image processing apparatus currently connected thereto, the signal processing unit of the digital camera device 100 determines the image processing apparatus as a USB host terminal (for example, a PC). Thereafter, the signal processing unit transmits the result of the determination to the central processing unit 103 of the digital camera device 100 so that the digital camera device 100 is set into a USB slave mode.

Then, the digital camera device 100 operates as a usual digital PC camera device, and as a USB host terminal the PC connected to the digital camera device 100 drives the digital camera device 100 according to a usual USB host operation sequence. Here, the digital camera device 100 operates in the same manner as a usual digital PC camera device, and thus a description of the digital camera device 100 operating in the USB slave mode will be omitted.

In the meantime, FIG. 2B is a timing diagram showing the initial state of input signals for operating the digital camera device 100 in a USB host mode. As shown in FIG. 2B, when a predetermined signal (i.e., a USB system type identification signal) is not input through the two USB signals 104c and 104d after a predetermined period of time $\Delta t$ lapses since the digital camera device 100 was supplied with a power from an image processing apparatus currently connected thereto, the signal processing unit determines the image processing apparatus as a USB slave terminal (for example, a portable phone). Thereafter, the signal processing unit transmits the result of the determination to the central processing unit 103 so that the digital camera device 100 is set into a USB host mode.

Here, the digital camera device 100 independently operates in each mode (i.e., the USB host mode or the USB slave mode). In other
words, when an operating mode of the digital camera device 100 is set according to the type of USB system for an image processing apparatus connected to the digital camera device 100 after a power is supplied from the image processing apparatus, the digital camera device 100 consistently operates in the set operating mode until a power is cut off.

An image processing apparatus (for example, a portable phone) communicating data with the digital camera device 100 of the present invention supports a slave transmission method conforming to the USB standards and has a connection means for USB transmission. A standard connector for portable phones, which is defined by the ministry of information and communication in Korea, or an earphone jack, which has four electrodes including one for a power supply and has been recently supported by portable phones, can be used as the connection means. Excluding existing connection means, a new connection means can be used for portable phones. In other words, in the present invention, as well as the standard connector for portable phones or the earphone jack with four electrodes, any connection means used at present can be used.

FIG. 3 is an exploded perspective view of the digital camera device 100 having a USB host function according to the present invention. As shown in FIG. 3, the digital camera device 100 includes a lens unit 101, a sensor unit 102, a central processing unit 103, a connection unit 104, an operating unit 105, a top cover 200, a bottom cover 201, and a circuit board 203.

The lens unit 101, the sensor unit 102, the central processing unit 103, the connection unit 104, and the operating unit 105 were described with reference to FIG. 1, and thus descriptions thereof will be omitted. A signal processing unit (not shown) can be included in the central processing unit 103. Electrical parts, such as the sensor unit 102, the central processing unit 103, and the signal processing unit, performing
the functions of the digital camera device 100 are installed on the circuit board 203.

FIG. 4 is a diagram showing types of signal sources constituting a connection unit of a digital camera device having a USB host function according to the present invention. As described above with reference to FIGS. 1 through 2B, a connection unit 300 provided for USB connection to a portable phone are composed of four signal sources, i.e., a power supply 301, a ground 302, D+ 303, and D- 304.

FIG. 5 is a functional block diagram of a digital camera device having a USB host function in a USB host mode according to the present invention. Referring to FIG. 5, a digital camera device 400 includes a lens unit 401, a sensor unit 402, a USB host central processing unit 403, a connection unit 404, and an operating unit 405. The lens unit 401, the sensor unit 402, the connection unit 404, and the operating unit 405 operate in the same manner as the lens unit 101, the sensor unit 102, the connection unit 104, and the operating unit 105 shown in FIG. 1, and thus descriptions thereof will be omitted.

The USB host central processing unit 403 is the central processing unit 103 that determines a type of USB system for an image processing apparatus (for example, a portable phone) as a USB slave mode and drives the digital camera device 400 in a USB host mode when the input signals shown in FIG. 2B are transmitted from the image processing apparatus to the digital camera device 400. In other words, when the digital camera device 400 operates in the USB host mode, a central processing unit of the digital camera device 400 operates as the USB host central processing unit 403.

The connection unit 404 is composed of four signal sources, i.e., a power supply 404a, a ground 404b, D+ 404c, and D- 404d, for USB connection. The four signal sources have been described above, and thus descriptions thereof will be omitted.
FIGS. 6A and 6B are flowcharts of a data transmission method for a digital camera device having a USB host function according to the present invention. If a predetermined image processing apparatus is connected to the digital camera device 400 in step S100, the USB host central processing unit 403 of the digital camera device 400 is supplied with a power from the predetermined image processing apparatus and initializes peripheral circuits including the sensor unit 402 and previous image transmission routines in step S105.

It is determined whether a USB system type identification signal is received from the predetermined image processing apparatus within a predetermined period of time \( \Delta t \), which is defined in the USB standards, after the supply of power from the predetermined image processing apparatus in step S110.

If it is determined that the USB system type identification signal is received within the predetermined of time \( \Delta t \), as shown in FIG. 2A, in step S110, the USB host central processing unit 403 determines a type of USB system for the predetermined image processing apparatus currently connected to the digital camera device 400 as a USB host mode and sets the digital camera device 400 into a USB slave mode in step S115. Here, the predetermined image processing apparatus connected to the digital camera device 400 may be a PC. Then, the digital camera device 400 operates as a usual digital PC camera device in step S120. Detailed descriptions of the operations of the digital camera device 400 set into the USB slave mode will be omitted.

If it is determined that the USB system type identification signal is not received within the predetermined of time \( \Delta t \), as shown in FIG. 2B, in step S110, the USB host central processing unit 403 determines a type of USB system for the predetermined image processing apparatus as the USB slave mode and sets the digital camera device 400 into the USB slave host in step S125. Here, the predetermined image processing
apparatus connected to the digital camera device 400 may be a portable phone.

The USB host central processing unit 403 configures the type of USB system for the portable phone in step S130. Here, the configuration includes a series of processes of, for example, bringing terminal information carried by the portable phone and allocating a particular terminal address to the portable phone. The terminal information carried by the portable phone is a descriptor defined in the USB standards. The descriptor includes various kinds of information for USB transmission between terminals. A total of 5 types of descriptor exist.

If an error occurs during the configuration in step S135, the digital camera device 400 is driven in a suspended state defined in the USB standards in step S140. In the meantime, if the configuration is normally completed, the USB host central processing unit 403 transmits a command request signal to the portable phone in step S145. Then, the USB host central processing unit 403 receives a command signal corresponding to the command request signal from the portable phone and performs an operation according to the command signal in step S150. Step S150 will be described in detail later with reference to FIGS. 7A and 7B.

After step S150, if an end command signal is received from the portable phone in step S155, the method progresses to step S140. If the end command signal is not received from the portable phone, the method progresses to step S145.

FIGS. 7A and 7B are flowcharts of a procedure in which a digital camera device having a USB host function according to the present invention performs the operation in response to the received command signal. The USB host central processing unit 403 of the digital camera device 400 analyzes a type of the command signal transmitted from the
portable phone in step S1505 and operates according to the analyzed result.

More specifically, if the received command signal is analyzed as a simple command signal, the USB host central processing unit 403 performs an operation according to the simple command signal in step S1510.

In the meantime, if the received signal is analyzed as a moving image transmission command signal, the USB host central processing unit 403 prepares for the transmission of moving image data and then transmits moving image data picked up through the lens unit 401 to the portable phone in step S1515.

Thereafter, if a moving image transmission interrupt signal is received, transmission of the currently transmitted moving image data is interrupted, and thereafter, the moving image data is retransmitted to the portable phone when a retransmission request signal is received from the portable phone, in steps S1520 through S1535. Here, the digital camera device 400 of the present invention uses a bulk USB transmission method in order to transmit moving or still image data to the portable phone. The bulk USB transmission method will be described in detail later with reference to FIG. 11.

While transmitting the moving image data, if the USB host central processing unit 403 receives a still image transmission command signal from the portable phone in step S1540, it prepares for transmission of still image data and then transmits still image data to the portable phone in step S1545.

If the received command signal is analyzed as an idle command signal, the USB host central processing unit 403 operates the digital camera device 400 in an idle state in step S1550 and determines whether a predetermined number of idle command signals have been consecutively received in step S1555.
If it is determined that the predetermined number of idle command signals have not been consecutively received, the method progresses to step S1505 in order to analyze a type of next command signal.

In the meantime, if it is determined that the predetermined number of idle command signals have been consecutively received, the digital camera device 400 is operated in a suspended state in step S1560. Thereafter, a remote wake-up signal is received from the portable phone in step S1565, the USB host central processing unit 403 sets the digital camera device 400 into a state preparing for performing an operation according to a next command signal transmitted from the portable phone and analyzes the next command signal in step S1505.

The following description concerns a method of transmitting data between the digital camera device 400 and the portable phone.

According to a usual data transmission method defined in the USB standards, a data transmission flow has a system in which a USB slave terminal responds to a request of a USB host terminal. In other words, even if the digital camera device 400 operates in a USB host mode, it is a peripheral device of the portable phone in terms of operation. Accordingly, when like a conventional USB host terminal, the digital camera device 400 takes the lead in data transmission between the portable phone and the digital camera device 400 while managing the entire operation of the portable phone, many operational problems may occur.

Therefore, the digital camera device 400 of the present invention must use a method of transmitting data corresponding to a request, which is received from the portable phone, to the portable phone in the USB host mode.

The present invention suggests an interrupt transmission method as a method of transmitting USB commands between the digital camera device 400 and the portable phone.
Interrupt transmission is a data transmission method defined in the USB standards and is provided to transmit a small amount of periodic and reporting data. Here, the portable phone communicating with the digital camera device 400 of the present invention stores a communication period, with which the portable phone communicates with the digital camera device 400, in a descriptor.

FIG. 8 is a diagram showing a data flow in interrupt transmission defined in the USB standards. As shown in FIG. 8, the digital camera device 400 set in a USB host mode transmits an initial signal Token for interrupt transmission to a portable phone set in a USB slave mode in step S200.

Here, the portable phone transmits one among three types of signals, i.e., a negative acknowledgement (NAK) signal, data 0/data 1, and a stall signal, to the digital camera device 400 according to the current state of the portable phone. In other words, when the portable phone is in a state in which it cannot transmit data at present, it transmits the NAK signal to the digital camera device 400 in order to drive the digital camera device 400 in a standby state in step S205a. When the portable phone is in a state in which it can transmit data, it transmits the prepared data 0 or 1 to the digital camera device 400 in step S205b. When a serious error occurs during the present interrupt transmission, the portable phone transmits the stall signal in order to report the error state to the digital camera device 400 in step S205c.

When the digital camera device 400 receives one among the NAK signal, the data 0 or 1, and the stall signal from the portable phone as a response to the initial signal Token, it transmits a handshake signal to the portable phone in step S210 in order to report that a single interrupt transmission is completed.

As described with reference to FIG. 8 above, the digital camera device 400 of the present invention periodically communicates with a portable phone using the interrupt transmission method, so it receives
command data corresponding to a command signal from the portable phone. Here, the command data has a size of 1 byte.

FIG. 9 is a diagram of the structure of command data used in interrupt transmission. As shown in FIG. 9, command data 500, which is transmitted from a portable phone to the digital camera device 400 according to interrupt transmission, contains a particular command in each bit.

In other words, simple commands for driving the digital camera device 400 to perform a simple operation are respectively recorded in first and second bits 501 and 502 of the command data 500. In particular, in the first bit 502 can be recorded a command for driving the digital camera device 400 to generate a control command to the portable phone so that a plurality of data (for example, register control data for the digital camera device) can be transmitted from the portable phone to the digital camera device 400.

A moving image transmission command for driving the digital camera device 400 to transmit moving image data is recorded in a second bit 503 of the command data 500. For example, when the second bit 503 has a value of 1, the digital camera device 400 starts an operation for transmitting moving image data.

A still image transmission command for driving the digital camera device 400 to transmit still image data is recorded in a third bit 504 of the command data 500. For example, when the third bit 504 has a value of 1, the digital camera device 400 starts an operation for transmitting still image data.

In order to drive the digital camera device 400 in an idle state, 0 is recorded in every bit of the command data 500.

While it has been described with reference to FIG. 9 that the commands, i.e., a simple command, a moving image transmission command, and a still image transmission command, are recorded in the respective bits of the command data 500, the present invention is not
limited to the above-described embodiment. In addition to the above-described commands, many commands previously agreed between the digital camera device 400 and a portable phone can also be contained in the command data 500.

As described with reference to FIGS. 8 and 9 above, the digital camera device 400 having a USB host function according to the present invention uses an interrupt transmission method for communication with a portable phone so that it receives a command from the portable phone, performs an operation corresponding to the received command, and transmits the result of performing the operation to the portable phone.

FIG. 10 is a flowchart of an operation performed by a portable phone communicating with a digital camera device having a USB host function according to the present invention. If the digital camera device 400 is connected to the portable phone in step S300, the portable phone supplies power to the digital camera device 400 in step S305. In the meantime, when the digital camera device 400 is not connected to the portable phone, the portable phone performs a fundamental operation in step S370.

Thereafter, the portable phone is automatically subjected to configuration by the digital camera device 400 in step S310 and then determines whether an image pickup start signal is generated in step S315. Here, the image pickup start signal can be generated by a user’s key operation or can be automatically generated upon completion of the configuration led by the digital camera device 400.

If the image pickup start signal is generated, the portable phone checks whether the configuration led by the digital camera device 400 has been successfully completed therewithin. If it is determined that the configuration has been successfully completed, the portable phone transmits command data containing predetermined commands (i.e., a simple command and a moving image transmission command) to the digital camera device 400 according to an interrupt transmission method.
in step S320. Here, the commands contained in the command data are sequentially transmitted to the digital camera device 400, and the moving image transmission command or the still image transmission command is lastly transmitted to the digital camera device 400.

Thereafter, the portable phone receives moving image data, which is transmitted from the digital camera device 400 in response to the moving image transmission command, and displays the moving image data on its screen in step S325. Here, the digital camera device 400 of the present invention uses a bulk USB transmission method to transmit the moving image data to the portable phone.

While the portable phone is receiving the moving image data from the digital camera device 400, if an incoming call is generated in step S330, the portable phone transmits a moving image transmission interrupt signal to the digital camera device 400 in order to temporarily interrupt the transmission of moving image data in step S335.

If the call is terminated in step S340, the portable phone transmits a moving image retransmission request signal to the digital camera device 400 and receives the moving image data transmitted from the digital camera device 400 in step S345. Here, since the digital camera device 400 of the present invention uses a bulk USB transmission method for the transmission of moving image data to the portable phone, steps S330 through S345 can be performed by the portable phone.

During step S325 or S345, if it is determined that a still image is requested by a user in step 350, the portable phone transmits a still image transmission command signal to the digital camera device 400, then receives still image data transmitted from the digital camera device 400, and then stores the received still image data in a predetermined memory area (not shown) at the user's request in step S355.

Thereafter, if the user inputs an end button to stop the current operation in step S360, the portable phone transmits an end command signal, i.e., a sensor OFF signal, to the digital camera device 400 in step
S365 to terminate the current operation. Then, the digital camera device 400 operates in a suspended state in response to the end command signal received from the portable phone.

FIG. 11 is a diagram showing the flow of image data in bulk USB transmission. Referring to FIG. 11, when the digital camera device 400 of the present invention receives a moving image transmission interrupt signal from a portable phone while periodically transmitting moving image data to the portable phone, it interrupts the transmission of current moving image data (for example, an (N+2)-th frame moving image data). Thereafter, when a retransmission request signal is received from the portable phone, the digital camera device 400 transmits the remaining (N+2)-th frame moving image data which has not been transmitted due to the interrupt of transmission.

Generally, portable phones mainly aiming at voice communication have a tendency not to allow their fundamental operations to be hindered by peripheral devices. In other words, if a call is generated, while an image data is being received from a digital camera device, most of portable phones cancel the reception of the image data (for example, N-th frame image data) and perform a fundamental operation as a telephone. Here, since a conventional digital camera device uses an isochronous transmission method for image data transmission to the portable phone, it cancels the transmission with respect to the entire N-th frame image data when an image transmission interrupt signal is received from the portable phone. Thereafter, if retransmission of image data is requested from the portable phone, the conventional digital camera device retransmits the N-th frame image data from the beginning.

As described above, a conventional digital camera device uses the isochronous transmission method for image data transmission to a portable phone. Accordingly, in a case where a call is generated while a user is transmitting important image data from a conventional digital camera device to a portable phone, after the call is terminated, the user
suffers inconvenience of retransmission of entire data of an image frame that was under transmission. To overcome this problem, in the present invention, the digital camera device 400 uses a bulk USB transmission method for image data transmission to a portable phone.

In the meantime, due to many restrictions on the supply of power, image processing apparatuses are generally embodied such as to efficiently manage power including that used to control peripheral devices. A suspend/remote wake-up method is conventionally used to achieve efficient power management between a USB host terminal and a USB slave terminal. According to the USB standards, it is a USB host terminal that determines the entrance into a suspended state. In other words, when there is no operation between a USB host terminal and a peripheral device, i.e., a USB slave terminal, for a predetermined period of time, the USB host terminal transmits a suspend signal to the USB slave and then itself operates in a suspended state. Here, in order to terminate the suspended state, the USB slave terminal must generate a remote wake-up signal.

Since the digital camera device 400 of the present invention must be supplied with power from an image processing apparatus, the digital camera device 400 also uses an efficient power management method. In other words, for power management, the digital camera device 400 operates in a suspended state.

For example, when three idle command signals or idle command signals as many as previously agreed between the portable phone and the digital camera device 400 for the interrupt of transmission are consecutively transmitted from a portable phone to the digital camera device 400, the digital camera device 400 operates in the suspended state. In other words, after the digital camera device 400 completes configuration for the portable phone, if the idle command signal for the interrupt of transmission is transmitted from the portable phone to the digital camera device 400 until a predetermined period of time lapses, the
digital camera device 400 operates in the suspended state. In addition, upon receiving an end command signal (i.e., a sensor OFF signal) from the portable phone, the digital camera device 400 entirely stops its operation and enters into the suspended state.

A data transmission method for a digital camera device having a USB host function according to the present invention can be made into a program which can be executed in a computer. In this case, a data transmission method of the present invention can be realized in a universal digital computer, which can execute the program, using a medium used in the computer. The medium may be a storage medium, such as a magnetic storage medium (for example, a ROM, a floppy disc, or a hard disc), an optical readable medium (for example, a CD-ROM or a DVD), or carrier waves (for example, transmitted through Internet).

While this invention has been particularly shown and described with reference to preferred embodiments thereof, it should not be construed as being limited thereto. It should be construed that various changes may be made therein without departing from the scope of the invention.

Industrial Applicability

The present invention provides a universal serial bus (USB) host function to a usual digital camera device so that the digital camera device can perform direct one-to-one USB communication with all kinds of image processing apparatuses. Therefore, a user can conveniently manipulate images picked up by the digital camera device regardless of a place and a type of image processing apparatus.

In addition, according to the present invention, after a type of USB system for an image processing apparatus connected to a digital camera device is determined, an operating mode of the digital camera device is automatically set according to the determined result so that the digital camera device can perform data communication with the image
processing apparatus. Therefore, a user can easily manipulate images picked up by the digital camera device with minimum operation.
What is claimed is:

1. A digital camera device capable of performing data communication with an image processing apparatus through a universal serial bus (USB) method, the digital camera device comprising:
   a lens unit for inputting an image;
   a sensor unit, which is installed to face the lens unit and acquires the image input through the lens unit according to a control signal;
   a connection unit including a connector connected to the image processing apparatus;
   a signal processing unit, which determines a type of USB system for the image processing apparatus according to whether a USB system type identification signal is transmitted from the image processing apparatus within a predetermined period of time after the image processing apparatus is connected to the connection unit, and outputs the determined result; and
   a central processing unit, which sets the digital camera device into a predetermined operating mode according to the determined result output from the signal processing unit, and if a predetermined command signal is transmitted from the image processing apparatus, outputs the control signal for image acquirement to the sensor unit, receives the acquired image from the sensor unit, performs a predetermined process on the image, and transmits the processed image to the image processing apparatus,
   wherein the central processing unit drives the digital camera device in a USB host mode according to an interrupt method.

2. The digital camera device of claim 1, further comprising an operating unit operated by a user to pick up a still image.

3. The digital camera device of claim 1, further comprising a memory unit storing the image acquired by the sensor unit.
4. The digital camera device of claim 1, wherein the signal processing unit is included within the central processing unit.

5. The digital camera device of claim 1 or 4, wherein the signal processing unit determines the type of USB system for the image processing apparatus connected to the connector as the USB host mode when the USB system type identification signal is received from the image processing apparatus within the predetermined period of time after power is supplied from the image processing apparatus, and determines the type of USB system for the image processing apparatus as a USB slave mode when the USB system type identification signal is not received from the image processing apparatus within the predetermined period of time after power is supplied from the image processing apparatus.

6. The digital camera device of claim 5, wherein the central processing unit sets the digital camera device into the USB slave mode when the signal processing unit determines the type of USB system for the image processing apparatus as the USB host mode, and sets the digital camera device into the USB host mode when the signal processing unit determines the type of USB system for the image processing apparatus as the USB slave mode.

7. The digital camera device of any one of claims 1 through 6, wherein the USB host is defined in USB standards.

8. A method of transmitting data from a digital camera device to an image processing apparatus connected to the digital camera device, the method comprising:
(a) determining whether a universal serial bus (USB) system type identification signal is received from the image processing apparatus within a predetermined period of time after the digital camera device is supplied with power from the image processing apparatus;

(b) setting the digital camera device into a USB host mode when the USB system type identification signal is not received within the predetermined period of time;

(c) configuring a USB system type for the image processing apparatus and then transmitting a command request signal to the image processing apparatus; and

(d) receiving a command signal corresponding to the command request signal from the image processing apparatus and transmitting predetermined data generated by performing a predetermined fundamental operation according to the command signal to the image processing apparatus;

wherein the digital camera device operates in the USB host mode.

9. The method of claim 8, wherein the USB system type for the image processing apparatus is configured through a series of enumeration and configuration defined in USB standards.

10. The method of claim 8, wherein the command request signal is transmitted to the image processing apparatus using an interrupt method.

11. The method of claim 8, wherein the command signal is at least one selected from the group consisting of a moving image transmission command signal, a still image transmission command signal, an idle command signal, a suspend command signal, and a remote wake-up command signal.
12. The method of claim 11, wherein the command signal uses one bit or one byte.

13. The method of claim 8, wherein the fundamental operation is at least one selected from the group consisting of a moving image transmission operation, a still image transmission operation, an idle operation, a suspended operation, and a remote wake-up operation.

14. The method of claim 13, wherein the suspended operation is performed when a predetermined number of idle command signals are consecutively transmitted from the image processing apparatus to the digital camera device.

15. The method of claim 8, wherein the predetermined data generated by performing the fundamental operation is at least one among moving image data and still image data.

16. The method of claim 15, wherein the moving image data and still image data are transmitted to the image processing apparatus using a bulk USB transmission method.

17. The method of any one of claims 8 through 16, wherein the USB host is defined in USB standards.

18. A recording medium on which software for realizing the method of any one of claims 8 through 16 in a digital processing apparatus is recorded.

19. A data transmission system comprising:
   a memory storing a program; and
   a processor connected to the memory and executing the program,
wherein the processor performs the method of any one of claims 8 through 16 by executing the program.
FIG. 6A

START

S100

IS IMAGE PROCESSING APPARATUS CONNECTED?

YES

PERFORM INITIALIZATION IN RESPONSE TO SUPPLY OF POWER

S105

IS USB SYSTEM TYPE IDENTIFICATION SIGNAL RECEIVED?

YES

SET DIGITAL CAMERA DEVICE INTO USB HOST MODE

S125

CONFIGURE TYPE OF USB SYSTEM FOR IMAGE PROCESSING APPARATUS

S130

DOES ERROR OCCUR?

NO

A

YES

PERFORM OPERATIONS AS USUAL DIGITAL PC CAMERA DEVICE

S120

OPERATE IN SUSPENDED STATE

S140

END

B
FIG. 7A

RECEIVE PREDETERMINED COMMAND SIGNAL AND PERFORM OPERATION ACCORDING TO PREDETERMINED COMMAND SIGNAL

S150

S1505

ANALYZE TYPE OF COMMAND SIGNAL

SIMPLE COMMAND SIGNAL

TRANSMIT MOVING IMAGE DATA ACCORDING TO MOVING IMAGE TRANSMISSION COMMAND SIGNAL

S1510

PERFORM OPERATION ACCORDING TO SIMPLE COMMAND SIGNAL

S1515

MOVING IMAGE TRANSMISSION COMMAND SIGNAL

D

E

IDLE COMMAND SIGNAL

IS MOVING IMAGE TRANSMISSION INTERRUPT SIGNAL RECEIVED?

S1520

NO

YES

INTERRUPT TRANSMISSION OF MOVING IMAGE DATA

S1525

IS RETRANSMISSION REQUEST SIGNAL RECEIVED?

S1530

YES

NO

RETRANSMIT MOVING IMAGE DATA

S1535

IS STILL IMAGE TRANSMISSION COMMAND SIGNAL RECEIVED?

S1540

NO

YES

TRANSMIT STILL IMAGE DATA

RETURN
FIG. 7B

D

S1550

PERFORM OPERATION IN IDLE STATE ACCORDING IDLE COMMAND SIGNAL

S1555

HAVE PREDETERMINED NUMBER OF IDLE COMMAND SIGNALS BEEN RECEIVED?

NO

S1560

PERFORM OPERATION IN SUSPENDED STATE

S1565

IS REMOTE WAKE-UP SIGNAL RECEIVED?

YES

NO

E
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04N 5/225

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 H04N, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Patents and applications for invention since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NPS "digital camera, usb, host, slave"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>Y</td>
<td>US 5784581 A (INTEL CO.) 21 JULY 1998 claim 1, Fig 5 Fig 7,8</td>
<td>1-7</td>
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<tr>
<td>Y</td>
<td>US 5841471 A (EASTMAN KODAK CO.) 24 NOVEMBER 1998 Fig 6, 8</td>
<td>8-17</td>
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  *&* document member of the same patent family

See patent family annex.

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<td>US 5784581 A</td>
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