A selective call communication system (10), receives a facsimile (FAX) image to be delivered to at least one selective call receiver (40) capable of receiving the FAX image, has a receiver (22, 38) to receive the FAX image and a processor (20), coupled to the receiver (22, 38), to process the FAX image. The processor (20) has an optical character recognizer (OCR) (206) to recognize characters in the FAX image, a segmenter (208) to identify and mark at least one textual region (42) of the FAX image having the characters recognized by the OCR (206) and an extractor (210) to extract the at least one textual region (42) from the FAX image. The FAX image remaining forms a graphics region. A compressor (212) compresses the graphics region, an encoder (214) encodes the graphics region (44) and at least one textual region (42) to form a hyperFAX and a transmitter (216) transmits the hyperFAX to at least one selective call receiver (40).
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FACSIMILE COMMUNICATION WITH A SELECTIVE CALL SYSTEM AND METHOD THEREFOR

Field of the Invention

This invention relates in general to selective call systems, and more particularly to a selective call system capable of facsimile communication.

Background of the Invention

Contemporary selective call receiver communication systems employ messaging schemes that can deliver voice, numeric, or alphanumeric messages to its user. The majority of selective call systems transmit address and message information using a protocol such as GSC (Motorola's Golay Sequential Code), POCSAG (Great Britain's Post Office Code Standardisation Advisory Group) or FLEX™. To originate a message or page, a base station (or selective call terminal) is typically accessed via a Public Switch Telephone Network (PSTN) from a telephone.

In the case of transmission of facsimile (FAX) type messages to selective call receivers, the information is scanned in by facsimile machine, transferred and processed by the selective call system and then transmitted to a selective call receiver designated by the address. Unfortunately, the transmission of FAX information results in a large amount of information to be processed. If the information being FAXed is destined for a selective call messaging (paging) system, and the data transport protocols, if adequate, would not gracefully allow for the transmission of such large amount of information. As is well known, selective call receivers are powered by limited energy content battery supplies that are quickly degraded when receiving and displaying long messages.

Another area of growing concern is the ability to send a printed page or document containing text and graphic information via a facsimile machine to a wireline device, for example selective call receivers. While contemporary facsimile communication equipment employ data compression techniques in their coding formats, such data compression techniques are inadequate for preserving the battery life of the selective
call receivers. Furthermore, the long data messages indicative of facsimile communication results in costly service fees and destroy the battery saving schemes currently employed with selective call communication systems, because the long messages require the message fragmentation and transmission to the selective call receivers. This degradation in battery live of the selective call receiver makes facsimile communication unattractive or impossible to the users of selective call receivers even though the need exists.

Thus, what is needed is a method and apparatus, in a selective call communication system, for providing facsimile communication of messages to selective call receivers without severely destroying their battery lives.

Brief Description of the Drawings

FIG. 1 is an electrical block diagram of a selective call system in accordance with the preferred embodiment of the present invention.

FIG. 2 is an electrical block diagram of a processor of the selective call system of FIG. 1 according to the preferred embodiment of the present invention.

FIG. 3 is an electrical block diagram of a selective call receiver in accordance with the preferred embodiment of the present invention.

FIG. 4 is an electrical block diagram of a processor/controller of the selective call receiver of FIG. 3 in accordance with the preferred embodiment of the present invention.

FIG. 5 is a flow diagram illustrating the operation of the selective call terminal in accordance with the preferred embodiment of the present invention.

FIG. 6 is a flow diagram illustrating a more detail operation of selective call terminal in FIG. 1 according to the preferred embodiment of the present invention.

FIG. 7 is a protocol diagram of a selective call information signaling format in accordance with the preferred embodiment of the present invention.

FIGs. 8 and 9 are flow diagrams illustrating the operation of the selective call receiver in FIG. 3 according to the preferred embodiment of the present invention.
Description of a Preferred Embodiment

Referring to FIG. 1, an electrical block diagram of a selective call communication system 10 is shown in accordance with the preferred embodiment of the present invention. Operationally, a user enters a source document 26 into a facsimile (FAX) machine (scanner) 14. The source document 26 preferably comprises at least one region that has text information 42 and at least one region that has graphics information 44. The FAX machine 14 retrieves (or scans) and quantizes an image (text and graphics information) 42, 44 contained thereon. As is well known to one of ordinary skill in the art, the FAX machine comprises an encoder 34 and a modem 36 for encoding the received information and transmitting the received information from the FAX machine 14.

The FAX machine 14 is coupled to a message controller 22 of a selective call terminal 28 via a network interface 24. The network interface 24, well known to one of ordinary skill in the art, can include a Public Switch Telephone Network (PSTN) or an Integrated Service Digital Network (ISDN). It can also be appreciated by one of ordinary skill in the art that the FAX machine 14 can be directly connected to the message controller 22 via a high speed network (e.g., RS-232, IEEE 802.3) to achieve an extremely high speed message throughput. Therefore, the FAX machine 14 needs not be located at the same physical site as the selective call terminal 28. Actually, the FAX machine 14 can be replaced by, for example, a computer, a conventional document scanner, or possibly a dedicated message entry device, each capable of communicating with the message controller 22 via the network interface 24.

To send a FAX to a subscriber (a person or device having a FAX selective call receiver 40), the sender, for example, enters the subscriber’s cap-code (address) and other system information together with the source document 26. The sender can send a FAX, by alternatively, calling a subscriber’s paging service provider using a conventional telephone to enter, for example, the user’s cap-code number (a unique number assigned by the paging service provider that corresponds to the actual coded address of the selective call receiver 40) and other system information. The paging service provider maintains a list of FAX
capable cap-code numbers (addresses) and upon receiving the entered cap-code number, a procedure to receive a facsimile message is initiated, the details will be discussed below. The user, according to the preferred embodiment of the present invention, enters the address of the selective call receiver 40 to which the FAX information or message is intended and other system information on the source document 26. The source document 26 is then scanned into a FAX machine 14. The information is encoded and compressed by the encoder 34 of the FAX machine 14 and transferred by the modem 36 via the network interface 24 to the selective call terminal 28 which will produce a paging FAX message that will be transmitted to a targeted subscriber. The method, protocol, and apparatus required for the transmission of the paging message will be discussed in detail below.

After the document has been entered into the FAX machine 14, the entire source document 26 is scanned and quantized (retrieved). Thereafter, the retrieved information forms a FAX image which is encoded and compressed by the encoder 34 in the FAX machine preferably according to the Group III FAX coding scheme which is well known to one of ordinary skill in the art. The Group III facsimile (FAX) machine is defined under the CCITT (Consultative Committee on International Telegraph and Telephone). The Group III Facsimile Standards for encoding and compressing data are performed using the coding scheme known as the modified Huffman code. The modified Huffman code uses the standard Huffman code in conjunction with the modified READ (Relative Element Addressing Designate) code. Once the FAX image is Group III encoded and compressed, it is transferred by the modem 36 and is received by the message controller 22 via the PSTN 24. The message controller 22 directs the information to a processor (or image processor) 20 for providing additional processing of the FAX image suitable for selective call communication. After storing at least a portion of the FAX image in a message memory 16, the processor 20 and the message controller 22 begin to process the FAX image.

Referring to FIG. 2, an electrical block diagram of the processor is shown illustrating the details for processing the FAX image. The processor 20 preferably comprises a receiver 202 that receives the FAX image and stores it in a memory 204. An optical character recognizer (OCR) 206 operates on the received FAX image in memory to optically
detect the printed characters and classifies each detected character defined as letters from the alphabet, for example, A through Z (or a through z), numbers 0 through 9 and other punctuation marks or special characters. A text segmenter 208 identifies and marks the location of a group of detected characters detected by the OCR 206 as a textual region 42. The text segmenter 208 marks each group of detected characters where there is at least one group of characters recognized in the FAX image. The text segmenter 208 creates text information comprising the detected characters in the textual regions 42 and marks their corresponding locations in the original FAX image. A text extractor 210 removes or extracts the detected textual regions including the characters within the textual regions from the FAX image, thereby leaving only blank spaces or whitespace in the extracted textual regions of the FAX image. While the text information (characters) are being extracted from the textual regions, the text extractor also determines the coordinates of the location of the text information, and the text information and its coordinates are stored in a memory 218. A compressor 212 compresses the remaining graphics region in the FAX image in response to the text extractor 210 extracting all the textual regions from the FAX image. An encoder and formatter 214 encodes the graphics region, the textual regions 42 and their coordinates retrieved from the memory 218 to form a hyperFAX to enable subsequent transfer (or transmission) 216 to an at least one selective call receiver 40 capable of receiving the hyperFAX using one of the well known selective call system protocols. The hyperFAX comprises the encoded graphics information retrieved from the graphics region and the encoded text information and their corresponding coordinate locations to enable the reconstruction of the FAX image by the selective call receiver 40.

Referring to FIG. 1, when the selective call terminal 28 has completed processing the incoming FAX information to generate the hyperFAX which is transferred by the message controller 22 to a receiver 38 which receives the hyperFAX and a transmitter comprising a base station 30 and an antenna 32, to broadcast a signal modulated with the processed hyperFAX including the selective call address. A selective call receiver 40 is then able to detect its address, recovers the signal, alerts the user, and decodes the received information to retrieve the hyperFAX which is made available for presentation to the user of the selective call receiver 40.
In this way, a printed page or document preferably comprising text and graphics information can be FAXed to a selective call receiver. The text information is detected and regions containing the text information are extracted from the printed document. As is well known to one of ordinary skill in the art, text information need a higher resolution than graphics information to be intelligible. However, most compression systems, including the Group III FAX standard treat both text information and graphics information identically and therefore are limited to compress the image at the higher resolution required by the text information. Therefore, by separating the textual information from the graphics information, the graphics information can be compressed at a lower resolution than the text information to obtain a maximum compression advantage.

Referring to FIG. 3, an electrical block diagram of the selective call receiver 40 is shown in accordance with the preferred embodiment of the present invention. The selective call receiver 40 comprises an antenna 64 for intercepting transmitted radio frequency (RF) signals comprising the hyperFAX which is coupled to the input of a receiver 66. The receiver 66 provides for reception of transmissions on a single reception frequency, or, as will be further described below, reception on multiple reception frequencies. When multiple frequency reception is provided, a frequency synthesizer 67 enables the generation of the multiple reception frequencies in a manner well known to one of ordinary skill in the art. The receiver 66 receives and demodulates the transmitted signals, preferably frequency modulated data signals, providing at the output of the receiver a stream of binary data signals corresponding to the destination IDs transmitted from any particular destination location. The binary data signals are coupled into the input of a decoder/controller 68 which processes the signals, in a manner well known in the art. The received destination IDs are compared with the predetermined destination ID corresponding to the destination to which the subscriber has preselected. A memory 70, coupled to the decoder/controller 68, includes a table of destination IDs, or addresses, which are stored in a destination memory 74 section of the memory 70. Selector switches 76 are provided to enable the selection of one or more destination addresses identifying destinations at which the subscriber wishes to be notified. A display 90 is used to display the destination information stored in the
destination memory 74 for enabling the subscriber to readily select the destination at which an alert is desired, as will be described below. The decoder/controller 68 compares the received destination IDs with the predetermined destination address selected by the subscriber from the destination memory 74, and when a match is detected, the decoder/controller 68 generates an alert enable signal which is coupled to the input of a sensible alerting device, such as a tactile alerting device 80. The tactile alerting device 80 preferably provides a silent vibratory output alerting the subscriber that the destination selected is being approached.

When the selective call receiver 40 is used to provide both destination notification alerting and paging capability including FAX capability, the addresses assigned to the selective call receiver 40 for use in the selective call communication system 10 are stored in an address memory 72 portion of memory 70. The decoder/controller 68 then controls the generation by the frequency synthesizer 67 of the selective call system's frequency or the paging system's frequency, to enable selectively receiving signals on a paging channel or the selective call system channel. A power switch 82 coupled to the decoder/controller 68 is used to control the supply of power to the receiver 66, thereby providing a battery saving function, as is well known in the art for use with selective call receivers. When the paging channel is selected, the received paging address signals are processed by the decoder/controller 68, and when a paging address signal is detected which corresponds to an assigned address of the selective call receiver 40, the decoder/controller 68 generates an alert enable signal which can be coupled to an audible alerting device 84, such as an audible transducer, to provide an audible alert, or can be coupled to the tactile alerting device 80 to provide a silent alert. Selection of either audible or silent alerting is provided by the selector switches 76 in a manner well known in the art.

The controller/decoder 68 of FIG. 3 can be implemented utilizing a microcomputer as shown in FIG. 4. FIG. 4 is an electrical block diagram of a microcomputer based decoder/controller suitable for use in the selective call receiver of FIG. 3. As shown, the microcomputer 68 is preferably of the family of MC68HC05 series microcomputers, such as manufactured by Motorola, Inc., which includes an on-board display driver 414. The microcomputer 68 includes an oscillator 418 which generates the timing signals utilized in the operation of the
microcomputer 68. A crystal, or crystal oscillator (not shown) is coupled to the inputs of the oscillator 418 to provide a reference signal for establishing the microcomputer timing. A timer/counter 402 couples to the oscillator 418 and provides programmable timing functions which are utilized in controlling the operation of the receiver or the processor. A RAM (random access memory) 404 is utilized to store variables derived during processing, as well as to provide storage of FAX or paging information which are received during operation as a selective call receiver. A ROM (read only memory) 406 stores the subroutines which control the operation of the receiver or the processor which will be discussed further. It will be appreciated that in many microcomputer implementations, the programmable-ROM (PROM) memory area can be provided either by a programmable read only memory (PROM) or an EEPROM (electrically erasable programmable read only memory). The oscillator 418, timer/counter 402, RAM 404, and ROM 406 are coupled through an address/data/control bus 408 to a central processing unit (CPU) 410 which performs the instructions and controls the operations of the microcomputer 68.

The demodulated data generated by the receiver is coupled into the microcomputer 68 through an input/output (I/O) port 412. The demodulated data is processed by the CPU 410 and when the received address is the same as that stored within the code-plug memory which couples into the microcomputer through, for example an I/O port 413, the hyperFAX is received and stored in RAM 404. Recovery of the stored hyperFAX, and selection of the predetermined destination address, is provided by the switches which are coupled to the I/O port 412. The microcomputer 68 then recovers the hyperFAX with a hyperFAX decoder 420 that decodes the text information and the graphics information. A decompressor 422 decompresses the graphics information, and a text and graphics combiner 424 combines the text and graphics information using the retrieved coordinates. The reconstructed FAX image is directed over the data bus 408 to the display driver 414 which processes the information and formats the information for presentation by the display (output display screen) 90 (FIG. 3) such as an LCD (liquid crystal display).

When the selective call receiver 40 receives its address, the alert signal that is generated can be routed through the data bus 408 to an alert generator 416 that generates the alert enable signal which is coupled to
the audible alert device that was described above. Alternatively, when
the vibrator alert is selected, as described above, the microcomputer
generates an alert enable signal which is coupled through data bus 408 to
the I/O port 413 to enable generation of a vibratory, or silent alert.

The battery saver operation is controlled by the CPU 410. The
battery saving signals are directed over the data bus 408 to the I/O port
412 which couples to the power switch 82 (FIG. 3). Power is periodically
supplied to the receiver to enable decoding of the received selective call
receiver address signals, the hyperFAX and the coordinates which are
directed to the selective call receiver 40. The reconstructed FAX image is
stored and ready to be displayed on the display 90.

Referring to FIG. 5, a flow diagram is shown illustrating facsimile
communication in accordance with the preferred embodiment of the
present invention. When the source document 26 has been entered, step
602, the FAX machine 14 scans and quantizes the text 42 and graphics 44
information on the source document 26, step 604. The quantized
information is then encoded and compressed, preferably according to the
Group III facsimile standard, step 606. The encoded and compressed
information is transferred from the FAX machine 14 to the message
controller 22 via the PSTN 24, step 608. The message controller 22
receives the compressed information and stores it in memory to be
accessed by the processor 20 which processes the compressed information
before transmission to its designated selective call receiver 40, step 610.
The received information is then decoded from the Group III format to
retrieve the information, step 612. The information is processed, step
614, according to the preferred embodiment of the present invention by
extracting the text information 42 and the (x, y) co-ordinates of the textual
region of the FAX image to be discussed in detail below.

Referring to FIG. 6, a flow diagram of the processor of the selective
call terminal is shown according to the preferred embodiment of the
present invention. The FAX image is received by the processor, step 802.
The FAX image comprises a transmission of a printed page or document
from the fax machine comprising text and graphics information. The
processing of the FAX image comprises the following steps of optically
detecting the printed characters and classifying each detected characters
defined as letters from the alphabet, for example, A through Z (or a
through z), numbers 0 through 9 and other punctuation marks or special
characters, step 804. A group of characters detected in step 804 is identified and marked as a textual region, step 806. The marked textual region comprises the detected characters in the textual regions and their corresponding location in the original FAX image. The marked textual region is removed or extracted including the characters within the textual regions from the FAX image, thereby leaving only blank spaces or whitespace in the extracted textual regions of the FAX image, step 808. The remaining graphics region in the FAX image is compressed, step 810. The compression step 810 preferably downsamples the graphics information to a lower resolution, and the extracted text information and compressed graphics information are encoded and formatted as a hyperFAX to enable subsequent transmission 216 to an at least one selective call receiver capable of receiving the hyperFAX.

A hyperFAX comprises information about the textual regions and their location in the FAX image. Since the exact locations of the textual regions in the FAX image are known it is not necessary to code the textual regions as raster information thereby reducing the information to be transmitted to the selective call receiver. Therefore, by identifying and extracting the textual regions from the FAX image, the remaining graphics region can be compressed to a lower resolution. The FAX image can be transmitted as the hyperFAX and the receiver can reconstruct the FAX image by combining the text information with the graphics information. Since the method described involves a preprocessing of the information by extracting the text, this method can be used effectively with any compression algorithm.

Referring to FIG. 5, the information is selective call encoded, step 616, with the address and the hyperFAX for transmission to the at least one selective call receiver 40. The message is then transmitted to the at least one selective call receiver, step 618.

Referring to FIG. 7, a protocol diagram of a selective call communication format is shown in accordance with the preferred embodiment of the present invention. The signaling protocol is used for addressing and transmitting facsimile information to the selective call receiver 40 using any facsimile standard. A FAX paging information packet 700 preferably comprises a selective call address 702, a facsimile message header 704, format or message type identifier 710, hyperFAX comprising the text and graphics information and the coordinates for
reconstructing the FAX image 706, and an end-of-message flag 708. The end-of-message flag 708 can be omitted without compromising the integrity of this signaling format. The address signal 702 comprises a conventional selective call address of a type that is well known to one of ordinary skill in the art. The message header 704 contains information on the data block length, FAX protocol type, a data flag to determine if a hyperFAX or a regular paging message is being received and possibly an encryption type for use in a secure hyperFAX messaging system. Following the message header 704 is the format identifier 710 that identifies the format of the information. Following the format identifier 710 is the data block 706 containing standard facsimile data of the format or type indicated by the format identifier. This embodiment can be used in conjunction with a conventional FAX machine to receive the hyperFAX via a wireless data channel. Furthermore, when used in conjunction with a personal computer or the like (e.g., a laptop computer), the selective call receiver 40 as illustrated in FIG. 3 can couple the received hyperFAX to the computer for storage in a file, thus allowing the user to have an archive of the FAX image reconstructed from the hyperFAX.

Referring to FIG. 8, the flow diagram illustrates the receiving operation of the selective call receiver of FIG. 3. The process of receiving a selective call message or information begins at step 902. In step 904, the address decoder searches a received signal for an address signal. Step 906 tests any recovered address signals to determine if they correlate with at least one predetermined address associated with the selective call receiver 40. If the received address does not correlate (match), control is returned to step 904 and a new search is performed. When a received address correlates with at least one predetermined address associated with the selective call receiver, step 908 decodes the message header then passes control to step 910. Step 910 tests for the presence of a FAX data flag. If step 910 is false, the following data block will contain symbols that will be decoded as a conventional paging or selective call message, step 912. When decoding is complete, step 916 stores the information and step 918 tests for an end of message condition that may be indicated by an end-of-message marker or the lack of another data flag. If step 918 is false (not yet at end of message) the processing continues to step 910. When step 910 is true, the following data block will contain a hyperFAX. The
hyperFAX message is processed and decoded in step 914, and stored, step 916. When step 918 is true, control is returned to step 902 and the address decoder resumes searching for valid addresses.

Referring to FIG. 9, a flow diagram is shown illustrating a more detailed operation of the processor of the selective call receiver. The hyperFAX is decoded, step 1002 to recover the graphics information and the text information, step 1004. The graphics information is decompressed to a graphics image, step 1006. The text character sizes and fonts of the text information are determined by using the coordinates transmitted in the hyperFAX and the display size and characteristics of the selective call receiver to determine the best format to present the FAX image to the user, step 1008. Once the font and the size of the characters of the text information are determined, the text information and the graphic information are combined to generate the FAX image, step 1010.

According, the text information contained in the hyperFAX is used to convert the text information, and the text character font and size are determined from the size of the textual region 42 and the number of text characters required to be displayed in it. This operation attempts to preserve the variable text sizes necessary to maintain the original look of the FAX image, even if the actual font used is not the same. The text information is transformed to a raster bit-map image representation that is downsampled to match the resolution of the FAX image.

This method is especially effective for sending a very low-resolution FAX image as a preview. In this case, the FAX is downsampled from, for example an original 200 dpi (dots-per-inch) resolution to 50 dpi or 25 dpi resolution, creating a much smaller image. For FAX preview, the concern is recognizability where only the high-level, large scale structure is important, and the textual regions in the FAX image do not need to be intelligible for recognizability. Since the text information at the FAX preview resolution is too small to be readable anyway, the text information does not need to be sent and any text information can be generated locally at the decoder to preserve the appearance to the FAX image. Therefore, any arbitrary pre-stored or available text information can then be used to fill the textual regions of the FAX image at the decoder.
Fax compression system like CCITT Group III or IV are lossless, i.e., they generate the bit-image exactly at the selected resolution. This aspect limits, to a great extent, the compression efficiency that can be achieved by such systems for data comprising graphics and text information.

Furthermore, all the lossless compression techniques, including the more efficient Joint Bi-level Image Group (JBIG) algorithm International Standards Organization (ISO) Standard 11544, have difficulty compressing the textual regions of the image due to the high frequency content in the signal; but operate more effective in areas with many blanks or whitespace and smooth, continuous areas. By separating the high frequency textual regions from the FAX image, a significant coding gain is achieved.

In summary, in a selective call communication system, a method for facsimile (FAX) communication, comprises the steps of (a) receiving a FAX image at the selective call terminal and (b) processing the FAX image. The step of processing comprises the steps of (c) recognizing characters in the FAX image, (d) identifying and marking at least one textual region in the FAX image comprising the characters recognized in step (c), and (e) extracting the at least one textual region from the FAX image. The FAX image remaining forms a graphics region; The step of processing further comprises the steps (f) of compressing the graphics region, and (g) encoding the graphics region and the at least one textual region to form a hyperFAX. The facsimile communication further comprises the step (h) of transmitting the graphics region and the at least one textual region encoded as a hyperFAX to an at least one selective call receiver capable of receiving the hyperFAX. In the at least one selective call receiver, a method for reconstructing the FAX image comprises the steps of (i) receiving the hyperFAX, (j) decoding the hyperFAX to recover the graphics region and the at least one textual region, (k) decompressing the graphics region and (m) combining the graphics region and the at least one textual region to reconstruct the FAX image.

What is claimed is:
CLAIMS

1. In a selective call communication system, a method for facsimile (FAX) communication, comprising the steps of:
   (a) receiving an FAX image at a selective call terminal;
   (b) processing the FAX image, the step of processing comprising the steps of:
      (c) recognizing characters in the FAX image;
      (d) identifying and marking at least one textual region in the FAX image comprising the characters recognized in step (c);
      (e) extracting the at least one textual region from the FAX image, the FAX image remaining forms a graphics region;
      (f) compressing the graphics region;
      (g) encoding the graphics region and the at least one textual region to form a hyperFAX; and
      (h) transmitting the graphics region and the at least one textual region encoded as the hyperFAX to an at least one selective call receiver capable of receiving the hyperFAX.

2. The method according to claim 1 wherein the at least one selective call receiver further comprising the steps of:
   receiving the hyperFAX;
   decoding the hyperFAX to recover the graphics region and the at least one textual region;
   decompressing the graphics region; and
   combining the graphics region and the at least one textual region to reconstruct the FAX image.

3. The method according to claim 2 wherein the step of combining further comprising the steps of:
   determining coordinates of the at least one textual region; and
   formatting the characters of the at least one textual region to reconstruct the FAX image.

4. The method according to claim 1 wherein the step (g) of encoding encodes the graphics region to generate an encoded graphics region and
encodes the at least one textual region to generate an encoded textual region.

5. A selective call communication system for receiving a facsimile (FAX) image to be delivered to at least one selective call receiver capable of receiving the FAX image, comprising:
   a receiver for receiving the FAX image;
   a processor, coupled to said receiver, for processing the FAX image, the processor further comprising:
   an optical character recognizer (OCR) to recognize characters in the FAX image;
   a segmenter to identify and mark at least one textual region of the FAX image comprising the characters recognized by the OCR;
   an extractor to extract the at least one textual region from the FAX image, the FAX image remaining forms a graphics region;
   a compressor to compress the graphics region;
   an encoder to encode the graphics region and the at least one textual region to form a hyperFAX; and
   a transmitter to transmit the hyperFAX to the at least one selective call receiver.

6. The selective call communication system according to claim 5 wherein the at least one selective call receiver, comprising:
   a receiver to receive the hyperFAX;
   a decoder to decode the hyperFAX to recover the graphics region and the at least one textual region;
   a decompressor to decompress the graphics region; and
   an image processor to combine the graphics region and the at least one textual region to reconstruct the FAX image.

7. The selective call communication system according to claim 5 wherein the image processor comprising:
   means for determining coordinates of the at least one textual region;
   and
   means for formatting the characters of the at least one textual region for recombining the graphics region and the at least one textual region into the FAX image.
8. The selective call communication system according to claim 5 wherein the encoder encodes the graphics region to generate an encoded graphics region and encodes the at least one textual region to generate an encoded textual region.

9. In a selective call communication system, a method for facsimile (FAX) communication, comprising the steps of:
   (a) receiving an FAX image at a selective call terminal;
   (b) processing the FAX image, the step of processing comprising the steps of:
      (c) recognizing characters in the FAX image;
      (d) identifying and marking at least one textual region in the FAX image comprising the characters recognized in step (c);
      (e) extracting the at least one textual region from the FAX image, the FAX image remaining forms a graphics region;
      (f) compressing the graphics region;
      (g) encoding the graphics region and the at least one textual region to form a hyperFAX; and
      (h) transmitting the graphics region and the at least one textual region encoded as the hyperFAX to an at least one selective call receiver capable of receiving the hyperFAX, in the at least one selective call receiver, a method for reconstructing the hyperFAX comprising the steps of:
         (i) receiving the hyperFAX;
         (j) decoding the hyperFAX to recover the graphics region and the at least one textual region;
         (k) decompressing the graphics region; and
         (m) combining the graphics region and the at least one textual region to reconstruct the FAX image.

10. A selective call communication system for receiving a facsimile (FAX) image to be delivered to at least one selective call receiver capable of receiving the FAX image, comprising:
    a first receiver for receiving the FAX image;
    a processor, coupled to said first receiver, for processing the FAX image, the processor further comprising:
an optical character recognizer (OCR) to recognize characters in
the FAX image;

a segmenter to identify and mark at least one textual region of
the FAX image comprising the characters recognized by the OCR;

an extractor to extract the at least one textual region from the
FAX image, the FAX image remaining forms a graphics region;

a compressor to compress the graphics region;

an encoder to encode the graphics region and the at least one
textual region to form a hyperFAX;

a transmitter to transmit the hyperFAX to an at least one selective
call receiver, the at least one selective call receiver, comprising:

a second receiver to receive the hyperFAX;

a decoder to decode the hyperFAX to recover the graphics
region and the at least one textual region;

a decompressor to decompress the graphics region; and

an image processor to combine the graphics region and the at
least one textual region to reconstruct the FAX image.
FIG. 1

FIG. 2
RECEIVE FAX IMAGE

PROCESS FAX IMAGE WITH OPTICAL CHARACTER RECOGNIZER

IDENTIFY AND MARK TEXTUAL REGIONS

EXTRACT THE MARKED TEXTUAL REGIONS

COMPRESS REMAINING GRAPHICS REGION

ENCODE AND FORMAT TEXT AND GRAPHICS INFORMATION TO FORM A HYPERFAX

FIG. 6
FIG. 9

1002
DECODE HYPERFAX

1004
RECOVER TEXT AND GRAPHICS INFORMATION

1006
DECOMPRESS GRAPHICS INFORMATION

1008
DETERMINE TEXT CHARACTER SIZE AND FONT

1010
COMBINE TEXT AND GRAPHICS REGIONS TO RECONSTRUCT FAX IMAGE
# INTERNATIONAL SEARCH REPORT

## A. CLASSIFICATION OF SUBJECT MATTER

<table>
<thead>
<tr>
<th>IPC(6)</th>
<th>US CL</th>
<th>According to International Patent Classification (IPC) or to both national classification and IPC</th>
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<tbody>
<tr>
<td>H04N 1/32, 1/40; H04M 11/00; H04B 7/00</td>
<td>.358/468, 467, 462, 440; 379/57; 455/33.1</td>
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## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

<table>
<thead>
<tr>
<th>U.S.</th>
<th>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</th>
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</table>

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

**APS**

Search terms: (selective call#) and (fax or facsimile) and (text#(2p)graphic#)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
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<tbody>
<tr>
<td>X</td>
<td>US, A, 5,398,115 (LIN) 14 March 1995, see figs. 1-6, col. 2, line 58 - col. 10, line 5.</td>
<td>1-10</td>
</tr>
<tr>
<td>A</td>
<td>US, A, 5,331,431 (JASINSKI) 19 July 1994, see figs. 1-5.</td>
<td>1-10</td>
</tr>
<tr>
<td>X,P</td>
<td>US, A, 5,459,482 (ORLEN) 17 October 1995, see fig. 1, col. 3, lines 46-49; col. 4, line 58 - col. 5, line 6; col. 5, lines 3-6; col. 7, lines k30-43; col. 6, lines 56-60.</td>
<td>1-10</td>
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<tr>
<td>A</td>
<td>US, A, 5,422,733 (MERCHANT ET AL.) 06 June 1995.</td>
<td>1-10</td>
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<tr>
<td>A</td>
<td>US, A, 5,410,417 (KUZNICKI ET AL.) 25 April 1995.</td>
<td>1,5,9,10</td>
</tr>
</tbody>
</table>

*Further documents are listed in the continuation of Box C.*

*See patent family annex.*

**"** Special categories of cited documents:

*A* document defining the general state of the art which is not considered to be part of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, each combination being obvious to a person skilled in the art

"Z" document member of the same patent family

**Date of the actual completion of the international search**

02 AUGUST 1996

**Date of mailing of the international search report**

02 OCT 1996

**Name and mailing address of the ISA/US Commissioner of Patents and Trademarks**

Box PCT

Washington, D.C. 20231

Facsimile No. (703) 305-3230

**Authorized officer**

CHEUKFAN LEE

**Telephone No.** (703) 308-4867

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