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(54) **IMAGER READER WITH HAND GESTURE INTERFACE**

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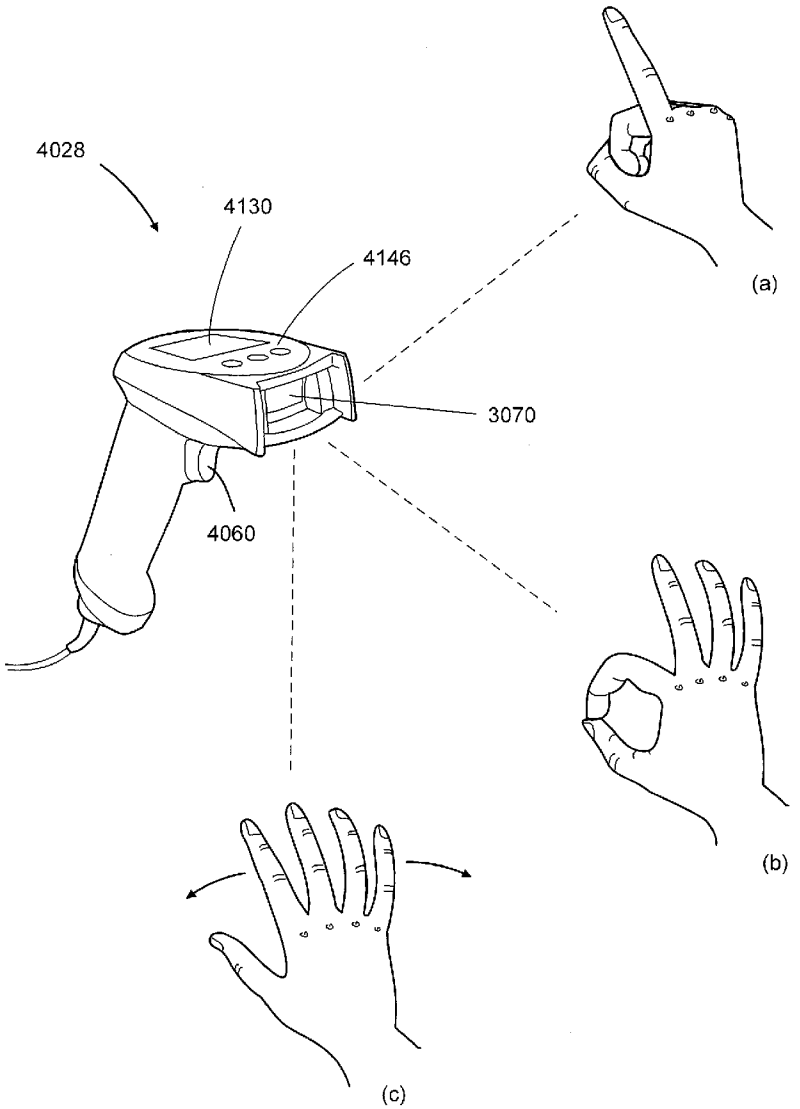
(57) **ABSTRACT**

A system for decoding an encoded symbol character associated with a product is provided herein. The system includes an imager-based indicia reading terminal comprising a housing and a two-dimensional image sensor array and an imaging lens for focusing an image on the two-dimensional image sensor array. The terminal is adapted to read an encoded symbol character, and further adapted to image a hand gesture. The terminal includes a digital link to transmit the image of the hand gesture. The system further includes a memory coupled to the indicia reading terminal via a digital connection. The memory includes a hand gesture attribute library to associate predefined hand gestures with a terminal mode of operation. The system further includes a central processing unit connected to the digital link to receive the image of the hand gesture, correlate the image with the predefined hand gestures in the hand gesture attribute library, and execute the associated terminal mode of operation.



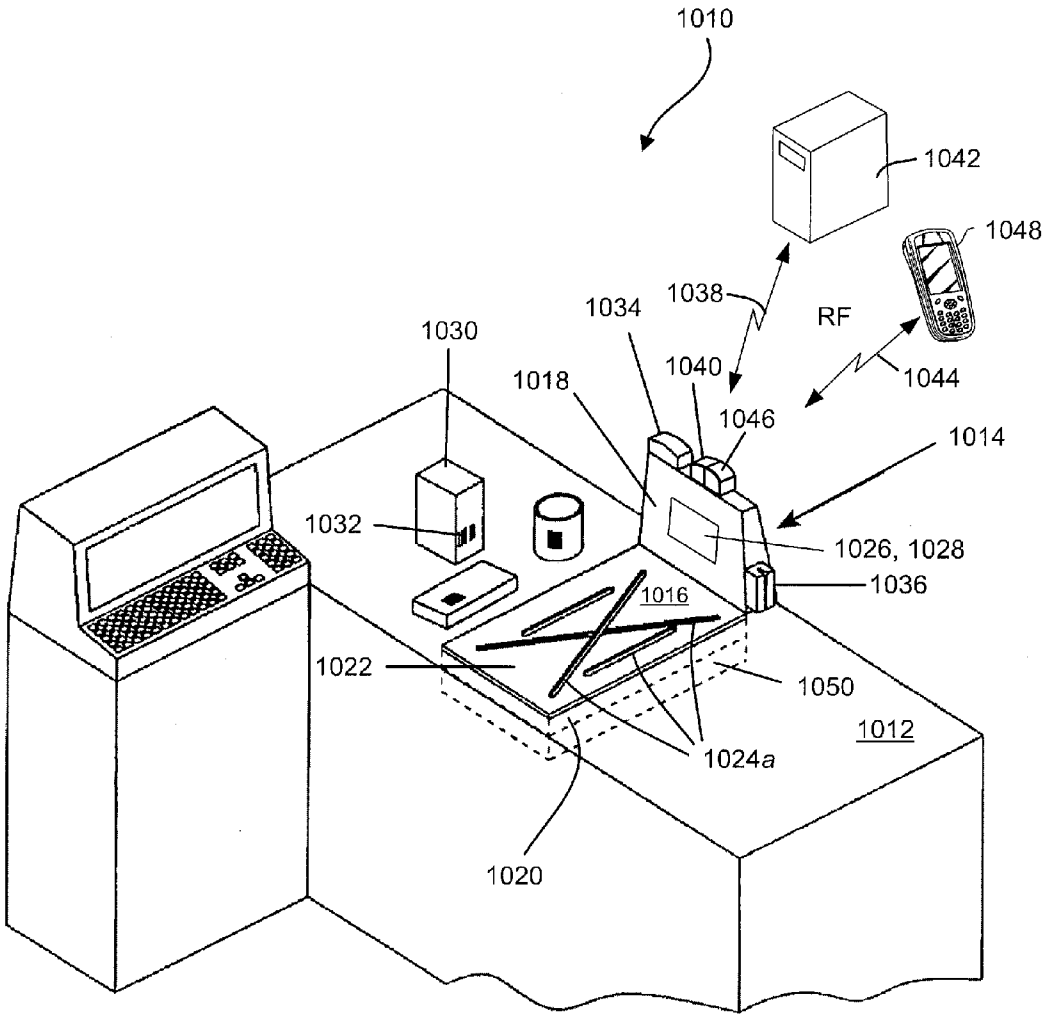

1010
1042
1048
1038
1034
RF
1030
1040
1044
1018
1046
1014
1032
1026, 1028
1036
1016
1022
1050
1012
1024a
1020

FIG. 1

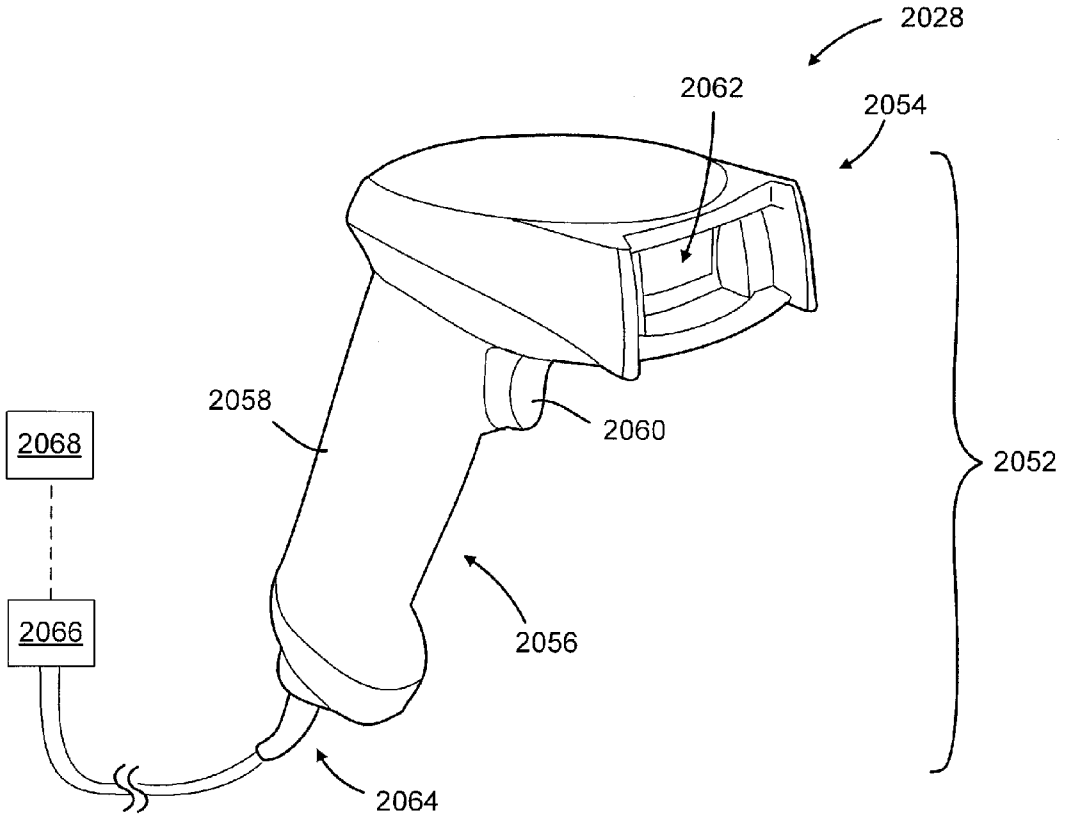



FIG. 2

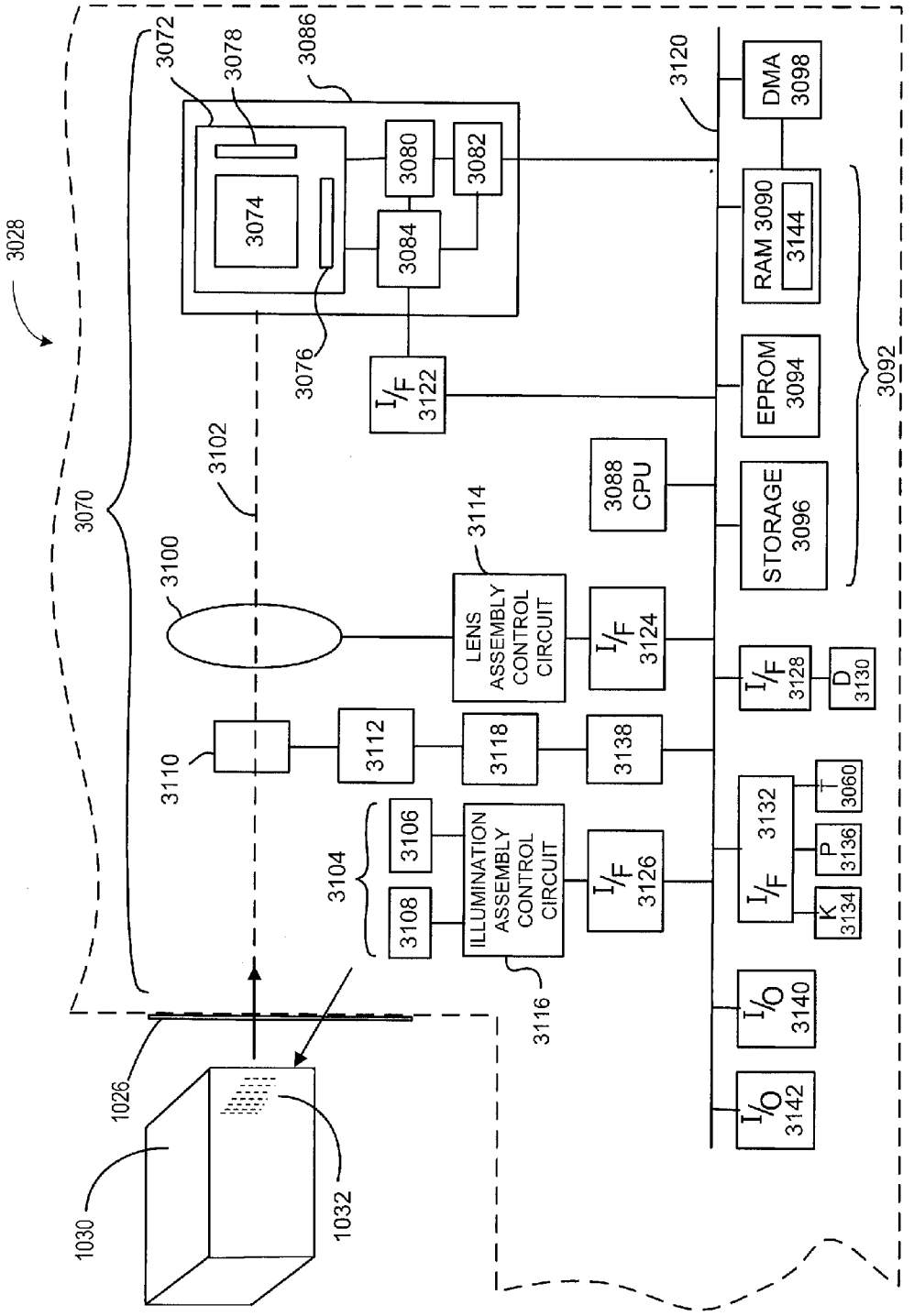

3028
3072
3078
3086
3074
3080
3082
3084
3076
3070
3102
3100
3110
3104
3106
3108
3112
3118
3138
3114
LENS ASSEMBLY CONTROL CIRCUIT
ILLUMINATION ASSEMBLY CONTROL CIRCUIT
3116
I/F 3122
I/F 3124
I/F 3126
I/F 3128
I/F 3132
I/O 3140
I/O 3142
3088 CPU
3120
DMA 3098
RAM 3090
3144
EPROM 3094
STORAGE 3096
3092
D 3130
T 3060
P 3136
K 3134
1026
1030
1032

FIG. 3

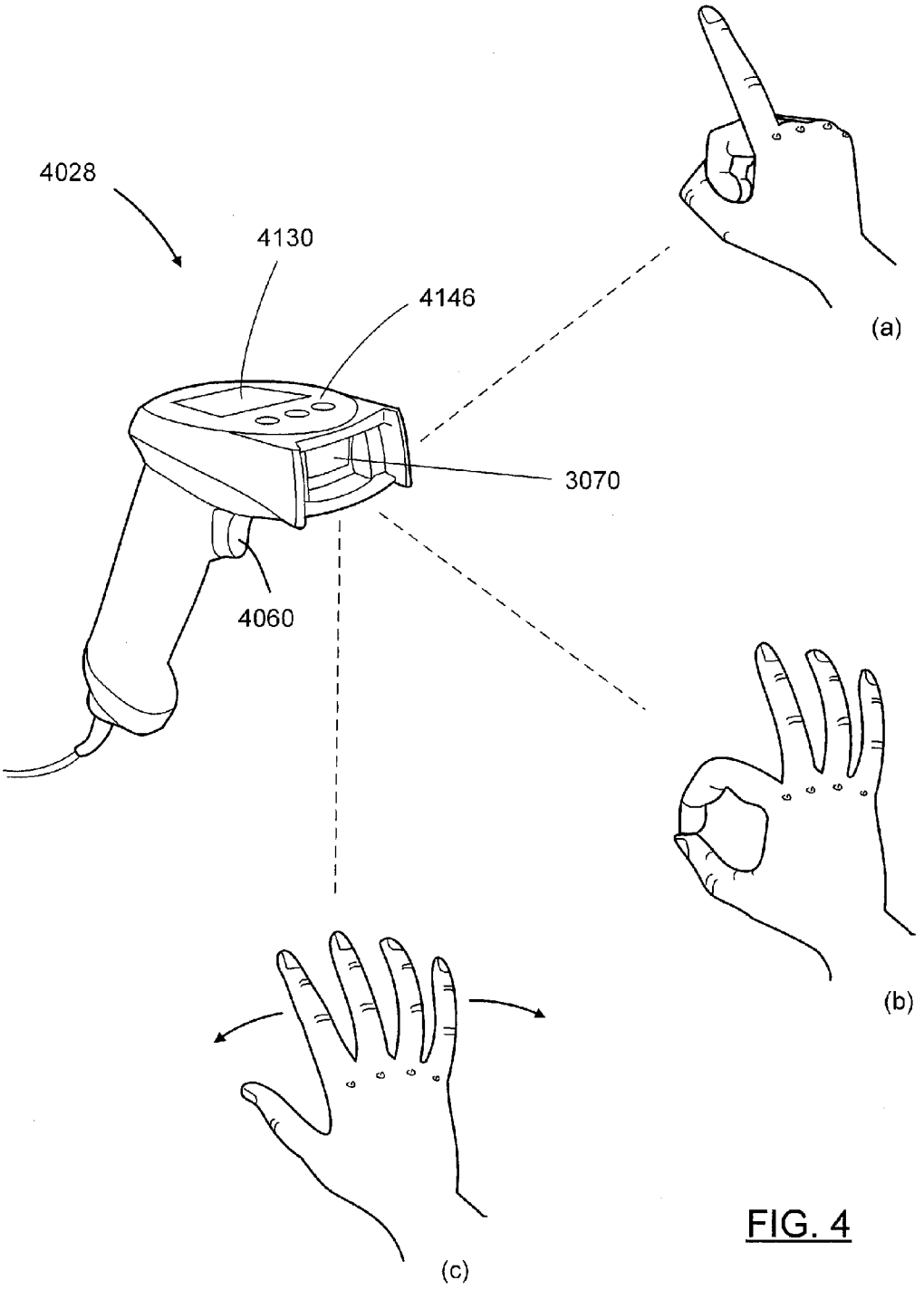



FIG. 4

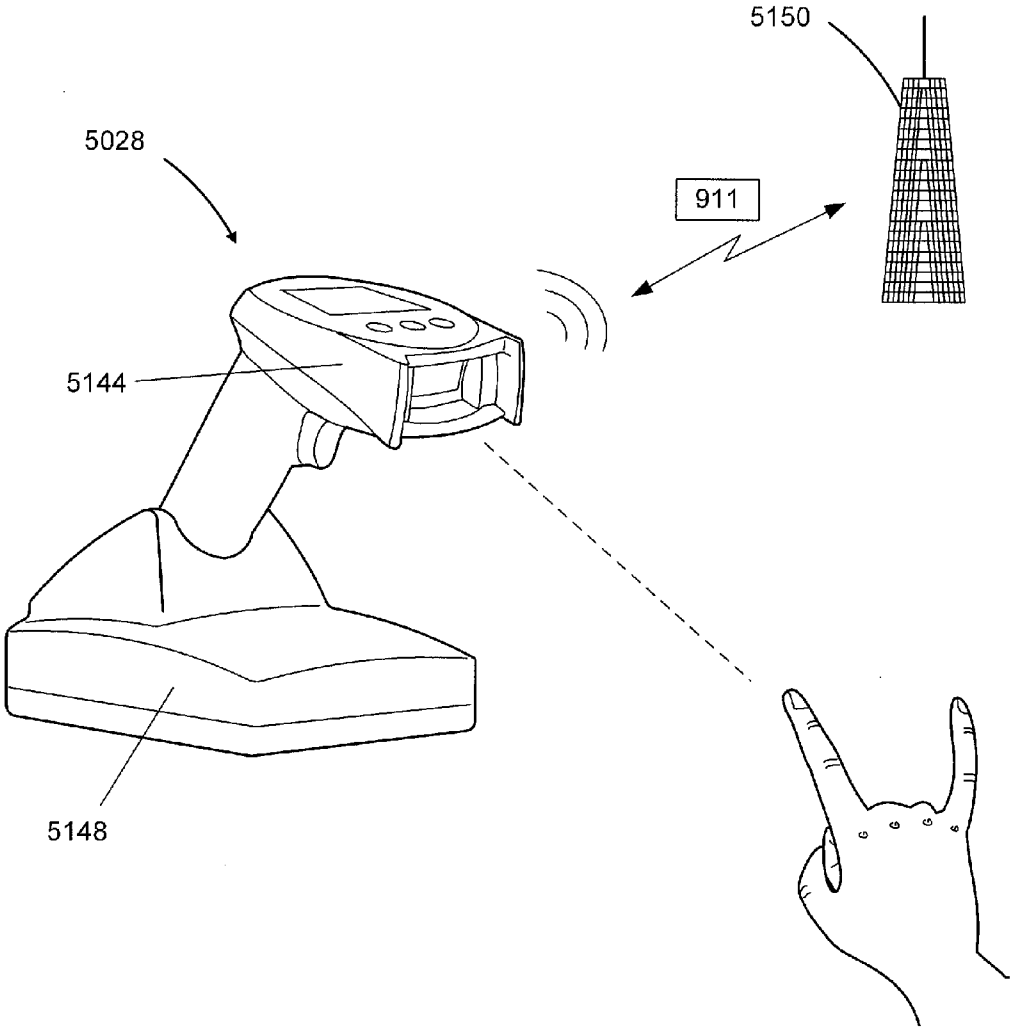



FIG. 5

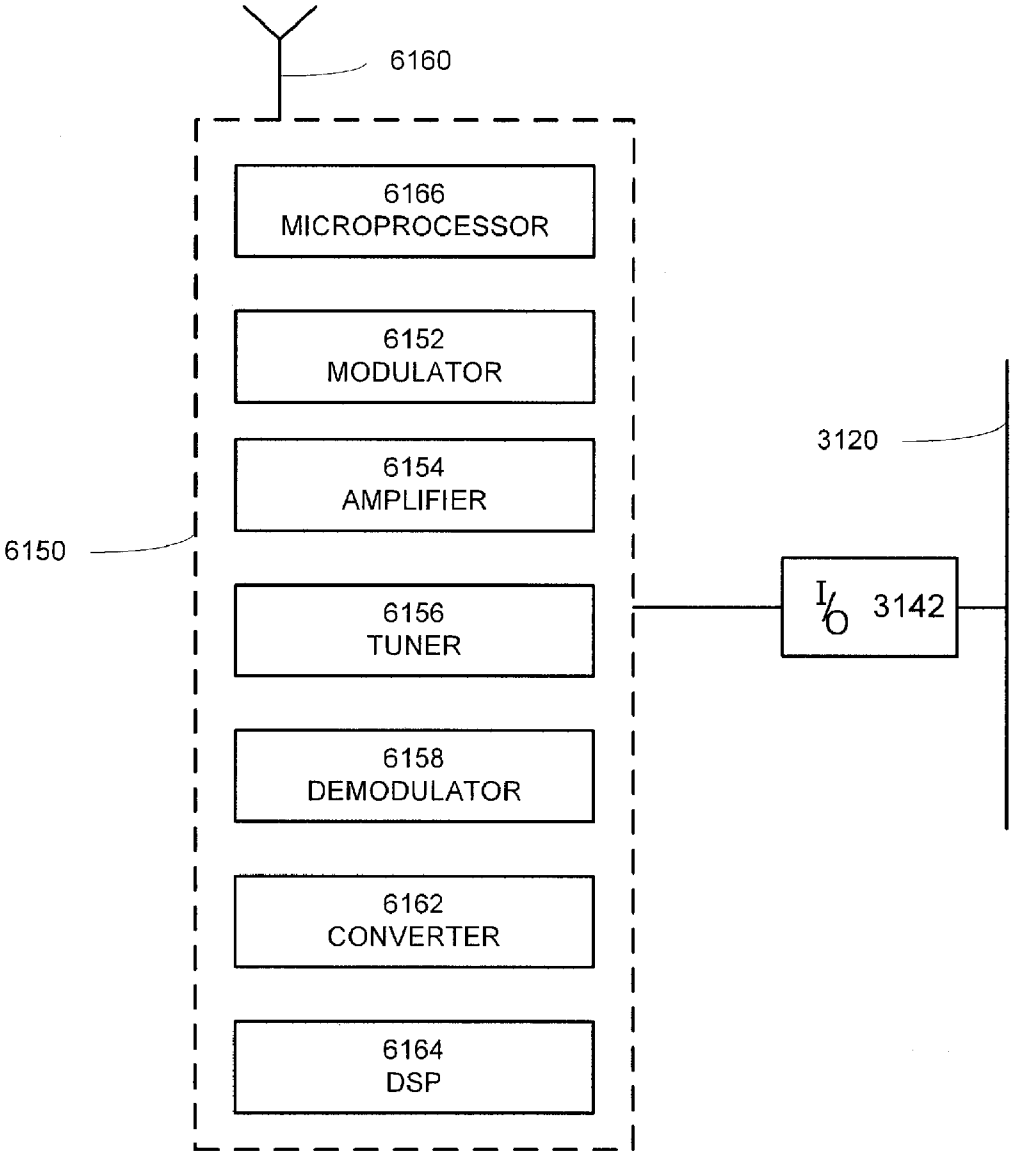

6160
6166
MICROPROCESSOR
6152
MODULATOR
6154
AMPLIFIER
6150
6156
TUNER
6158
DEMODULATOR
6162
CONVERTER
6164
DSP
3120
I/O
3142

FIG. 6

# IMAGER READER WITH HAND GESTURE INTERFACE

## FIELD OF THE INVENTION

**[0001]** This disclosure relates generally to imager-based indicia reading terminals and, more specifically, to embodiments of indicia reading terminals that are configured to execute changes in modes of operation using hand gestures.

## BACKGROUND OF THE INVENTION

**[0002]** The use of optical indicia, such as barcode symbols, for product and article identification is well known in the art. Presently, various types of indicia reading terminals have been developed, such as hand-held barcode scanners, hands-free scanners, bioptic in-counter scanners, and mobile computers such as personal digital assistants (PDAs). One common type of scan engine found in hand-held and retail scanners is the laser-based scan engine, which uses a focused laser beam to sequentially scan the bars and spaces of a barcode symbol pattern to be read. The majority of laser scanners in use today, particular in retail environments, employ lenses and moving (e.g., rotating or oscillating) mirrors and/or other optical elements in order to focus and scan laser beams across barcode symbols during code symbol reading operations.

**[0003]** Another common type of indicia reading terminal is the digital imager, which includes linear imagers and area imagers. Digital imagers typically utilize light emitting diodes (LEDs) and a lens to focus the image of the barcode onto a multiple pixel image sensor assembly, which often is a charge-coupled device (CCD) that converts light signals into electric signals. The LEDs simultaneously illuminate all of the bars and spaces of a barcode symbol with light of a specific wavelength in order to capture an image for recognition and decoding purposes.

**[0004]** Digital imagers have the capability to change modes of operation. For example, an imager may be configured to scan a barcode, take a picture, or engage in optical character recognition (OCR). Within the barcode scanning mode, the imager may be configured for presentation mode, trigger mode, or inventory mode, for example. In presentation mode, the imager typically remains stationary in a stand and a product bearing a barcode is swiped by the scanner. In trigger mode, the scanner is typically grasped by hand and directed to the barcode. Many trigger modes may be selected, such as single try, multi-try, and continuous. In inventory mode, a barcode is read and stored in non-volatile memory and not transferred to the host until commanded by the user. Such configurations may be required to accommodate different types of decodable indicia, packages, and other items.

**[0005]** One current method to configure the imager for each of the different modes of operation is to scan a configuration barcode from the Operating Manual or Configuration Guide. The Manual or Guide contains instructions to enter a configuration mode, then scan a printed barcode in the Manual, which subsequently changes the configuration of the terminal. One drawback to this approach is that this method often requires that the end user have available the relevant programming barcodes. The end user must search the manual to find the programming barcode for the desired configuration, which wastes time, may result in erroneous entry, and could lead to customer dissatisfaction.

**[0006]** Another method to configure the imager for a different mode of operation is to connect it to a companion device such as a computer or register, using a wired interface such as a RS-232 or USB cord. Often the imager and the computer communicate via a configuration or set-up tool, which requires the end user to not only have access to the companion device, but also to operate simultaneously the terminal and the companion device to implement the desired configuration for the terminal.

**[0007]** In those circumstances where the end user wishes to change the configuration of the imager for a short duration or one-time use, the current reconfiguration methods are cumbersome and time-consuming.

## SUMMARY OF THE INVENTION

**[0008]** Accordingly, there is a need for an imager that can quickly switch its mode of operation without complicated steps or additional hardware. In ones aspect of the invention, provided herein is a system for decoding an encoded symbol character associated with a product. The system includes an imager-based indicia reading terminal comprising a housing and a two-dimensional image sensor array and an imaging lens for focusing an image on the two-dimensional image sensor array. The terminal is adapted to read an encoded symbol character, and further adapted to image a hand gesture. The terminal includes a digital link to transmit the image of the hand gesture. The system further includes a memory coupled to the indicia reading terminal via a digital connection. The memory includes a hand gesture attribute library to associate predefined hand gestures with a terminal mode of operation. The system further includes a central processing unit connected to the digital link to receive the image of the hand gesture, correlate the image with the predefined hand gestures in the hand gesture attribute library, and execute the associated terminal mode of operation.

**[0009]** In another aspect of the invention, provided herein is a method for changing the mode of operation for an indicia reading terminal. The method includes the step of providing an imager-based terminal having a housing and a two-dimensional image sensor array and an imaging lens for focusing an image on the two-dimensional image sensor array. The two-dimensional image sensor array has a plurality of pixels formed in a plurality of rows and columns of pixels. The method further includes the step of providing a memory coupled to the terminal. The memory stores a hand gesture attribute library comprising a plurality of hand gesture attribute images. Each of the images are associated with a mode of operation for the terminal. The method further includes the steps of capturing an image with the imager-based terminal, accessing the hand gesture attribute library, and comparing the captured image to the stored hand gesture attribute images. If the captured image correlates with one of the stored hand gesture attribute images, the mode of operation associated with the hand gesture attribute image is executed.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0010]** The features described herein can be better understood with reference to the drawings described below. The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention. In the drawings, like numerals are used to indicate like parts throughout the various views.

**[0011]** FIG. **1** schematically illustrates an imaging apparatus in accordance with the present invention;

**[0012]** FIG. **2** schematically illustrates another embodiment of an imaging apparatus in accordance with the present invention;

**[0013]** FIG. **3** is a block schematic diagram of the imaging apparatus of FIG. **1** or FIG. **2**;

**[0014]** FIG. **4** schematically illustrates the imaging apparatus of FIG. **2** according to another embodiment of the invention;

**[0015]** FIG. **5** schematically illustrates the imaging apparatus of FIG. **2** according to yet another embodiment of the invention; and

**[0016]** FIG. **6** is a block diagram of a wireless transceiver according to an embodiment of the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

**[0017]** FIG. **1** illustrates a point-of-sale workstation **1010** used by retailers to process transactions involving the purchase of products bearing an encoded symbol character, typically a UPC symbol. The workstation **1010** includes a horizontal countertop **1012** for placement of products to be scanned. A bioptic scanner **1014** mounted within the countertop **1012** includes a first housing portion **1016** and a second housing portion **1018** which projects from one end of the first housing portion in a substantially orthogonal manner. When the bioptic scanner **1014** is installed within the countertop surface, the first housing portion **1016** is oriented horizontally, whereas the second housing portion **1018** is oriented vertically with respect to the point-of-sale (POS) station. Thus, as referred to herein, the terms 'first housing portion' and 'horizontally-disposed housing portion' may be used interchangeably but refer to the same structure. Likewise, the terms 'second housing portion' and 'vertically-disposed housing portion' may be used interchangeably but refer to the same structure

**[0018]** In one embodiment, first housing portion **1016** comprises a laser-based indicia scanning terminal and the second housing portion **1018** comprises an imager-based terminal. The countertop **1012** includes an optically transparent (e.g., glass) horizontal-scanning window **1020** mounted flush with the checkout counter, covered by an imaging window protection plate **1022** which is provided with a pattern of apertures **1024***a*. These apertures **1024** permit the projection of a plurality of vertical illumination planes from a first scan source located beneath the horizontal-scanning window **1020**.

**[0019]** The second housing portion **1018** of the bioptic scanner **1014** further includes a vertical-scanning window **1026** behind which an imager-based indicia reading terminal **1028** is housed. That is, in contrast to the laser-based terminal, the imager based terminal comprises a multiple pixel image sensor assembly, such as a CCD scanner. In general, an image sensor array simultaneously illuminates all of the indicia (e.g., bars and spaces of a bar code symbol) with light of a specific wavelength in order to capture an image for recognition and decoding purposes. Such scanners are commonly known as CCD scanners because they use CCD image detectors to detect images of the bar code symbols being read.

**[0020]** A product **1030** having a encoded symbol character **1032** may be scanned by the bioptic scanner **1014**. If the encoded symbol character **1032** is located on the bottom of the product **1030**, one or more of the scan lines projected through the horizontal-scanning window **1020** will traverse the symbol for decoding. If the encoded symbol character **1032** is located on the side of the product, then an image of the character **1032** will be captured by the imager-based indicia reading terminal **1028** and sent for decoding.

**[0021]** As used herein, "encoded symbol character" is intended to denote a representation of a unit of information in a message, such as the representation in a barcode symbology of a single alphanumeric character. One or more encoded symbol characters can be used to convey information, such as the identification of the source and the model of a product, for example in a UPC barcode that comprises twelve encoded symbol characters representing numerical digits. Also, an encoded symbol character may be a non-alphanumeric character that has an agreed upon conventional meaning, such as the elements comprising bars and spaces that are used to denote the start, the end, and the center of a UPC barcode. The bars and spaces used to encode a character as an encoded symbol are referred to generally as "elements." For example an encoded character in a UPC symbol consists of four elements, two bars and two spaces. Similarly, encoded symbol characters can be defined for other barcode symbologies, such as other one-dimensional ("1-D") barcode systems including Code 39 and Code 128, or for stacked two-dimensional ("2-D") barcode systems including PDF417.

**[0022]** The bioptic scanner configuration just described is exemplary, and is not limited to a construction having horizontal and vertical scan windows. A bioptic scanner can include a single scan window, but the scan window can have two (or more) scan sources. Although in some constructions the scan sources can be similar, in embodiments of the invention disclosed herein at least one of the scan sources is an imager-based terminal. For example, in addition to the imager-based terminal (e.g., multiple pixel image sensor array), alternate scan sources can include the previously noted laser-based terminal, a radio frequency identification device (RFID), or a weight scale. A second imager-based terminal can be in the horizontal plane. Or, the imager-based terminal can be in the horizontal plane and a laser-based terminal can be in the vertical plane. The image array sensor may be distinguished by the operating software and include 1-D imagers, 2-D imagers, optical character recognition readers, pattern recognition devices, and color recognition devices, for example.

**[0023]** In some constructions, the workstation **1010** may further include a radio frequency identification (RFID) reader **1034**; a credit card reader **1036**; a wide-area wireless (WIFI) interface **1038** including RF transceiver and antenna **1040** for connecting to the TCP/IP layer of the Internet as well as one or more storing and processing relational database management system (RDBMS) server **1042**; a Bluetooth 2-way communication interface **1044** including RF transceivers and antenna **1046** for connecting to Bluetooth-enabled hand-held scanners, imagers, PDAs, portable computers and the like **1048**, for control, management, application and diagnostic purposes. The workstation **1010** may further include an electronic weight scale module **1050** employing one or more load cells positioned centrally below the system's structurally rigid platform for bearing and measuring substantially all of the weight of objects positioned on the horizontal-scanning window **1020** or window protection plate **1022**, and generating electronic data representative of measured weight of such objects.

**[0024]** Other embodiments of the present invention may include a hand-held scanner comprising an imager-based scan terminal. For example, referring to FIG. **2**, an imager-

based indicia reading terminal **2028** has a housing with a form factor **2052** comprising a head portion **2054** and a handle portion **2056**, which is configured with a hand grip **2058** and a trigger **2060**. The trigger **2060** may be used to make active signals for activating frame readout and/or certain decoding processes. An imaging module **2062** is disposed in the head portion **2054**. The imager-based indicia reading terminal **2028** is also configured with a connectivity device **2064**, illustrated in the present example as a wired connection **2066** coupled to a companion device **2068** such as might be found in a POS application, e.g., wherein the wired device is coupled to a register and/or peripheral data capture devices. Other configurations of the connectivity device **2064**, however, may utilize wireless communication technology and/or contact-type features that do not require wires and/or the wired connection **2066**. In certain applications of the imager-based indicia reading terminal **2028**, for example, the companion device **2068** may be a docking station with corresponding mating contacts and/or connectors that are useful to exchange such things as power and data, including image data captured by the imaging module **2062**.

**[0025]** Although not incorporated in the illustrated embodiments, the imager-based indicia reading terminal **2028** can also include a number of peripheral devices such as a display for displaying such information as image frames captured with use of an image sensor assembly, a keyboard, and a pointing device.

**[0026]** Referring to FIG. **3**, there is shown a block diagram of an imager-based indicia reading terminal **3028** such as that disposed in the second housing portion **3018** of the bioptic scanner **3014** of FIG. **1**, or in the hand-held device illustrated in FIG. **2**. The terminal **3028** comprises a multiple pixel image sensor assembly **3070**, or imaging module, such as a CCD scanner. As will be explained more fully below, FIG. **3** shows the basic structures that together comprise the general form of an image sensor array that is suitable for use, and is generic to optical readers that use 1D image sensors and to optical readers that use 2D image sensors.

**[0027]** The image sensor assembly **3070** can include an image sensor **3072** comprising a multiple pixel image sensor array **3074** having pixels arranged in rows and columns of pixels, column circuitry **3076**, and row circuitry **3078**. Associated with the image sensor **3072** can be amplifier circuitry **3080**, and an analog-to-digital (A/D) converter **3082** which converts image information in the form of analog signals read out of multiple pixel image sensor array **3074** into image information in the form of digital signals. Image sensor **3072** can also have an associated timing and control circuit **3084** for use in controlling, e.g., the exposure period of image sensor **3072**, and/or gain applied to the amplifier **3080**. The noted circuit components **3072**, **3080**, **3082**, and **3084** can be packaged into a common image sensor integrated circuit **3086**. In one example, image sensor integrated circuit **3086** can be provided by an MT10V022 image sensor integrated circuit available from Micron Technology, Inc. In another example, image sensor integrated circuit **3086** can incorporate a Bayer pattern filter. In such an embodiment, prior to subjecting a frame to further processing, processor **3088** can interpolate pixel values intermediate of green pixel values for development of a monochrome frame of image data. In other embodiments, red, and/or blue pixel values can be utilized for the image data.

**[0028]** In the course of operation of the image sensor assembly **3070**, image signals can be read out of image sensor **3072**, converted and stored into one or more memories such as RAM **3090**. A memory **3092** of image sensor assembly **3070** can include RAM **3090**, a nonvolatile memory such as EPROM **3094**, and a storage memory device **3096** such as may be provided by a flash memory or a hard drive memory. In one embodiment, image sensor assembly **3070** can include processor **3088** (or CPU) which can be adapted to read out image data stored in memory **3092** and subject such image data to various image processing algorithms. Image sensor assembly **3070** can include a direct memory access unit (DMA) **3098** for routing image information read out from image sensor **3072** that has been subject to conversion to RAM **3090**. In another embodiment, image sensor assembly **3070** can employ a system bus providing for bus arbitration mechanism (e.g., a PCI bus) thus eliminating the need for a central DMA controller. A skilled artisan would appreciate that other embodiments of the system bus architecture and/or direct memory access components providing for efficient data transfer between the image sensor **3072** and RAM **3090** are within the scope of the invention.

**[0029]** Referring to further aspects of image sensor assembly **3070**, the sensor assembly can include an imaging lens assembly **3100** for focusing an image of the encoded symbol character **3032** onto image sensor **3072**. Imaging light rays can be transmitted about an optical axis **3102**. Image sensor assembly **3070** can also include an illumination assembly **3104** or excitation illumination module that comprises one or more of an illumination pattern light source bank **3106** for generating an illumination pattern substantially corresponding to the field of view of image sensor assembly **3070**, and an aiming pattern light source bank **3108** for generating an aiming pattern. In use, the product **3030** can be presented by an operator to the image sensor assembly **3070** in such manner that the aiming pattern is projected on the encoded symbol character **3032**. In the example of FIG. **3**, the encoded symbol character **3032** is provided by a 1D barcode symbol. Encoded symbol characters could also be provided by 2D barcode symbols or optical character recognition (OCR) characters.

**[0030]** The image sensor assembly **3070** can further include a filter module **3110** that comprises one or more optical filters, as well as in some embodiments an actuator assembly **3112** that is coupled generally to the filter module, such as to the optical filters. The filter module **3110** can be located on either side of the imaging lens assembly **3100**. Likewise, one or more of the optical filters within the filter module **3110** can be disposed on one or more surfaces of the imaging lens assembly **3100** and/or the image sensor **3072**.

**[0031]** Each of illumination pattern light source bank **3106** and aiming pattern light source bank **3108** can include one or more light sources. Lens assembly **3100** can be controlled with use of lens assembly control circuit **3114** and the illumination assembly **3104** comprising illumination pattern light source bank **3106** and aiming pattern light source bank **3108** can be controlled with use of illumination assembly control circuit **3116**. Filter module **3110** can be controlled with use of a filter module control circuit **3118**, which can be coupled to the actuator assembly **3112**. Lens assembly control circuit **3114** can send signals to lens assembly **3100**, e.g., for changing a focal length and/or a best focus distance of lens assembly **3100**. Illumination assembly control circuit **3116** can send signals to illumination pattern light source bank **3106**, e.g., for changing a level of illumination output.

**[0032]** Image sensor assembly **3070** can include various interface circuits for coupling several of the peripheral

devices to system address/data bus (system bus) bus **3120**, for communication with processor **3088** also coupled to system bus **3120**. Image sensor assembly **3070** can include interface circuit **3122** for coupling image sensor timing and control circuit **3084** to system bus **3120**, interface circuit **3124** for coupling the lens assembly control circuit **3114** to system bus **3120**, interface circuit **3126** for coupling the illumination assembly control circuit **3116** to system bus **3120**, interface circuit **3128** for coupling a display **3130** to system bus **3120**, interface circuit **3132** for coupling a keyboard **3134**, a pointing device **3136**, and trigger **3060** to system bus **3120**, and interface circuit **3138** for coupling the filter module control circuit **3118** to system bus **3120**.

**[0033]** In a further aspect, image sensor assembly **3070** can include one or more I/O interfaces **3140**, **3142** for providing communication with external devices (e.g., a cash register server, a store server, an inventory facility server, a image sensor assembly **3070**, a local area network base station, a cellular base station). I/O interfaces **3140**, **3142** can be interfaces of any combination of known computer interfaces, e.g., Ethernet (IEEE 802.3), USB, IEEE 802.11, Bluetooth, CDMA, and GSM, and may couple with processors, such as interface microcontrollers, and memories to carry out some or all the functions described herein.

**[0034]** Referring now to FIGS. **3** and **4**, in one embodiment an imager-based indicia reading terminal **4028** not only reads and decodes a barcode, but also monitors a user's behavior in the form of hand gestures to execute a specific mode of operation for the terminal. The memory **3092** may include a hand gesture attribute library **3144** to associate predefined hand gestures with a terminal mode of operation. In one example, the hand gesture attribute library **3144** is stored in RAM **3090**, and includes a group of images depicting a variety of hand gestures. Each depiction of a hand gesture is paired with a mode of operation for the terminal. The pairing may be in a lookup table, for example. The processor **3088** may be adapted to compare the captured image from the image sensor **3072** with the group of depictions or images stored in the hand gesture attribute library **3144**. Upon finding a match, the processor **3088** looks up the associated mode of operation and switches to or executes the new mode. The new mode of operation may be executed for a predetermined time period, a user-defined time period, or until a new mode of operation is commanded.

**[0035]** In one embodiment, the new mode of operation is executed for a single frame capture, and the terminal then reverts to its original setting. For example, the default mode of operation for the imager-based indicia reading terminal **4028** illustrated in FIG. **4** may be out-of-stand, multi-try trigger mode. In this configuration, the imager **4028** will capture and attempt to decode barcode images only when the trigger **4060** is depressed. Otherwise, the imager **4028** is in a continuous scan mode comparing the images on the image sensor array **3074** to the images in the hand gesture attribute library **3144**. In one example, the user gestures "number one" as shown in FIG. **4**(*a*). Using pattern recognition software or other image processing algorithms, the processor **3088** finds a match in the library **3144**, looks up the associated mode of operation, and executes the new mode. In one example the new mode could be a digital frame capture, wherein the terminal **4028** takes a picture when the trigger **3060** is depressed. Other modes of operation could be associated with the user gesturing "number two", "number three", or "number four", for example. For instance, the user could gesture "number two" to revert back to the original mode of operation.

**[0036]** In another embodiment, the indicia reading terminal **4028** may include one or more feedback indicators to indicate the terminal is prepared to switch modes. The terminal **4028** may also require confirmation from the user prior to continuing. The terminal **4028** may include a display **4130** that visually indicates a match has been achieved and shows the new mode of operation. The terminal **4028** may require a confirmation before proceeding, such as the "okay" gesture illustrated in FIG. **4**(*b*). Alternately, the terminal may require the user to press the trigger **4060** to continue, or some other affirmative action. If the terminal **4028** does not detect an affirmative action in a predetermined period of time, such as two seconds, no action is taken. If the terminal **4028** erroneously detects a hand gesture and the user does not wish to switch modes of operation, a hand gesture indicating denial may be initiated, such as the back-and-forth "no" gesture shown in FIG. **4**(*c*). In one example, the feedback indicator is an audible feedback indicator, such as a beep, tone, or synthesized voice indicating the command has been executed.

**[0037]** In another embodiment, visual indicators such as lights may be utilized to indicate the terminal is prepared to switch modes. For example, the indicia reading terminal **4028** may include one or more light emitting diodes (LEDs) **4146**. In one example, three different colors are utilized: green, yellow, and red. A yellow LED may indicate the terminal **4028** is attempting to decipher a hand gesture. A green LED may indicate the hand gesture has been accepted. A red LED may indicate the hand gesture has not been deciphered.

**[0038]** The bioptic scanner **1014** illustrated in FIG. **1** may be configured to rapidly and conveniently switch between often-used modes of operation. For example, a user may present the product **1030** in front of the vertical-scanning window **1026** and remain motionless for one second, indicating the user would like to take a picture of the object. In another example, waving the hand left-and-right may indicate to delete a previous barcode entry. In other examples, a predetermined hand gesture can change the mode of operation from barcode scanning to optical character recognition (OCR), RFID mode, weight scale mode, light pen enable/disable, barcode type (e.g., UPC, Code 128), and enable/disable in-store barcode reading.

**[0039]** A wide variety of modes of operation may be configured for the imager-based indicia reading terminal. In one example, the hand gesture attribute library may be programmed at the factory and an included user's manual would provide instructions for use. In one example, the library could be coded into EPROM **3094**. The hand attribute library could, for example, include sign language to construct an extensive combination of gestures.

**[0040]** In another example, the hand gesture attribute library could be user-programmable. In such an embodiment, any of the ordinary modes of operation provided in the Configuration Guide could be reprogrammed to execute with a user-selected hand gesture. In this manner, any of the modes of operation currently configurable by scanning a barcode or inputting coded text via a companion device could be replaced by a desired hand gesture. The user could enter a programming or learning mode, scan the barcode for the particular mode of operation, then furnish a hand gesture to replace or supplement the barcode. Then, instead of obtaining a Configuration Guide, searching for the correct barcode to

change the mode of operation, and scanning the barcode, the user simply uses the hand gesture and the new mode of operation is executed.

**[0041]** The modes of operation that may be configured to execute with a hand gesture for imager-based indicia reading terminals having a hand-held form factor may include, but are not limited to, scanning modes. Examples of scanning modes include presentation mode, multi-try trigger mode, continuous trigger mode, and single-trigger mode. Any of these modes may be separately configured for in-stand and out-of-stand operation. Examples of modes of operation configurable with hand gestures within the presentation mode may include: presentation mode immediately after button release, one second after button release, and five seconds after button release. Also within presentation mode, pass-through settings may be enabled or disabled, or a pass-through timeout may be set to 100 or 300 milliseconds, for example.

**[0042]** The modes of operation that may be configured to execute with a hand gesture for imager-based indicia reading terminals having a hand-held form factor may include, but are not limited to, inventory modes. An inventory mode may be enabled or disabled, for example. When enabled, records scanned from barcodes are stored in internal memory, and a hand gesture may execute a command to transmit all records to a local host computer. Hand gestures could also be utilized to identify quantities of items, for example by gesturing the number one, the number two, and the like.

**[0043]** The image sensor assembly **3070** may be utilized to capture a series of images to detect motion as well as still gestures. For example, the back-and-forth motion depicted in FIG. **4**(*b*) may be deciphered by comparing a sequential series of captured images with a like set in the hand gesture attribute library. In another embodiment, a lack of motion for a predetermined period may indicate a request for a change in the mode of operation. For example, the imager-based indicia reading terminal may be adapted such that when an objects stops in the scan volume for a predetermined time (e.g., 2 seconds), the terminal can switch to a camera mode.

**[0044]** Turning to FIG. **5**, an imager-based indicia reading terminal **5028** may be utilized to interpret a hand gesture and send a distress communication to a device in the event of an emergency, such as a store robbery. In one embodiment, the imager-based indicia reading terminal **5028** is a hand-held device, which may be secured in a base **5148** on a store countertop. As described in other embodiments of the invention, the terminal **5028** includes hand gesture attribute library **5144** that includes a distress signal, such as that shown in FIG. **5**. The particular hand gesture to denote an emergency may be any convenient image, such as a user-generated image, and is not limited to the illustration. When a user displays the hand gesture to the terminal **5028** and the image correlates with that in the library **5144**, the terminal may be adapted to call local police or 911, for example.

**[0045]** In one embodiment, shown in FIG. **6**, the I/O interface **3140** may be coupled to a wireless transceiver **6150**. The wireless transceiver includes a variety of components that perform various tasks or functions. For example, the components may include a radio frequency (RF) signal modulator **6152**, an RF signal amplifier **6154**, an RF signal tuner **6156**, and an RF signal demodulator **6158**. The RF signal modulator **6152** may include any suitable structure for modulating data onto an outgoing RF signal for transmission. The RF signal amplifier **6154** may include any suitable structure for amplifying RF signals. The RF signal tuner **6156** may include any suitable structure for tuning the wireless transceiver **6150** to a specified RF frequency or frequencies. The RF signal demodulator **6158** may include any suitable structure for demodulating data in an incoming RF signal received by the wireless transceiver **6150**. The transmission and reception of RF signals could occur using an internal or external antenna **6160**, which represents any suitable structure capable of transmitting and receiving RF or other wireless signals.

**[0046]** The components in the wireless transceiver **6150** may also include analog-to-digital (A/D) and digital-to-analog (D/A) signal converters **6162**, a digital signal processor (DSP) **6164**, and a microprocessor **6166**. The signal converters **6162** include any suitable structure(s) for converting analog signals into digital signals or digital signals into analog signals. The digital signal processor **6164** includes any suitable structure for processing signals, such as signals to be provided to the RF signal modulator **6152** for transmission or signals received by the RF signal demodulator **6158**. The microprocessor **6166** includes any suitable structure for controlling the overall operation of the wireless transceiver **6150**, such as a microprocessor or microcontroller, and may further be adapted to the system bus **3120** to control the overall operation of the indicia reading terminal.

**[0047]** Turning now back to FIG. **5**, in the event of an emergency, the user simply gestures the distress signal to the terminal **5028**. Upon correlating the image of the distress signal to that in the library **5144**, the terminal **5028** is adapted to execute a mode of operation wherein a distress call is placed through the wireless transceiver via the I/O interface. The call, which may be transmitted in a predetermined frequency, may be received by local police, private security companies, the in-store alarm, or the like **5168**. In one embodiment, the terminal **5028** does not execute any audio or visual feedback (e.g., a silent alarm).

**[0048]** Alternately, the terminal **5028** shown in FIG. **5** may be connected via a wired connection to an external device such as modem (not shown) for communication of the distress signal. Other embodiments may include the bioptic scanner illustrated in FIG. **1**, so long as the scanner includes an imager-based terminal.

**[0049]** One of the improvements of the present disclosure is that cumbersome steps to switch modes of operation for an imager-based indicia reading terminal are alleviated. Rather than search through an Operation Manual (which may be over 50 pages) to find the correct barcode to switch a mode of operation, or connecting a companion device to the terminal, the user simply performs a hand gesture.

**[0050]** While the present invention has been described with reference to a number of specific embodiments, it will be understood that the true spirit and scope of the invention should be determined only with respect to claims that can be supported by the present specification. Further, while in numerous cases herein wherein systems and apparatuses and methods are described as having a certain number of elements it will be understood that such systems, apparatuses and methods can be practiced with fewer than the mentioned certain number of elements. Also, while a number of particular embodiments have been described, it will be understood that features and aspects that have been described with reference to each particular embodiment can be used with each remaining particularly described embodiment.

What is claimed is:

**1**. A system for decoding an encoded symbol character associated with a product, the system comprising:

an imager-based indicia reading terminal comprising a housing and a two-dimensional image sensor array and an imaging lens for focusing an image on the two-dimensional image sensor array, the two-dimensional image sensor array having a plurality of pixels formed in a plurality of rows and columns of pixels, the terminal adapted to read an encoded symbol character and further adapted to image a hand gesture, the terminal having a digital link to transmit the image of the hand gesture;

one or more memories coupled to the indicia reading terminal via a digital connection, at least one of the memories comprising a hand gesture attribute library to associate predefined hand gestures with a terminal mode of operation; and

one or more processors connected to the digital link to receive the image of the hand gesture, correlate the image with the predefined hand gestures in the hand gesture attribute library, and execute the associated terminal mode of operation.

**2**. The system of claim **1**, wherein the imager-based indicia reading terminal has a hand-held form factor.

**3**. The system of claim **1**, wherein the imager-based indicia reading terminal is a bioptic scanner.

**4**. The system of claim **1**, wherein the image of the hand gesture indicates a numeral.

**5**. The system of claim **1**, wherein the image of the hand gesture comprises an "okay" sign.

**6**. The system of claim **1**, wherein the imager-based indicia reading terminal further comprises an input/output interface for providing communication with a device, the communication responsive to the terminal mode of operation.

**7**. The system of claim **6**, wherein the image of the hand gesture comprises a distress signal, and the terminal mode of operation comprises sending a distress communication to the device.

**8**. The system of claim **7**, wherein the device is a wireless transceiver.

**9**. The system of claim **7**, wherein the device is a wired connection.

**10**. The system of claim **1**, wherein the image of the hand gesture comprises sign language.

**11**. The system of claim **1**, wherein the image of the hand gesture comprises a plurality of images comprising a hand in motion.

**12**. The system of claim **11**, wherein the plurality of images comprises a hand in back-and-forth motion.

**13**. The system of claim **1**, wherein the image of the hand gesture comprises a plurality of images in still motion for a predetermined time period.

**14**. The system of claim **1**, further comprising a visual feedback indicator.

**15**. The system of claim **14**, wherein the visual feedback indicator is a light.

**16**. The system of claim **15**, wherein the light comprises a plurality of light emitting diodes.

**17**. The system of claim **16**, wherein the light emitting diodes comprise the colors green, yellow, and red.

**18**. A method for changing the mode of operation for an indicia reading terminal, the method comprising the steps of:

providing an imager-based terminal having a housing and a two-dimensional image sensor array and an imaging lens for focusing an image on the two-dimensional image sensor array, the two-dimensional image sensor array having a plurality of pixels formed in a plurality of rows and columns of pixels;

providing one or more memories coupled to the terminal, at least one of the memories storing a hand gesture attribute library comprising a plurality of hand gesture attribute images, each of the images associated with a mode of operation for the terminal;

capturing an image with the imager-based terminal;

accessing the hand gesture attribute library and comparing the captured image to the stored hand gesture attribute images; and

if the captured image correlates with one of the stored hand gesture attribute images, executing the mode of operation associated with the hand gesture attribute image.

**19**. The method of claim **18**, wherein the stored hand gesture attribute image comprises a distress signal, and the mode of operation associated with the distress hand signal is sending a distress communication to a device.

**20**. The method of claim **18**, further comprising the step of providing feedback to indicate the terminal is prepared to execute the mode of operation associated with the hand gesture attribute image.

**21**. The method of claim **19**, wherein the step of providing feedback comprises visually indicating on a display that a match has been achieved.

**22**. The method of claim **21**, wherein the display shows the new mode of operation.

**23**. The method of claim **19**, wherein the step of providing feedback comprises illuminating a light.

**24**. The method of claim **19**, further comprising the step of requiring a confirmation before executing the mode of operation.

**25**. The method of claim **24**, wherein the confirmation is a hand gesture.

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