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(54) **Title**: GRAPHICAL USER INTERFACE FOR A PORTABLE PROJECTION DEVICE

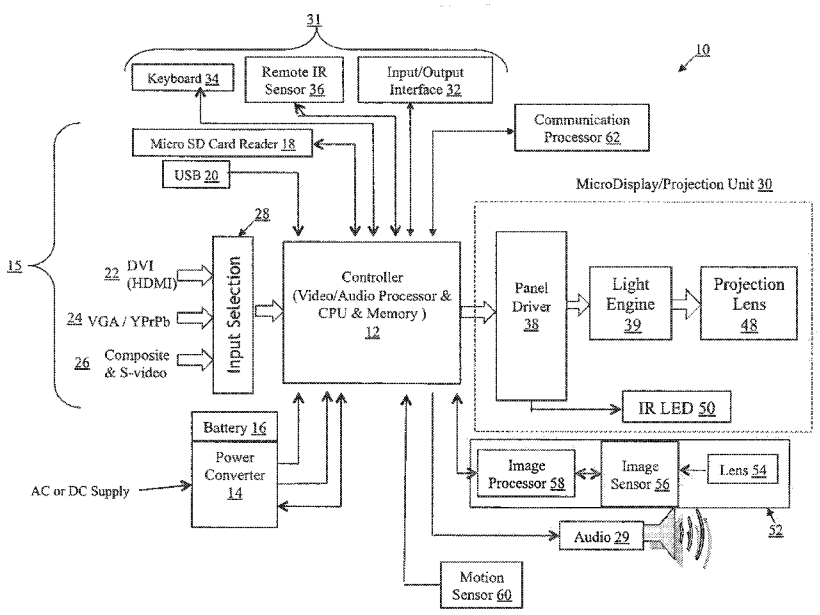

Fig. 1

(57) **Abstract**: An apparatus for and method of projecting received images onto a display surface is provided. A projection unit (30) selectively projects at least one received image onto a display surface and a controller (12) coupled to the projection unit (30) generates at least one graphical user interface (GUI) including instructions displayable to a user via the projection unit (30) on a display surface, the instructions in the GUI are used in configuring at least one parameter of the projection unit (30).

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Graphical User Interface for a Portable Projection Device

FIELD

[001] The present arrangement provides a system and method for controlling the operation of a portable projection device.

BACKGROUND

[002] Conventionally, projection devices were (and are) designed as non-mobile devices that are positioned in a room and project a series of audio-visual images on a screen that is viewable by individuals within the room and in the line of sight of the projected image. To ensure projection quality and an optimal viewing experience for the individuals, these projection devices are precisely configured to minimize errors in the audio-visual images being displayed. Examples of these systems include but are not limited to movie theaters, professional meeting rooms, lecture halls and the like.

[003] However, the rapid miniaturization of electronic devices has also extended to projection devices. Currently, there exists a portable electronic projection device that may be easily transported and able to turn virtually any room into a projection room. These portable electronic projection devices are termed pico projectors. A pico projector may be included in any handheld device that can selectively project at least one of an image or series of images on a surface. Moreover, it is important for the pico projector to be able to generate a clear image of sufficient quality on any type of surface. This may include, for example, a conventional display screen or a wall in a room. It is therefore necessary for the pico projector to compensate for any surface impurities when generating and projecting a display image.

[004] Moreover, a further drawback associated with pico projection relates to the nature of the device itself. Because the pico projector is naturally handheld and/or portable, the pico projector suffers from increased visual display errors as compared to a traditional projection device. The increased visual errors (e.g. noise, distortion, etc) in images projected by pico projectors result from the often sub-optimal positioning of the pico projector with respect to the surface on which the images are being displayed as well as the orientation of individuals viewing the image to the surface on which the image is displayed.

[005] Furthermore, as pico projectors are increasingly being embodied in multi-function devices, activities associated with functions other than the projection of images may interrupt, distort and/or otherwise affect the image being projected by the pico projector and/or the experience of the individuals viewing the projected images. An example of these drawbacks is present in a multi-function portable electronic device that, in addition to being a pico projector, is also a portable communication device (e.g. smartphone). Various call and message functionality associated with the portable communication device may interfere with the functionality of the pico projector embodied in the multifunction portable electronic device.

[006] It would therefore be desirable to correct any of the above identified drawbacks associated with pico projectors. A system and method according the present invention addresses these deficiencies.

SUMMARY

[007] In one embodiment, an apparatus for projecting received images onto a display surface is provided. A projection unit selectively projects at least one received image onto a display surface and a controller coupled to the projection unit generates at least one graphical user interface (GUI) including instructions displayable to a user via the projection unit on a display surface, the instructions in the GUI are used in configuring at least one parameter of the projection unit.

[008] In another embodiment, a method of projecting received images onto a display surface is provided. The method includes projecting, by a projection unit, at least one received image onto a display surface and generating, by a controller coupled to the projection unit, at least one graphical user interface (GUI) including instructions displayable to a user, the instructions in the GUI are used in configuring at least one parameter of the projection unit; and projecting, via the projection unit, the GUI including instructions on a display surface.

[009] In a further embodiment, an apparatus for projecting received images onto a display surface is provided. The apparatus includes a means (30) for selectively projecting at least one received image onto a display surface; and a means (12) for generating at least one graphical user interface (GUI) including instructions displayable to a user via the projection unit on a display surface, the instructions in the GUI are used in configuring at least one parameter of the projection unit.

[0010] The above presents a simplified summary of the subject matter in order to provide a basic understanding of some aspects of subject matter embodiments. This summary is not an extensive overview of the subject matter. It is not intended to identify key/critical elements of the embodiments or to delineate the scope of the subject matter. Its sole purpose is to present some concepts of the subject matter in a simplified form as a prelude to the more detailed description that is presented later.

[0011] To the accomplishment of the foregoing and related ends, certain illustrative aspects of embodiments are described herein in connection with the following description and the annexed drawings. These aspects are indicative, however, of but a few of the various ways in which the principles of the subject matter can be employed, and the subject matter is intended to include all such aspects and their equivalents. Other advantages and novel features of the subject matter can become apparent from the following detailed description when considered in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. 1 is a block diagram of the portable projection device according to aspects of the present invention;

[0013] FIGS. 2A – 2D are exemplary light engines for use in the portable projection device according to aspects of the present invention;

[0014] FIG. 3 is a block diagram of the controller of the portable projection device according to aspects of the present invention;

[0015] FIGS. 4A & 4B are flow diagrams detailing exemplary operation of the portable projection device according to aspects of the present invention;

[0016] FIGS. 5A – 5D are exemplary display images generated by the portable projection device according to aspects of the present invention;

[0017] FIG. 6 is a flow diagram detailing an exemplary operation of the portable projection device according to aspects of the present invention; and

[0018] FIG. 7 is an exemplary display image generated by the portable projection device according to aspects of the present invention.

DETAILED DESCRIPTION

[0019] It should be understood that the elements shown in the FIGS. may be implemented in various forms of hardware, software or combinations thereof.

Preferably, these elements are implemented in a combination of hardware and software on one or more appropriately programmed general-purpose devices, which may include a processor, memory and input/output interfaces.

[0020] The present description illustrates the principles of the present disclosure. It will thus be appreciated that those skilled in the art will be able to devise various arrangements that, although not explicitly described or shown herein, embody the principles of the disclosure and are included within its spirit and scope.

[0021] All examples and conditional language recited herein are intended for pedagogical purposes to aid the reader in understanding the principles of the disclosure and the concepts contributed by the inventor to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions.

[0022] Moreover, all statements herein reciting principles, aspects, and embodiments of the disclosure, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

[0023] Thus, for example, it will be appreciated by those skilled in the art that the block diagrams presented herein represent conceptual views of illustrative circuitry embodying the principles of the disclosure. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudocode, and the like represent various processes which may be substantially represented in computer readable media and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

[0024] The functions of the various elements shown in the figures may be provided through the use of dedicated hardware as well as hardware capable of executing software in association with appropriate software. When provided by a processor, the functions may be provided by a single dedicated processor, by a single shared processor, or by a plurality of individual processors, some of which may be shared. Moreover, explicit use of the term "processor" or "controller" should not be construed to refer exclusively to hardware capable of executing software, and may implicitly include, without limitation, digital signal processor ("DSP") hardware, read only

memory ("ROM") for storing software, random access memory ("RAM"), and nonvolatile storage.

[0025] If used herein, the term "component" is intended to refer to hardware, or a combination of hardware and software in execution. For example, a component can be, but is not limited to being, a process running on a processor, a processor, an object, an executable, *and/or* a microchip and the like. By way of illustration, both an application running on a processor and the processor can be a component. One or more components can reside within a process and a component can be localized on one system *and/or* distributed between two or more systems. Functions of the various components shown in the figures can be provided through the use of dedicated hardware as well as hardware capable of executing software in association with appropriate software.

[0026] Other hardware, conventional and/or custom, may also be included. Similarly, any switches shown in the figures are conceptual only. Their function may be carried out through the operation of program logic, through dedicated logic, through the interaction of program control and dedicated logic, or even manually, the particular technique being selectable by the implementer as more specifically understood from the context.

[0027] In the claims hereof, any element expressed as a means for performing a specified function is intended to encompass any way of performing that function including, for example, a) a combination of circuit elements that performs that function or b) software in any form, including, therefore, firmware, microcode or the like, combined with appropriate circuitry for executing that software to perform the function. The disclosure as defined by such claims resides in the fact that the functionalities provided by the various recited means are combined and brought together in the manner which the claims call for. It is thus regarded that any means that can provide those functionalities are equivalent to those shown herein. The subject matter is now described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the subject matter. It can be evident, however, that subject matter embodiments can be practiced without these specific details. In other instances, well-known structures and devices are shown in block diagram form in order to facilitate describing the embodiments.

[0028] The present invention is directed towards a multifunction portable electronic device (hereinafter, the "device") that includes audiovisual image projection capabilities (e.g. a pico projector) and method of operating the same. An exemplary block diagram of the device 10 is provided in Figure 1. The device 10 includes a controller 12. The controller 12 is a component that executes various operational algorithms that control the various functions of the device 10. In one embodiment, the controller 12 executes algorithms that enable audio and video processing of a source input signal. The controller 12 may also include a memory in which various machine executable instructions controlling various device functionality may be stored and accessed as needed in response to various control signals generated by one of (a) a user and (b) other components of the device 10 as will be discussed below. The memory of the controller 12 may also store data associated with any input signal received by the controller 12. The memory of controller 12 may also store user-specific information that is associated with a user of the device 10. In one embodiment, user specific information may include user preferences for configuring the device for a particular type of operation. The user specific information may include global preference information that configures aspects of device operation that are common between the various functions as well as function specific preference information that configures the device to operate in a particular manner when executing a particular function. While the controller 12 is described as including a memory, one skilled in the art should understand that the memory (or other storage medium) within the device may be a separately embodied component that is read/write accessible by the controller 12 as needed.

[0029] The device 10 also includes a power converter 14 and battery 16 connected to the power converter 14. The power converter 14 is selectively connectable to an input power source (either AC or DC) for receiving power therefrom. Power received by the power converter 14 is provided to the battery 14 and selectively charges the battery 16 as needed. It should be understood that the operation of charging is meant to include an initial charging of the battery 16 as well as recharging the battery 16 after the power level has been depleted. Power is also simultaneously provided by the power converter 14 to the controller 12 for powering operation thereof. The controller 12 may selectively detect when input power is being provided to the power converter 14 causing the device 10 to operate in a first power mode when a connection to an input power source is detected and a second mode when no connection to an input

power source is detected. In one embodiment of the first power mode, the controller 12 may execute a battery monitoring algorithm that enables the controller 12 to selectively detect a power level in the battery 16 and control the power converter 14 to direct power thereto. The controller 12 can also control charging of the battery 16 when the detected power level in the battery 16 is below a predetermined threshold. In another embodiment of the first power mode, the controller 12 may automatically direct power from the power converter 14 to be provided to the battery 16 in response to connection of the power converter with the input power source. In the second mode of operation, the controller 12 is powered by the battery 16 until such time that the battery power is depleted below a predetermined operational threshold representing a minimum amount of power needed to operate the device.

[0030] The controller 12 may receive an input audiovisual signal from one of a plurality of device inputs collectively referred to using reference numeral 15. The controller 12 can control selective projection of the audiovisual input signal using projection unit/microdisplay 30. The input audiovisual signal may include one of (a) a still image; (b) a series of images; (c) a video signal; and (d) an audio signal. The input audiovisual signal may also include an audio component that is intended to be audibly reproduced by speaker 29 in conjunction with the projection, by the projection unit 30, of the one still image or series of images as will be discussed below.

[0031] The plurality of inputs may include any combination of but is not limited to (a) a card reader 18; (b) a USB port 20; (c) a digital video input port (HDMI) 22; (d) a VGA/Component video input port 24; and (e) a composite/S-Video input port 26. The depiction of the plurality of input ports 15 is for purposes of example only and the device 10 may include any combination of the described input ports or other known input ports.

[0032] The card reader selectively receives a storage card that may include data representative of the input audiovisual signal that is accessed by the controller 12 and provided to the projection unit 30 and/or speaker 29 for output thereof. In one embodiment, the card reader 18 may be a MicroSD card reader. This is described for purposes of example only and any card reading device able to read any standardized storage card may be included in device 10. The USB port 20 enables the device 10 to be selectively connected to one of (a) a portable storage device (e.g. flash drive); or (b) a secondary device, that stores data representative of the audiovisual input signal.

Any of the digital video input 22, VGA/component input 24 and/or composite video input 26 may enable connection with a secondary device that includes the source audiovisual input signal and are coupled to the controller 12 via an input selector 28. The input selector 28 selectively couples a respective one of the digital video input 22, VGA/component input 24 and/or composite video input 26 with the controller 12 such that the controller 12 may provide the audiovisual input signal to the projection unit 30 and speaker 29 for output thereof.

[0033] The device 10 further includes a plurality of user controls, collectively referred to using reference numeral 31, enabling the user to selectively control various device functions. An input/output (IO) interface 32 may include at least one user selectable button associated with at least one device function such that selection thereof initiates a control signal received by the controller 12 that is used to control the particular device function. In one embodiment, the IO interface 32 may be a touch screen and the at least one button may be a user selectable image element displayed on the touch screen enabling selection thereof by a user. In this embodiment, the number and types of user selectable image elements may be generated by the controller 12 depending on the particular operational mode of the device. For example, during projection mode, the user selectable image elements may enable activation of image projection functionality and, if the device 10 is operating in a communication mode, the user selectable image elements displayed on the I/O interface 32 may relate to communication functionality. In another embodiment, the IO interface 32 may include at least one dedicated button on a housing of the device 10 that may be manually activated by a user.

[0034] Another user control 31 included with the device 10 includes a keyboard 34. The keyboard 34 enables a user to enter alphanumeric text-based input commands for controlling the operation of the device. In one embodiment, the keyboard is positioned on the housing of the device. In another embodiment, there is no dedicated keyboard and the keyboard may be generated by the controller 12 and provided for display by the IO interface 32.

[0035] A further user control 31 that may be provided is a remote infrared (IR) sensor 36. Remote IR sensor 36 selectively receives an IR input signal that is generated by a remote control. The IR input signal received by the remote IR sensor 36 is communicated to the controller 12 which interprets the received IR input signal and initiates operation of a particular function of the device corresponding to user input.

[0036] Any of the user controls 32, 34 and/or 36 may be used to generate control signals for selecting an input audiovisual signal from a respective input source of the plurality of input sources 15. The control signals input via the user are received by the controller 12 which processes the user input signal and selects the source of the input audiovisual signal. Input received from any of the user controls 31 may also condition the controller 12 to selectively output the audiovisual signal using projection unit 30 and speaker 29.

[0037] Operation of the projection unit 30 will now be discussed. The projection unit 30 may include a microdisplay/pico projection unit 30. The projection unit 30 includes a panel driver 38, a light engine 39 and a projection lens 48. The panel driver 38 receives the audiovisual input signal from the controller 12 and controls the light engine to emit light representative of the audiovisual input signal that may be projected via a projection lens 48 coupled thereto. The light engine 39 may include a light source and light processing circuitry that is selectively controlled by the panel driver 38 to generate light and project an image representing the audiovisual signal onto a surface. Exemplary types of light engines 39 will be discussed in greater detail with respect to Figures 2A – 2D. However, persons skilled in the art will understand that any light engine used in any type of projection device (portable or otherwise) may be incorporated in the projection unit 30 of the device 10. In operation, the light generated by the light engine 39 is provided to the projection lens 48 which projects the full color image onto a display surface (e.g. screen, wall, etc). The projection lens 48 may be focused in response to user input received by the controller 12 as needed. Additionally, the operation and position of the various components of the projection unit 30 may be controlled via a control signal that is generated by either the user or another component of device 10.

[0038] The projection unit 30 of the device may also include an infrared light emitting diode (IR LED) 50 that is coupled to the panel driver 38. In certain exemplary operations, the controller 12 may generate an IR audiovisual input signal based on the audiovisual input signal received from one of the plurality of inputs 31 or user controls. The IR audiovisual signal may be provided to the panel driver 38 which conditions the IR LED 50 to project an IR version of the audiovisual input signal. The IR signal is imperceptible to the human eye but may be used by other components as an input control signal in the manner discussed below.

[0039] The device 10 may also include a camera module 52. The camera module 52 may include a lens 54 coupled to an image sensor 56. Image data received via the lens 54 and sensed by image sensor 56 may be processed by image processor 58. The camera module 52 may operate as a convention digital camera able to capture one of still images and video images. The camera module 52 may also operate as a sensor that senses at least one type of image being displayed and uses the sensed image as a control signal for controlling at least one function of the device 10 as will be discussed below. The lens 54 of the camera module 52, shown in conjunction with the projection lens 48 of the projection unit, is described for purposes of example only and the device may include a single lens that is shared between the projection unit 30 and camera module 52.

[0040] A motion sensor 60 is also provided. The motion sensor 60 is coupled to the controller 12 and selectively senses data representing movement of the device 10. The motion sensor 60 may sense the position of the device and generate an input control signal used by the controller 12 for controlling device operation. The motion sensor 60 may include any type of motion sensor including but not limited to a gyroscope and/or an accelerometer. For example, in an embodiment, where the motion sensor 60 includes an accelerometer, the device 10 may include at least three accelerometers positioned on the X, Y and Z axis such that accelerometers may sense the position of the device 10 with respect to gravity. The motion sensor 60 may refer to a plurality of different sensors that are able to sense various types of data which may be provided to the controller 12 for analysis and processing thereof.

[0041] The device 10 also includes a communications processor 62 that enables bidirectional communication between the device 10 and a remote device. The communication processor 62 is described generally and is intended to include all electronic circuitry and algorithms that enable bidirectional communication between devices. In one embodiment, the communication processor 62 enables the device to operate as a cellular phone. In another embodiment, the communication processor 62 includes all components and instructions for connecting the device 10 to the internet. In a further embodiment, the communication processor 62 includes all components associated with a smartphone to enable a plurality of different types of bidirectional communication (e.g. telephone, email, messaging, internet, etc) between the device and a communications network.

[0042] Figures 2A – 2D are block diagrams representing different types of light engines 39 that may be employed within the projection unit 30 described in Figure 1. It should be understood that the portable projection device 10 as discussed herein may utilize any of the different light engines 39a – 39d described in Figures 2A – 2D. It should also be appreciated that the description of the light engines 39a – 39d is not limited to those described herein and any type of light engine able to generate and process light into a full color image for display on a surface may be used by the device 10.

[0043] Figure 2A represents a three-color LED light engine 39a. The light engine 39a is controlled via the panel driver 38 (Fig. 1). The panel driver 38 receives the audiovisual input signal from the controller 12 and controls the operation of light emitting diodes (LED) 40a, 40b, and 40c. The LEDs 40a – c represent three color LEDs including a blue LED 40a, a green LED 40b and a red LED 40c. The audiovisual input signal provided to the panel driver 38 has been separated into its component colors by the controller 12 and the panel driver 38 selectively controls the LEDs 40a-c to emit the necessary light to generate the desired audiovisual image for output. Light generated by the LEDs 40a-c is focused into a full color image by a focusing element 42. In one embodiment, the focusing element 42 may be an x-cube. In another embodiment, the focusing element 42 may be a dichroic mirror. These focusing elements are described for purposes of example only and any focusing element 42 able to combine light from a plurality of LEDs into a single full color image may be used in the projection unit 30.

[0044] The focused image is projected on a liquid crystal on silicon (LCOS) chip 44 for receiving light emitted from each of the LEDs 40a – c and optically combines the received light via a polarizing beam splitter 46. The combined light is provided to the projection lens 48 which projects the combined full color image onto a display surface (e.g. screen, wall, etc). The projection lens 48 may be focused in response to user input received by the controller 12 as needed. Additionally, the operation and position of the various components of the projection unit 30 may be controlled via a control signal that is generated by either the user or another component of device 10.

[0045] Figure 2B depicts a white-light LED light engine 39b that may be used in the projection unit of the device 10. Light engine 39b may include a while light LED 41. The panel driver 38 (in Fig. 1) receives the audiovisual input signal from the controller 12 and controls the operation of the white light LED 41. The LED 41 is

controlled to emit a pattern of light to generate the desired audiovisual image for output. Light generated by the LED 41 is provided to a LCOS chip 44b. The LCOS chip 44b has a predetermined pattern of primary color dots thereon. The panel driver 38 controls the LCOS chip 44b to have certain of the dots illuminated by the light emitted by LED 41 to provide colored light to the polarizing beam splitter 46b which optically combines the colored light reflected off of the LOCS chip 44b. The combined light is provided to the projection lens 48 which projects the combined full color image onto a display surface (e.g. screen, wall, etc).

[0046] Figure 2C depicts a digital light processing (DLP) engine 39c. The DLP engine 39c includes three colored light sources 40a, 40b, and 40c. In one embodiment, the light sources 40a – c represent three color LEDs including a blue LED 40a, a green LED 40b and a red LED 40c. While these are described as LED light sources, this is done for purposes of example only and the light sources may be any type of light sources including, but not limited to lasers as are known to be implemented in a DLP light engine. In operation, the light sources 40a-c are not on simultaneously. Rather, the panel driver 38 controls the individual light sources in sequence and the emitted light is provided to the focusing element for producing the full color image. In another embodiment of a DLP engine, a color wheel may be positioned between a light source and the focusing element 42. The panel driver 38 selectively controls the color wheel to rotate to one of the three primary colors based on the data in the audiovisual input signal to illuminate a respective light color at a given time.

[0047] The audiovisual input signal provided to the panel driver 38 has been separated into its component colors by the controller 12 and the panel driver 38 selectively controls the LEDs 40a-c to emit the necessary light to generate the desired audiovisual image for output. Light generated by the LEDs 40a-c are projected and focused into a full color image by a focusing element 42. The focusing element 42 may include a mirror unit 45 formed from at least one mirror which reflects the emitted light through prisms 47. The focused image is provided to the projection lens 48 which projects the combined full color image onto a display surface (e.g. screen, wall, etc).

[0048] Figure 2D depicts a laser-based light engine 39d. The laser light engine 39d includes light sources 43a – c that each emit a respective color light based on an audiovisual input signal. The light sources 43a – c are lasers that emit light in three

distinct wavelengths. For example, light source 43a may be a laser that emits light at a wavelength associated with the color red whereas light source 43b may emit light at a wavelength associated with the color green and light source 43c may emit light at a wavelength associated with the color blue. The panel driver 38 controls the light sources 43a-c to emit respective colored light based on the audiovisual input signal received from the controller 12. The emitted light (either, concurrently or sequentially – depending on the panel driver being used) is provided to a focusing element 42. The focusing element 42 includes a set of combiner optics 49 that receives and combines the emitted laser light and provides the light to the mirror unit 45 including a plurality of individual mirrors. The mirror unit 45 is controlled by the panel driver 38 to rotate the plurality of mirrors based on the audiovisual input signal and reflects light to the projection lens 48 for projection onto a display surface (e.g. screen, wall, etc).

[0049] The portable projection device 10 described in Figure 1 advantageously generates various graphical user interfaces (GUI's) in response to receiving data sensed by one or more sensors embodied within the device. The GUIs generated by the device 10 may be mode-specific GUI's such that a certain set of GUI generation algorithms are executed by the controller 12. In a first mode, the controller 12 executes a configuration algorithm that enables the user to configure and position the device with respect to the display surface such that the resulting audiovisual output by the projection unit 30 is substantially optimal. The configuration algorithm advantageously senses the position of the unit and monitors the audiovisual image being output by the projection unit 30 for display on the display surface and generates configuration messages to inform the user how to optimize the appearance of the audiovisual image being projected by the device 10. The use of positional data sensed by at least one sensor advantageously ensures proper configuration because of the portable nature of the device 10. When configuring one setting, each positional change potentially affects how the device 10 need be positioned for all subsequent settings. In this case, each movement of the unit affects many parameters of the setup so optimization is needed to incorporate all features and advise the user the best method to complete the setup.

[0050] The GUI configuration algorithm advantageously generates user interface images representing instructions informing a user on how to correct the image being displayed (e.g. brightness, size, focus, keystoning or any other trapezoid correction, etc). The novelty of this GUI configuration algorithm centers around the device sensing various positional shifts of the device with respect to the surface on which it

is positioned and the image on the display screen. The algorithm uses this sensed data to determine the next recommended user action and generate a user interface display image including instructions corresponding to the determined next recommended user action. In one embodiment, a sensor on the projector could determine the amount of room lighting and recommend a picture size to provide adequate brightness to overcome the background lighting. In another embodiment, the sensor may advise that the ambient light be turned off. In a further embodiment, configuration settings that require movement of the device 10 from a current position to a new position may be continually monitored and the GUI may automatically update the user interface to notify the user when the device has been moved into its desired position. These types of real-time configuration messages may also be supplemented with sound providing the user with an additional indication that the particular configuration operation has been completed.

[0051] In another mode of operation, the GUI generation algorithm may include a disruption algorithm that is in operation when the device is in a projection mode and is projecting an audiovisual image onto a display surface. The disruption algorithm advantageously enables the device to selectively generate a disruption message that is combined with the audiovisual images being projected thereby notifying the user that the device is receiving a communication and that the received communication is pre-authorized to disrupt the projection mode. In one embodiment, the disruption algorithm is particularly useful if the device 10 includes cellular phone or other communication circuitry. Generally, if the portable projection device 10 includes communication circuitry, the communication functionality is disabled when the device is in projection mode so as not to disrupt the presentation as well as to ensure that the audiovisual image being projected is not negatively impacted by receiving a communication notification such as a vibration notification and/or audible notification (e.g. ringer, ringtone, etc). Thus, the disruption algorithm enables the device to identify the source of any incoming communication and generate an override message to notify the user of the communication if the incoming communication is determined to be from a pre-authorized source.

[0052] Figure 3 represents a block diagram that excerpts certain of the components of the device 10 described in Figure 1 that are used in generating at least one GUI message for output by the projection unit onto a display surface. The controller 12 includes a microprocessor 302 for controlling all logic operations able to be executed

by the controller 12. A memory 304 is also provided for storing at least one type of data therein. The at least one type of data stored in memory 304 may be any data related to a particular operation of the controller 12 as will be discussed below. A video processor 306 and audio processor 310 are also provided. The video processor 306 processes the video component of any audiovisual (A/V) input signal 301 in a known manner and provides video data to the panel driver 38 of the projection unit 30 (Fig. 1). The audio processor 310 processes any audio component of the A/V input signal 301 for output to the audio driver 312 coupled to the speaker 29 (Fig. 1). A communication bus 303 connects each of the microprocessor 302, memory 304, video processor 306 and audio processor 310 and enables each of the components to communicate data therebetween.

[0053] The video processor 306 also includes an on-screen display (OSD) module 308 that generates data representing messages that may be selectively projected by the projection unit 30 onto the display surface. The OSD module is responsive to various input signals received by the video processor 306 from sensors 320. Sensors 320 selectively sense data representing one of (a) environmental data around the device 10 and (b) output data that is output by any component of the device 10. Environmental data may include, but is not limited to, (a) position of the device with respect to a display surface; (b) position of the device with respect to a projection surface (e.g. the surface on which the device is positioned); (c) ambient light; and (d) ambient sound. Output data may include, but is not limited to, (a) size of images being projected; (b) brightness of images being projected; (c) geometry of images being projected; (d) focus of images being projected and (e) alignment of images being projected.

[0054] The sensors 302 may include the motion sensor 60 which senses the position of the device 10 with respect to the display surface and the projection surface and a camera module 52 that can capture and record images being projected onto the display surface by the projection unit 30. The motion sensor 60 and camera module 52 may selectively sense at least one of the environmental data and output data associated with the device and the images being currently projected thereby. The environmental data and output data sensed by the motion sensor 60 and camera module 52 may be provided as a configuration signal to the video processor 306 by the microprocessor 302. The video processor 306 uses the configuration signal representing device position and image output to determine if the images being projected by the projection unit 30 meet a projection threshold. The projection

threshold includes substantially optimal values associated with at least one type of image characteristic including, but not limited to, at least one of (a) brightness; (b) focus; (c) size; (d) alignment; and (e) geometry. In one embodiment, the projected image may be a configuration image having predetermined image characteristics enabling the video processor 306 to compare data image characteristic data values associated with the image being projected with the known data values for the characteristics in the configuration image.

[0055] The video processor 306 uses the data in the configuration signal to condition the OSD module 308 to generate at least one message providing the user with instructions on modifying the position of the device to ensure that the projected image meets the projection threshold. To accomplish this, the OSD module generates a graphical user interface representing a configuration message including the instruction which is provided in conjunction with projected images to the panel driver 38 resulting in the projection of a configuration message GUI and/or the projected image by the projection unit. The device may be continually re-configured in response to further position modifications made by the user resulting in the generation of at least one updated configuration signal that may be used by the video processor 306 to generate further configuration messages until such time that the image being projected meets the projection threshold. This is particularly advantageous because, with each change in position of the device, the respective image characteristics may change. Thus, in order to meet the projection threshold, the device needs to account for both the environmental data and output data at a given time and use them to provide the user with instructions meeting the projection threshold.

[0056] In operation, a user engages a respective one of the user input controls 31 and conditions the controller 12 to select and receive the A/V input signal 301 from a respective one of the input ports 15 (Fig. 1). The microprocessor 302 conditions the video processor 306 and audio processor 310 to process the A/V input signal 301 for output by the projection unit 30. However, prior to processing and outputting data representing the A/V input signal, it is highly desirable to ensure that the device 10 is in an optimal position for projecting the particular audiovisual image contained in the A/V input signal 301.

[0057] The controller 12 executes at least one type of GUI generation algorithm to ensure that the device 10 is properly configured in the particular state in which it is operating. In a first mode of operation, the GUI generation algorithm may be a

configuration algorithm which ensures that the projected image is being displaying in an optimal fashion. In one embodiment, execution of the configuration algorithm by the controller 12 may occur in response to user input using one of the user controls 31 shown in Figure 1. For example, the user may select a button on the device housing or an image element on the device display screen that sends a signal initiating the configuration algorithm. In another embodiment, the configuration algorithm may be automatically executed when the microprocessor 302 detects that the device has been placed in "projection mode". In this embodiment, the microprocessor 302 may execute the configuration algorithm one of (a) prior to selection of an A/V input signal 301 from a respective input 15; and (b) after selection of an A/V input signal 301 from a respective input 15.

[0058] Upon execution of the configuration algorithm, the microprocessor 302 retrieves from memory 304 the configuration image having predetermined image characteristic values against which current configuration parameters may be measured. Current configuration parameters represent the parameters currently used to project the configuration image on the display surface. Based on the position of the device and the characteristics of the configuration image being output by the device, the current configuration parameters may be modified to ensure that the current configuration parameters result in projection of the configuration image that meets the projection threshold representing a substantially optimal display of the configuration image on the display surface.

[0059] An exemplary configuration algorithm detailing an operation of the device 10 according to invention principles is provided in Figures 4A and 4B. At step 402, the controller 12 is caused to enter the adjustment routine. This may be accomplished, for example, by the user interacting with at least one of the user controls 31 that initiates execution of the configuration algorithm by the controller 12. Upon initiation of the configuration algorithm, the microprocessor 302 controls the video processor 306 to output the configuration image via the projection unit. At step 404, a first image characteristic of the configuration image is analyzed. In one embodiment, the first image characteristic analyzed is the ambient light in the room. The analysis in step 404 may occur using the camera module 52 which captures data representing the ambient light to determine if the room lighting needs adjustment. In one embodiment, to determine the ambient light, the controller 12 may selectively control the panel driver 38 of the projection unit 30 to disable the light engine 39. Once the light engine

39 has been disabled, the camera module 52 may sense the brightness level in the room using the camera imager sensor 56 (Fig. 1). At step 406, the algorithm queries the result of the analysis in block 404 to determine if the level of ambient light. The sensed data representing the brightness of the ambient light may be compared to a threshold value. If the sensed brightness data exceeds the threshold value, the controller will determine that the ambient light is too bright. If the result of the query in block 406 is negative indicating that the brightness level in the room exceeds the threshold brightness value, the video processor 306 controls the OSD module 308 to generate a GUI configuration message directing the user to reduce the ambient light (e.g. darken the room). The GUI configuration message is provided to the panel driver 38 and projected via the projection unit onto the display surface. An example of a GUI configuration message generated by the OSD module 308 that directs a user to modify the ambient light in a room is provided in Figure 5A which shows a display surface 502 (e.g. display screen) including the configuration message 504a displayed thereon. The display surface 502 being shown as a display screen is shown for purposes of example only and the GUI configuration message may be projected onto any type of surface able to display the image. Referring back to Figure 4A, once a user has undertaken an action directed by the GUI configuration message, the algorithm reverts back to step 404 to analyze whether or not the action undertaken by the user was sufficient. Thus, the device is able to further determine if the change in ambient light is sufficient.

[0060] In another embodiment, after the GUI configuration message instructing the user to reduce the ambient light is displayed, the user may manually proceed to the next configuration operation by activating a key on the display device in step 408 which directs the controller 12 to continue to the next step 410.

[0061] Upon one of determining that the ambient light is sufficient in step 406 or activating the key on the display in step 408, the controller 12 proceeds to determine if the screen brightness is sufficient in step 410. This activity in step 410 may be accomplished by the camera module 52 capturing the configuration image being projected by the projection unit 30 on the display surface as a configuration input signal. The microprocessor 302 receives the configuration input signal representing image brightness and calculates a brightness value associated therewith. Thereafter, in step 412, the controller 12 determines if the brightness level of the configuration image is of a sufficient level. The determination in step 412 may occur by the

microprocessor 302 comparing the calculated brightness value with a first threshold brightness value indicating a minimum brightness level and a second threshold brightness value indicating a maximum brightness level. In one embodiment, if the calculated brightness value one of (a) falls below the first threshold brightness value; or (b) exceeds the second threshold brightness value, the microprocessor 302 signals the video processor 306 that the target brightness level has not been reached. The video processor 306 controls the OSD module to generate a GUI configuration message directing the user to modify the position of the device 10 in order to achieve the target brightness level. If the target brightness level is not achieved, the OSD module 30 is controlled to generate a GUI configuration image instructing the user to change the position of the device 10 as shown in step 413. For example, if the brightness level is below the first threshold value, the OSD module 308 may generate a GUI configuration message instructing the user to move the device closer to the display surface thereby increasing the intensity of the image being projected. An exemplary GUI configuration message instructing the user to increase the brightness is shown in Figure 5B which includes the display surface 502 having the GUI configuration message 504b displayed thereon. Alternatively, if the brightness level is determined to exceed the second brightness threshold, the OSD module 308 may generate a GUI configuration message instructing the user to increase the distance between the device 10 and the display surface on which the configuration image is being projected. While an exemplary GUI configuration image including instructions to increase the distance between the device 10 and display surface 502 is not shown, one skilled in the art will understand that the OSD module 308 may readily generate such a message in a manner similar to that shown in Figure 5B.

[0062] The motion sensor 60 in the device automatically detects that the device 10 has been moved and generates a positional configuration input signal to the microprocessor 302 that the device has been moved. Upon receiving the positional configuration input signal from the motion sensor 60, the microprocessor 302 repeats steps 410 and 412 to determine that the currently projected configuration image is of sufficient brightness.

[0063] The configuration algorithm continues in Figure 4B at step 414. Once the ambient light and screen brightness has been determined to be sufficient, the configuration algorithm seeks to ensure that the image quality itself is sufficient. In step 414, the controller 12 initiates an auto-focus sequence. The microprocessor 302

causes the video processor 306 to initiate an auto-focus routine. In one embodiment, the auto-focus routine may be similar to a DSC auto-focus wherein the camera input can view (sense) the projected image pattern from the projection unit/microdisplay 30 and detect contrast changes when the focus of the microdisplay 30 is changed. One exemplary manner of detecting contrast changes includes determining the peak contrast of adjacent pixels in the projected pattern. Another exemplary manner of detecting contrast changes includes comparing adjacent pixels of the camera input with the image being projected until the comparison results are the most similar. A further exemplary manner of detecting contrast change in the projected image includes the controller controlling the IR LED 50 to aid focus by emitting an IR beam at the display surface and detecting contrast changes of the camera image as the focus of the microdisplay 30 is changed.

[0064] Once the auto-focus routine in step 414 has been completed, the controller 12, in step 416 determines if the currently displayed configuration image is in focus. The microprocessor 302, at the completion of the autofocus routine, causes the camera module to capture the currently projected configuration image and provide the captured data as a focus control input signal. The microprocessor 302 compares the data contained in the focus control input signal representing the currently projected configuration image with the actual configuration image to determine if the image is within an acceptable focus range indicated by the contrast change not exceeding a predetermined contrast threshold level. If the determination in step 416 is negative indicating the currently projected configuration image is out of focus, the video processor 306 controls the OSD module 308 to generate a GUI configuration message including instructions on moving the device 10 in a direction that the controller has determined will bring the currently displayed configuration image into focus as shown in step 417. An exemplary GUI configuration message used to improve the focus is shown in Figure 5C which includes the display surface 502 having the GUI configuration message 504c displayed thereon.

[0065] In another embodiment, step 416 the autofocus routine initiated in step 414 may replace the configuration image with a focus indictor that selectively changes from a first color indicative of the device being out of focus to a second color indicative of the device being in focus. In this embodiment, the GUI configuration message may provide instructions telling the user to move the device in any direction until the focus indicator having the second color is visible on the display surface. This

may be accomplished using the motion sensor 60 which continually senses the position of the device with respect to both the projection surface and display screen and continually provides positional configuration signals to the microprocessor 302 which uses these positional configuration signals to determine when the device 10 is in focus and instructs the video processor 306 once the device 10 is in the correct position to initiate generation of the focus indicator in the second color.

[0066] Once the determination in block 416 is positive, the configuration algorithm proceeds at step 418 to ensure that the geometry/alignment of the device 10 with respect to the display surface is correct. In step 418, the microprocessor 302 controls the video processor 306 to generate a geometry configuration image for projection onto the display surface by the projection unit 30. In one embodiment, the geometry configuration image may be a grid pattern. In step 420, the controller 12 determines if the geometry/alignment is within an acceptable range. To determine if the geometry/alignment is correct, the microprocessor 302 controls the camera module 52 to capture the projected image representing the grid pattern. The captured grid pattern image is provided as an alignment input signal including alignment data to the microprocessor 302. The alignment data may include a measurement of certain angles within each box that forms the grid pattern. Alternatively, the alignment data may include the angular measurement of the entire grid. The alignment data values are compared to the known angular values of the grid and, if the angular data values of the currently projected grid image are within an acceptable range, the microprocessor 302 determines that the geometry/alignment is acceptable and proceeds to step 422 where the controller 12 queries whether or not the geometry/alignment were adjusted. If the result of the query in step 422 is negative, the controller 12 ends the configuration algorithm and the device is correctly configured to optimally project an image therefrom.

[0067] Referring back to step 420, if the geometry is determined to be unacceptable, the configuration algorithm proceeds to step 421. In step 421, the microprocessor 302 signals the video processor 306 that the geometry/alignment is not acceptable. The video processor 306 causes the OSD module to generate a GUI configuration image including instructions on changing the position of the device. An exemplary embodiment of the GUI configuration image used to correct the geometry/alignment of the device 10 is shown in Figure 5D which includes the display surface 502 having GUI configuration message 504d that instructs the user to selectively rotate the device

in one of a clockwise or counterclockwise direction. In another embodiment, the GUI configuration message for correcting geometry/alignment may also instruct the user to move the device 10 towards or away from the display surface either alone or in conjunction with rotating the device.

[0068] As the user re-positions the device 10, the motion sensor 60 detects the change in position and continually provides positional input signals to the microprocessor 302. Upon receipt of the positional input signals, the microprocessor 302 may control the camera module 52 to re-capture the image being projected to provide the microprocessor 302 with updated alignment data which may be compared to the known desired alignment values to determine if the new position has improved the geometry/alignment to be at an acceptable level. This process is repeated until such time that the microprocessor 302 determines that the re-positioning of the device results in a projected grid pattern being within the acceptable alignment range. The microprocessor 302 stores in memory 304 data indicating that the device 10 has been moved to correct the geometry/alignment.

[0069] The configuration algorithm returns to step 422 and queries the memory 304 to determine whether or not the memory 304 has data stored therein indicating that geometry/alignment has been modified by re-positioning the device 10. If the result of this query in step 422 is positive, the controller 12 automatically returns to block 414 and repeats the autofocus routine and geometry detection steps in blocks 414 – 422 until the controller 12 determines that the projected image is in focus and that the geometry/alignment is within an acceptable range. Thereafter, the controller 12 exits the configuration algorithm in step 424.

[0070] Referring back to Figure 3, after the configuration algorithm has been completed and the device is optimally projecting an image onto a display surface, the controller 12 may enter the second mode of operation. In the second mode of operation, the device is in a projection mode which results in certain other device functions being inhibited. In one embodiment, where the device includes the communication processor 62 that may include all components of a cellular phone/smartphone/network connected device, the communication features associated therewith are inhibited. For example, if a phone call or email is received during projection mode, the device will be inhibited from providing a notification of the receipt of such communication until after the device exits projection mode. However, there may be times when the user would desire to allow certain notifications of

communications to be received even when the device 10 is in projection mode. To accomplish this goal, the controller 12 inhibits all forms of communication notification typically associated with the device (e.g. phone ringer, speaker, vibration module, etc) and executes the disruption algorithm. The disruption algorithm enables the microprocessor 302 to receive a communication input signal from the communication processor 62 that indicates that a communication has been received thereby. The communication input signal includes data characterizing the communication such as, but not limited to, (a) type of communication; (b) source of communication; and (c) contents of the communication. The type of communication may include but is not limited to (a) a phone call; (b) an email; (c) an SMS message; (d) an MMS message; (e) a notification from an application executing on the device 10 (e.g. notification of incoming Tweet). The source of the communication may include at least one of (a) a persons name; (b) a phone number; (c) a physical address; (d) an internet address; (e) an email address; and (f) a screen name or other alias. The contents of the communication may include at least one of (a) a type of message; (b) presence or absence of an attachment; and (c) a priority indicator indicating a priority level associated with the communication.

[0071] The microprocessor 302 receives the communication input signal and parses the data characterizing the communication to determine whether or not the communication should be provided to the user during projection mode. The microprocessor 302 may query the memory 304 for a list of pre-authorized communications that are permitted during the projection mode. To determine if the communication is pre-authorized, the microprocessor 302 may compare data characterizing the communication with predetermined communication data stored in memory 304. The predetermined communication data may include at least one of (a) a list of approved communication sources (e.g. telephone numbers, email addresses, etc); (b) a contact list wherein each entry in the contact list that is pre-authorized includes an authorization indicator stored in their respective contact entry; and (c) a predetermined group of sources from which communication is to be received (e.g. a "Caller Group" feature which groups individuals by family, work, friends, etc which could serve as a priority group feature).

[0072] Once the microprocessor 302 determines that the received communication is pre-authorized, the microprocessor 302 controls the video processor 306 to use the OSD module 308 to generate a GUI notification message including data representing

at least one characteristic of the communication (e.g. name and phone number or name and email address, etc). The video processor 306 automatically provides the GUI notification message to the panel driver 38 and controls the panel driver 38 to display the GUI notification message with the currently projected image thereby enabling the user (e.g. device owner) to receive only communications that are pre-authorized. In one embodiment, the GUI notification message may be provided simultaneously with the currently projected image. In another embodiment, the panel driver 38 may display the GUI notification message as an overlay on top of at least a portion of the currently projected image. In a further embodiment, the panel driver 38 may temporarily replace the currently projected image with the GUI notification message. Thus, the user of the device is advantageously notified when important communications have been received allowing them to take an appropriate action to one of accept or ignore the communication.

[0073] An exemplary disruption algorithm executed by the controller is shown in Figure 6. In step 602, the communication processor 62 receives an incoming communication and generates an input communication signal including data characterizing the communication. The microprocessor 302 automatically parses the input communication signal in step 604 to identify the source of the communication and determines in step 606 whether the incoming communication is a priority and thus pre-authorized during projection mode. If not, the microprocessor 302 automatically ignores the communication in step 607 and directs the communication processor 62 to handle the communication as if the device is unavailable (e.g. send to voicemail if a call or put in an inbox if a message, etc.). If the query in step 606 is positive, the microprocessor 302 generates an override message in step 608 and controls the video processor 306 to have the OSD module 308 generate the GUI notification message. The generated GUI notification message is combined with the currently projected image in step 610 and displayed on the display surface by the projection unit 30 in step 612. An exemplary GUI notification message providing the user with a notification of a pre-authorized communication is shown in Figure 7 which includes the display surface 702 having a composite image including the currently projected image 704 and the GUI notification message 706 projected thereon.

[0074] The implementations described herein may be implemented in, for example, a method or process, an apparatus, or a combination of hardware and software. Even if

only discussed in the context of a single form of implementation (for example, discussed only as a method), the implementation of features discussed may also be implemented in other forms (for example, a hardware apparatus, hardware and software apparatus, or a computer-readable media). An apparatus may be implemented in, for example, appropriate hardware, software, and firmware. The methods may be implemented in, for example, an apparatus such as, for example, a processor, which refers to any processing device, including, for example, a computer, a microprocessor, an integrated circuit, or a programmable logic device. Processing devices also include communication devices, such as, for example, computers, cell phones, tablets, portable/personal digital assistants ("PDAs"), and other devices that facilitate communication of information between end-users.

[0075] Additionally, the methods may be implemented by instructions being performed by a processor, and such instructions may be stored on a processor or computer-readable media such as, for example, an integrated circuit, a software carrier or other storage device such as, for example, a hard disk, a compact diskette, a random access memory ("RAM"), a read-only memory ("ROM") or any other magnetic, optical, or solid state media. The instructions may form an application program tangibly embodied on a computer-readable medium such as any of the media listed above. As should be clear, a processor may include, as part of the processor unit, a computer-readable media having, for example, instructions for carrying out a process. The instructions, corresponding to the method of the present invention, when executed, can transform a general purpose computer into a specific machine that performs the methods of the present invention.

[0076] What has been described above includes examples of the embodiments. It is, of course, not possible to describe every conceivable combination of components or methodologies for purposes of describing the embodiments, but one of ordinary skill in the art can recognize that many further combinations and permutations of the embodiments are possible. Accordingly, the subject matter is intended to embrace all such alterations, modifications and variations that fall within the spirit and scope of the appended claims. Furthermore, to the extent that the term "includes" is used in either the detailed description or the claims, such term is intended to be inclusive in a manner similar to the term "comprising" as "comprising" is interpreted when employed as a transitional word in a claim.

CLAIMS

1. An apparatus for projecting received images onto a display surface comprising

a projection unit (30) that selectively projects at least one received image onto a display surface; and

a controller (12) coupled to the projection unit that generates at least one graphical user interface (GUI) including instructions displayable to a user via the projection unit on a display surface, the instructions in the GUI are used in configuring at least one parameter of the projection unit.

2. The apparatus according to claim 1, further comprising

at least one sensor (32) coupled to the controller that senses data related to the at least one parameter and provides said sensed data to the controller; and

said controller uses the sensed data to generate the at least one GUI including instructions.

3. The apparatus according to claim 2, wherein

The sensor continually monitors the at least one parameter and provides updated sensed data to the controller; and

said controller automatically updates the instructions in the at least one GUI based on the sensed data enabling dynamic configuration of the at least one parameter.

4. The apparatus according to claim 2, wherein

the sensed data includes at least one of (a) environmental data; and (b) data output by the projection unit.

5. The apparatus according to claim 4, wherein

environmental data includes data representing any of (a) position of the apparatus with respect to a display surface; (b) position of the apparatus with respect to a projection surface; (c) ambient light; and (d) ambient sound.

6. The apparatus according to claim 4, wherein

output data includes data representing any of (a) size of images being projected; (b) brightness of images being projected; (c) geometry of images being projected; (d) focus of images being projected; and (e) alignment of images being projected.

7. The apparatus according to claim 2, wherein

The at least one sensor includes at least one of (a) a motion sensor able sense the position of the apparatus with respect to each of a projection surface and a display surface and (b) a camera module that selectively captures data representing images being projected by the projection unit and ambient light within a room.

8. The apparatus according to claim 1, wherein

the controller notifies a user when the at least one parameter has been successfully configured and automatically initiates configuration of a further parameter by generating further graphical user interfaces including instructions for use in configuring the further parameter.

9. The apparatus according to claim 1, wherein

the at least one parameter of the projection unit includes any of (a) an ambient light level; (b) screen brightness; (c) image focus; (d) image geometry and (e) image alignment.

10. The apparatus according to claim 1, further comprising

a communication processor (62) coupled to the controller that receives data representing at least one type of communication having at least one communication characteristic associated therewith from a remote source; and

said controller parses the received data representing the at least one type of communication during the projection of the at least one image and generates a graphical user interface including the at least one communication characteristic upon determining that the at least one type of communication received by the communication processor is authorized to interrupt the projection of the at least one image.

11. The apparatus according to claim 10, wherein

the controller automatically inhibits audible and visual notifications by the apparatus of the received communication when said projection unit is projecting the at least one image.

12. The apparatus according to claim 10, wherein

the at least one type of communication includes any of (a) a phone call; (b) an email; (c) an SMS message; (d) a MMS message; (e) and a notification from an application executing on the apparatus.

13. The apparatus according to claim 10, wherein

the communication characteristic includes any of (a) a persons name; (b) a phone number; (c) a physical address; (d) an internet address; (e) an email address; (f) a screen name or other alias; (g) a type of message; (h) presence or absence of an attachment; and (i) a priority indicator indicating a priority level associated with the communication.

14. The apparatus according to claim 10, wherein

the controller determines if the received communication is pre-authorized by comparing the at least one of the type of communication characteristic with predetermined communication data stored in a memory.

15. The apparatus according to claim 14, wherein

the predetermined communication data may include at least one of (a) a list of approved communication sources; (b) a contact list including pre-authorized entries; and (c) a predetermined group of sources from which communication is to be received.

16. The apparatus according to claim 10, wherein

the controller automatically combines the graphical user interface including the at least one communication characteristic with the at least one projected image into a composite notification image and the projection unit projects the composite notification image for a predetermined period of time.

17. The apparatus according to claim 16, wherein

the controller automatically ceases the display of the composite image and re-initiates projection by the projection unit of the at least one image after the expiration of the predetermined period of time.

18. A method of projecting received images onto a display surface comprises the activities of

projecting, by a projection unit (30), at least one received image onto a display surface;

generating, by a controller (12) coupled to the projection unit, at least one graphical user interface (GUI) including instructions displayable to a user, the instructions in the GUI are used in configuring at least one parameter of the projection unit; and

projecting, via the projection unit, the GUI including instructions on a display surface.

19. The method according to claim 18, further comprising

sensing, by at least one sensor (32) coupled to the controller, data related to the at least one parameter;

provides the sensed data to the controller; and

using the sensed data to generate the at least one GUI including instructions.

20. The method according to claim 19, further comprising

continually monitoring the at least one parameter by the sensor;

providing updated sensed data to the controller; and

automatically updating the instructions in the at least one GUI based on the sensed data enabling dynamic configuration of the at least one parameter.

21. The method according to claim 19, wherein the activating of sensing includes at least one of

sensing environmental data and sensing data output by the projection unit.

22. The method according to claim 21, wherein

environmental data includes data representing any of (a) position of the apparatus with respect to a display surface; (b) position of the apparatus with respect to a projection surface; (c) ambient light; and (d) ambient sound.

23. The method according to claim 21, wherein

output data includes data representing any of (a) size of images being projected; (b) brightness of images being projected; (c) geometry of images being projected; (d) focus of images being projected; and (e) alignment of images being projected.

24. The method according to claim 19, wherein the activity of sensing includes at least one of

(a) sensing, by a motion sensor, a position of the apparatus with respect to each of a projection surface and a display surface and (b) selectively capturing data representing images being projected by the projection unit and ambient light within a room by a camera module.

25. The method according to claim 18, further comprising

notifying a user when the at least one parameter has been successfully configured and automatically initiating configuration of a further parameter by generating further graphical user interfaces including instructions for use in configuring the further parameter.

26. The method according to claim 18, wherein

the at least one parameter of the projection unit includes any of (a) an ambient light level; (b) screen brightness; (c) image focus; (d) image geometry and (e) image alignment.

27. The method according to claim 18, further comprising

receiving data representing at least one type of communication having at least one communication characteristic associated therewith from a remote source by a communication processor (62) coupled to the controller;

parsing, the received data representing the at least one type of communication during the projection of the at least one image by the controller;

generating a GUI including the at least one communication characteristic upon determining that the at least one type of communication received by the communication processor is authorized to interrupt the projection of the at least one image; and

projecting the generated GUI including the at least one communication characteristic on the display surface by the projection unit.

28. The method according to claim 27, further comprising

automatically inhibiting audible and visual notifications by the apparatus of the received communication when said projection unit is projecting the at least one image.

29. The method according to claim 27, wherein

the at least one type of communication includes any of (a) a phone call; (b) an email; (c) an SMS message; (d) a MMS message; (e) and a notification from an application executing on the apparatus.

30. The method according to claim 27, wherein

the communication characteristic includes any of (a) a persons name; (b) a phone number; (c) a physical address; (d) an internet address; (e) an email address; (f) a screen name or other alias; (g) a type of message; (h) presence or absence of an attachment; and (i) a priority indicator indicating a priority level associated with the communication.

31. The method according to claim 27, further comprising

determining if the received communication is authorized by comparing the at least one of the type of communication characteristic with predetermined communication data stored in a memory.

32. The method according to claim 31, wherein

the predetermined communication data may include at least one of (a) a list of approved communication sources; (b) a contact list including pre-authorized entries; and (c) a predetermined group of sources from which communication is to be received.

33. The method according to claim 27, further comprising

Automatically combining the graphical user interface including the at least one communication characteristic with the at least one projected image into a composite notification image by the controller; and

projecting the composite notification image on the display surface for a predetermined period of time.

34. The method according to claim 33, further comprising

automatically ceasing the display of the composite image and re-initiating projection by the projection unit of the at least one image after the expiration of the predetermined period of time.

35. An apparatus for projecting received images onto a display surface comprising

means (30) for selectively projecting at least one received image onto a display surface; and

means (12) for generating at least one graphical user interface (GUI) including instructions displayable to a user via the projection unit on a display surface, the instructions in the GUI are used in configuring at least one parameter of the projection unit.

36. The apparatus according to claim 35, further comprising

means (32) for sensing data related to the at least one parameter and provides said sensed data to the controller; wherein said means for generating uses the sensed data to generate the at least one GUI including instructions.

37. The apparatus according to claim 36, wherein

said means for sensing continually monitors the at least one parameter, and provides updated sensed data to the means for generating, and said means for generating automatically updates the instructions in the at least one GUI based on the sensed data enabling dynamic configuration of the at least one parameter.

38. The apparatus according to claim 36, wherein

the sensed data includes at least one of (a) environmental data; and (b) data output by the projection unit.

39. The apparatus according to claim 38, wherein

environmental data includes data representing any of (a) position of the apparatus with respect to a display surface; (b) position of the apparatus with respect to a projection surface; (c) ambient light; and (d) ambient sound.

40. The apparatus according to claim 38, wherein

output data includes data representing any of (a) size of images being projected; (b) brightness of images being projected; (c) geometry of images being projected; (d) focus of images being projected; and (e) alignment of images being projected.

41. The apparatus according to claim 36, wherein

said means for sensing includes at least one of (a) a motion sensor able to sense the position of the apparatus with respect to each of a projection surface and a display surface and (b) a camera module that selectively captures data representing images being projected by the projection unit and ambient light within a room.

42. The apparatus according to claim 35, further comprising

means (12) for notifying a user when the at least one parameter has been successfully configured, and

means (12) for automatically initiating configuration of a further parameter using said means for generating to generate a further graphical user interface including instructions for use in configuring the further parameter.

43. The apparatus according to claim 35, wherein

the at least one parameter of the projection unit includes any of (a) an ambient light level; (b) screen brightness; (c) image focus; (d) image geometry and (e) image alignment.

44. The apparatus according to claim 35, further comprising

means (62) for receiving data representing at least one type of communication having at least one communication characteristic associated therewith from a remote source; and

said means for generating parses the received data representing the at least one type of communication during the projection of the at least one image and generates a graphical user interface including the at least one communication characteristic upon determining that the at least one type of communication received by the communication processor is authorized to interrupt the projection of the at least one image.

45. The apparatus according to claim 44, wherein

means (12) for automatically inhibiting audible and visual notifications by the apparatus of the received communication when said projection unit is projecting the at least one image.

46. The apparatus according to claim 44, wherein

the at least one type of communication includes any of (a) a phone call; (b) an email; (c) an SMS message; (d) a MMS message; (e) and a notification from an application executing on the apparatus.

47. The apparatus according to claim 44, wherein

the communication characteristic includes any of (a) a persons name; (b) a phone number; (c) a physical address; (d) an internet address; (e) an email address; (f) a screen name or other alias; (g) a type of message; (h) presence or absence of an attachment; and (i) a priority indicator indicating a priority level associated with the communication.

48. The apparatus according to claim 44, further comprising

means (12) for determining if the received communication is pre-authorized by comparing the at least one of the type of communication characteristic with predetermined communication data stored in a memory.

49. The apparatus according to claim 48, wherein

the predetermined communication data may include at least one of (a) a list of approved communication sources; (b) a contact list including pre-authorized entries; and (c) a predetermined group of sources from which communication is to be received.

50. The apparatus according to claim 44, wherein

said means for generating the controller automatically combines the graphical user interface including the at least one communication characteristic with the at least one projected image into a composite notification image and the projection unit projects the composite notification image for a predetermined period of time.

51. The apparatus according to claim 50, wherein

said means for generating automatically ceases the display of the composite image and re-initiates projection by the projection unit of the at least one image after the expiration of the predetermined period of time.

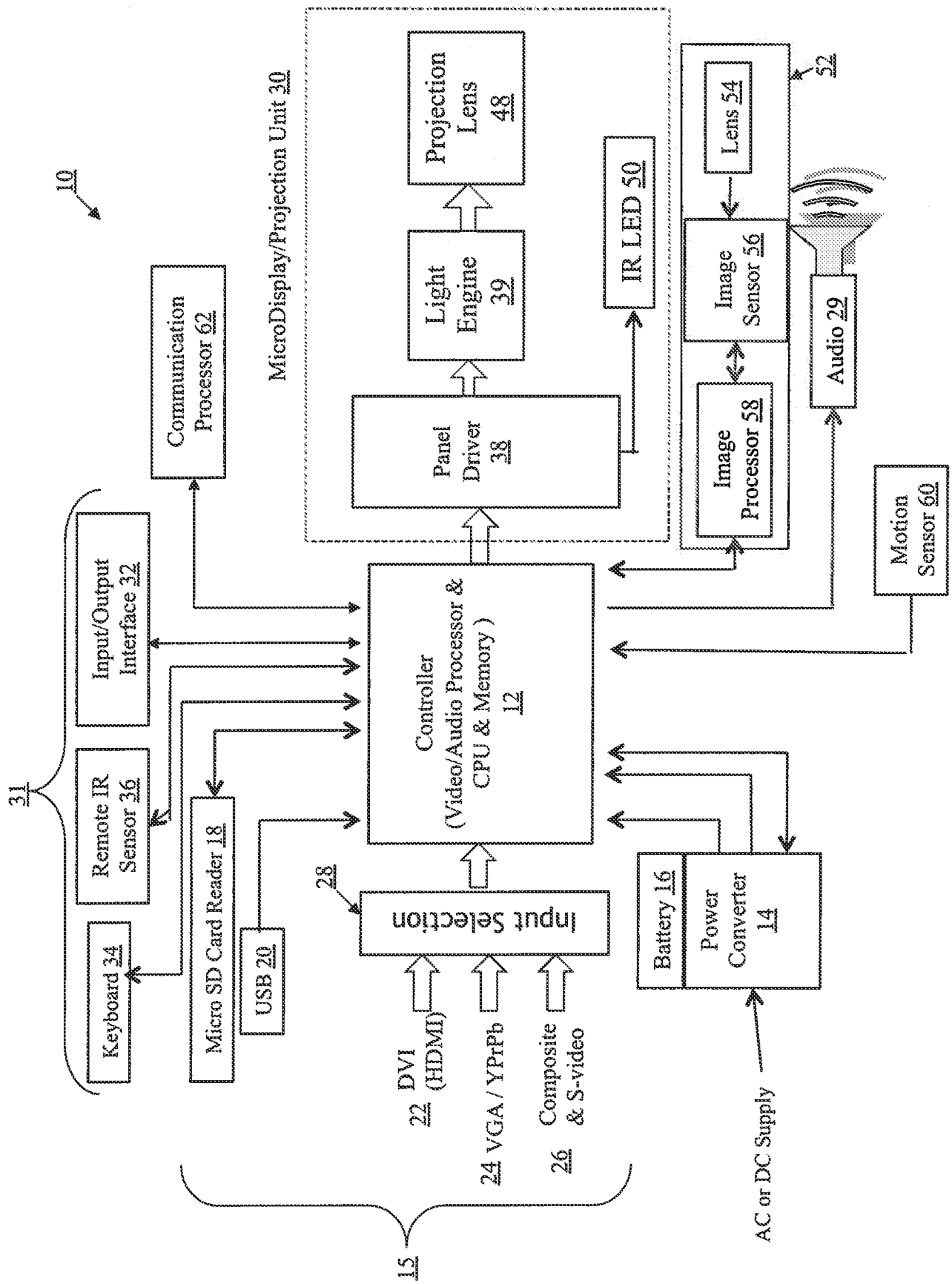
10
MicroDisplay/Projection Unit 30
Projection Lens 48
Light Engine 39
IR LED 50
Panel Driver 38
Communication Processor 62
Lens 54
52
Image Sensor 56
Image Processor 58
Audio 29
Motion Sensor 60
Input/Output Interface 32
Controller (Video/Audio Processor & CPU & Memory) 12
Remote IR Sensor 36
Micro SD Card Reader 18
USB 20
Keyboard 34
31
28
Input Selection
Battery 16
Power Converter 14
DVI (HDMI) 22
VGA / YPrPb 24
Composite & S-video 26
15
AC or DC Supply

Fig. 1

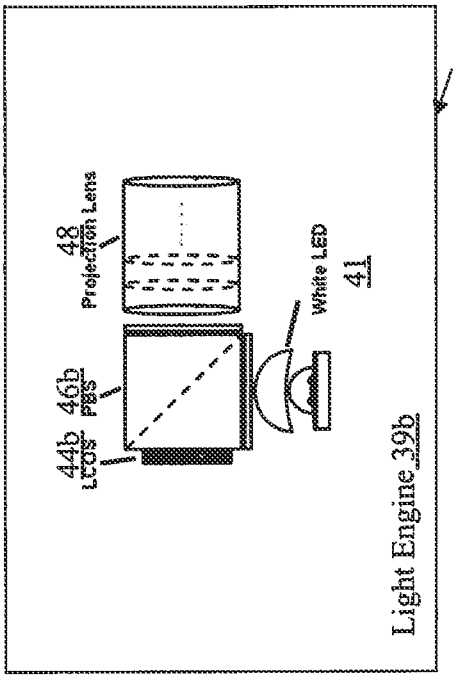

Fig. 2B

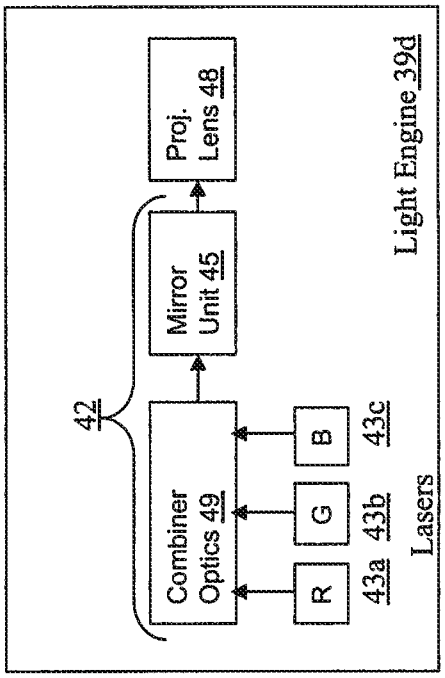

Fig. 2D

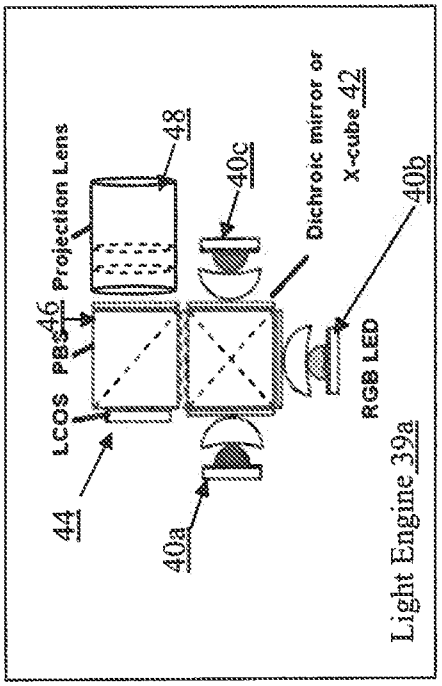

Fig. 2A

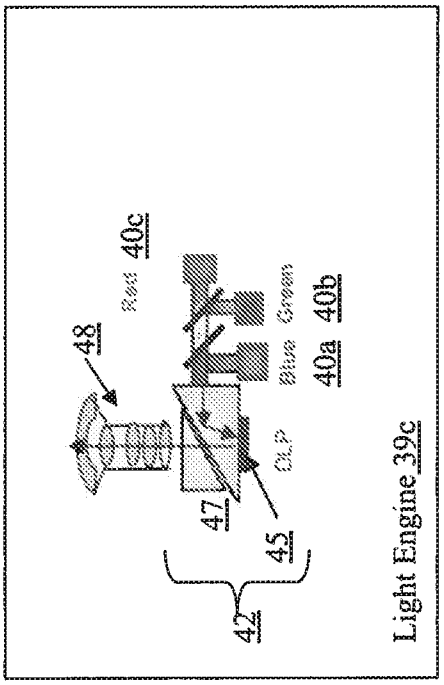

Fig. 2C

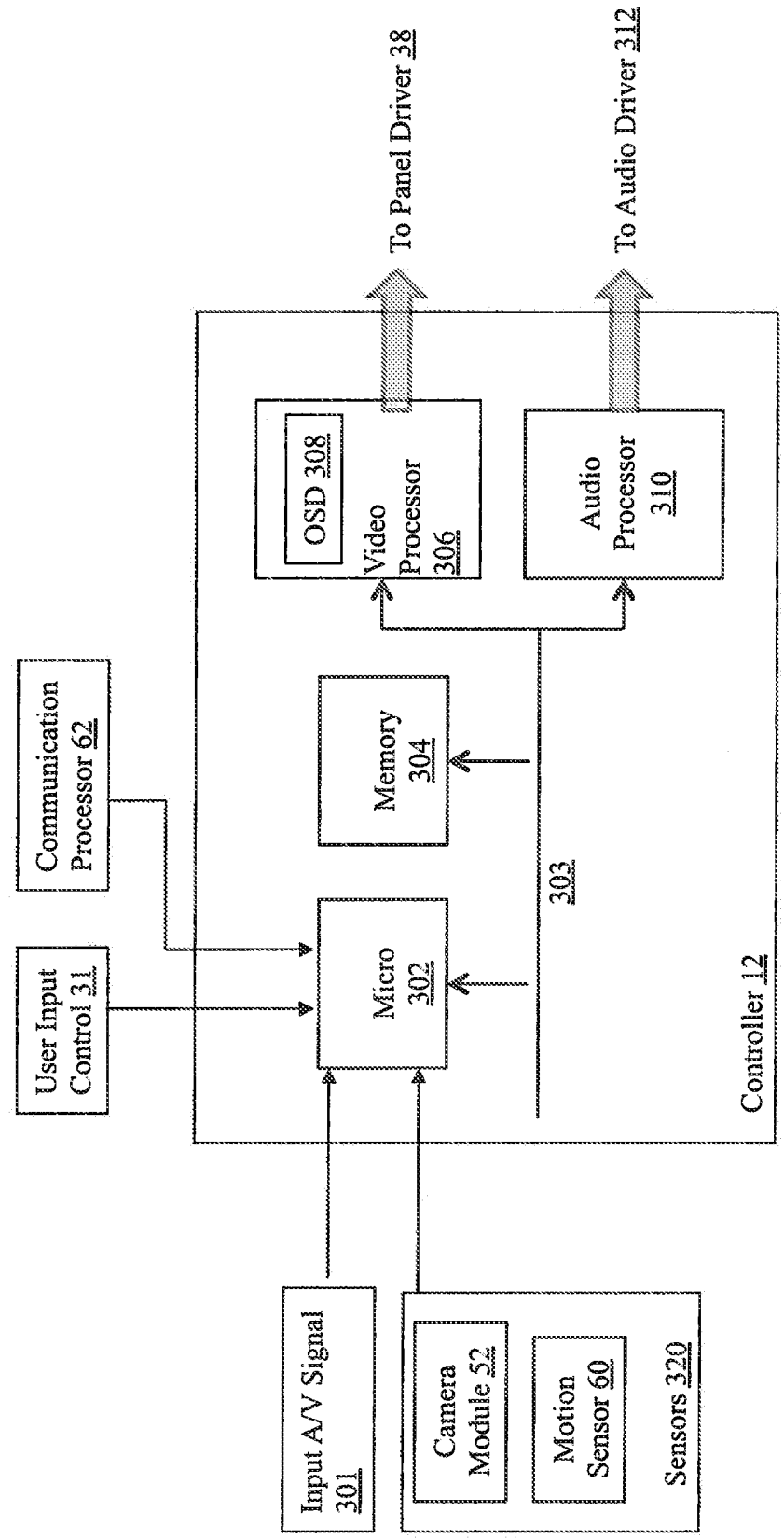
To Panel Driver 38
To Audio Driver 312
OSD 308
Video Processor 306
Audio Processor 310
Memory 304
303
Micro 302
Controller 12
Communication Processor 62
User Input Control 31
Input A/V Signal 301
Camera Module 52
Motion Sensor 60
Sensors 320

Fig. 3

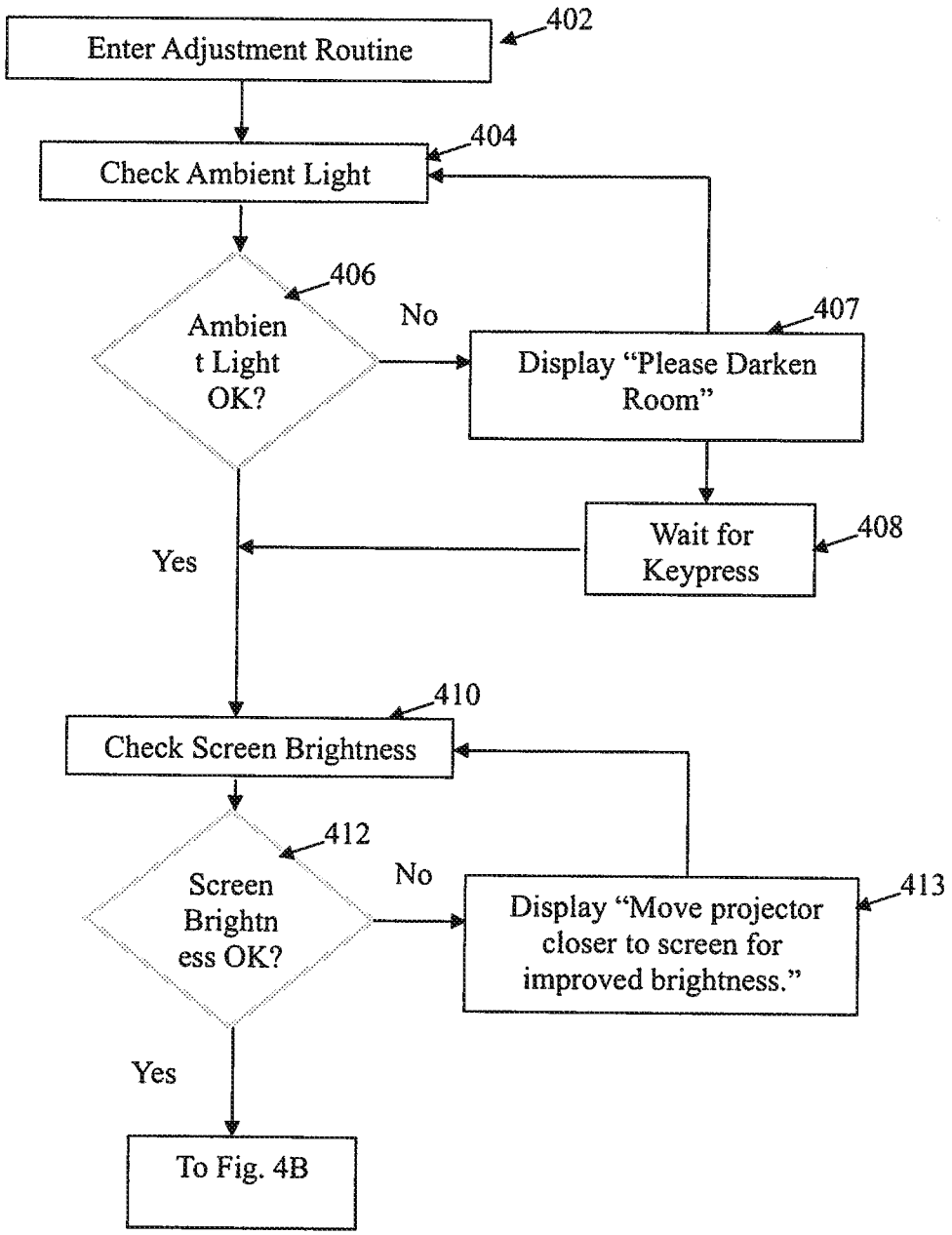
Enter Adjustment Routine
402
Check Ambient Light
404
Ambien t Light OK?
406
No
Display "Please Darken Room"
407
Wait for Keypress
408
Yes
Check Screen Brightness
410
Screen Brightn ess OK?
412
No
Display "Move projector closer to screen for improved brightness."
413
Yes
To Fig. 4B

Fig. 4A

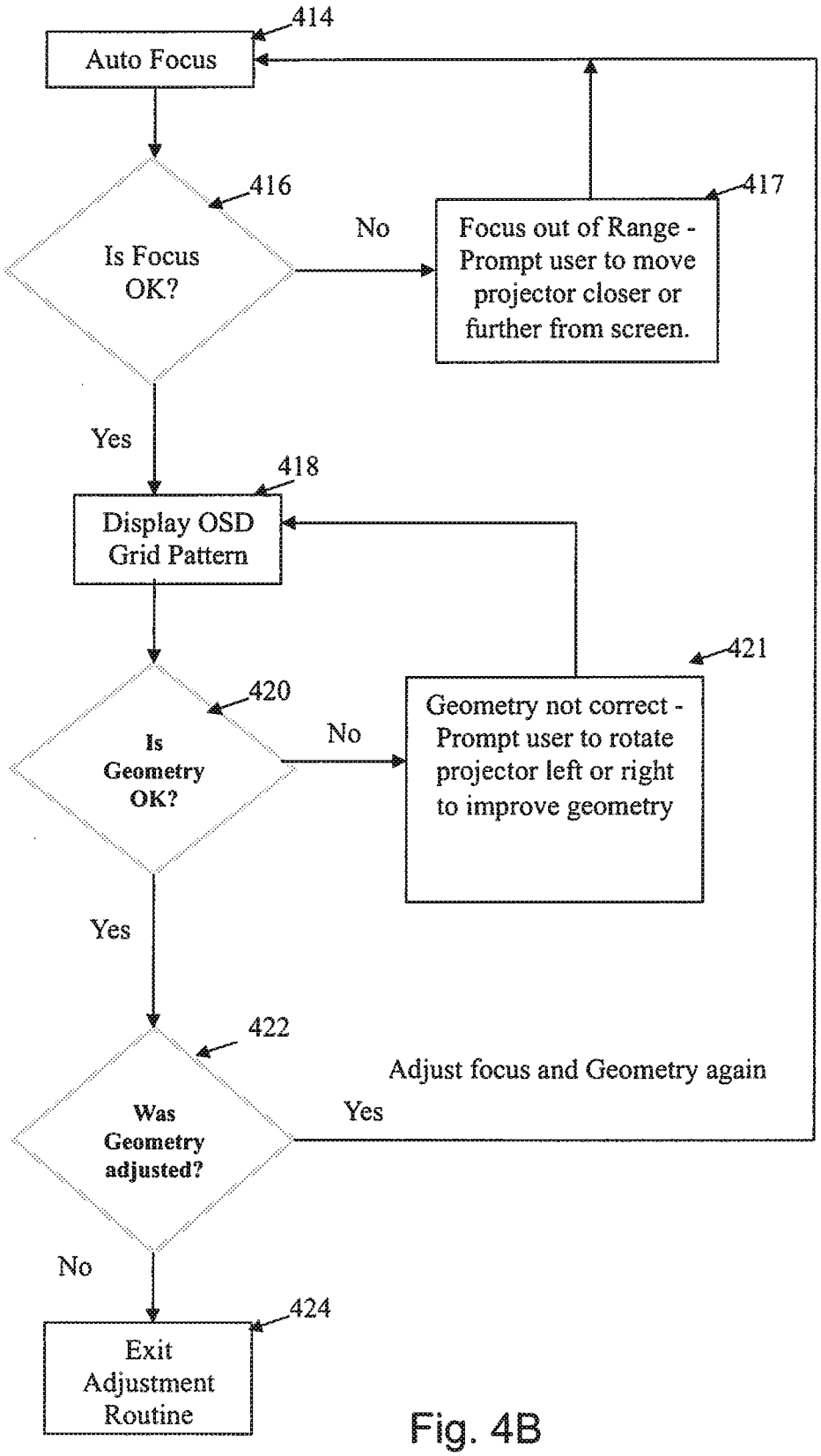
414
Auto Focus
416
Is Focus OK?
No
417
Focus out of Range - Prompt user to move projector closer or further from screen.
Yes
418
Display OSD Grid Pattern
421
420
Is Geometry OK?
No
Geometry not correct - Prompt user to rotate projector left or right to improve geometry
Yes
422
Adjust focus and Geometry again
Was Geometry adjusted?
Yes
No
424
Exit Adjustment Routine

Fig. 4B

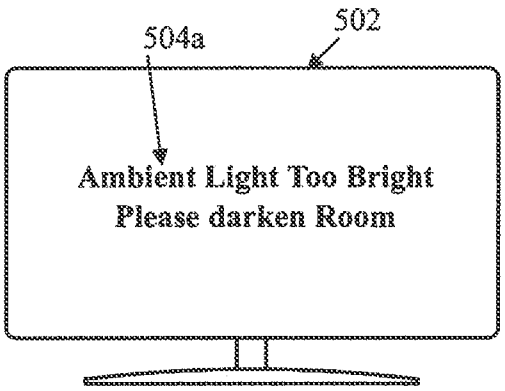

Fig. 5A

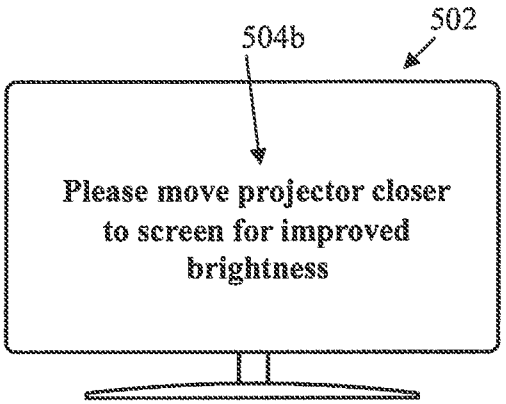

Fig. 5B

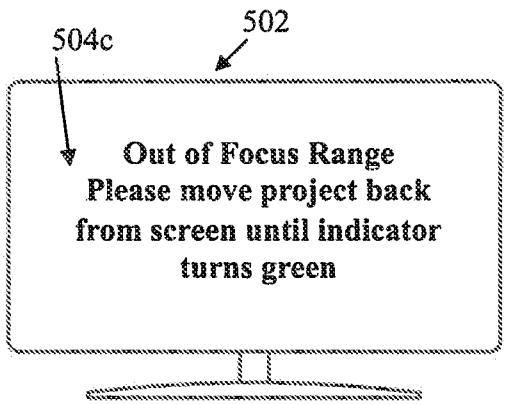

Fig. 5C

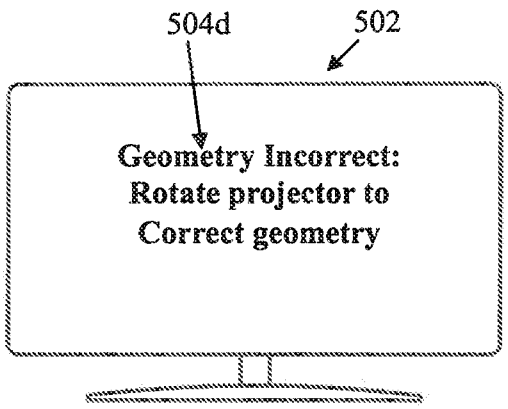

Fig. 5D

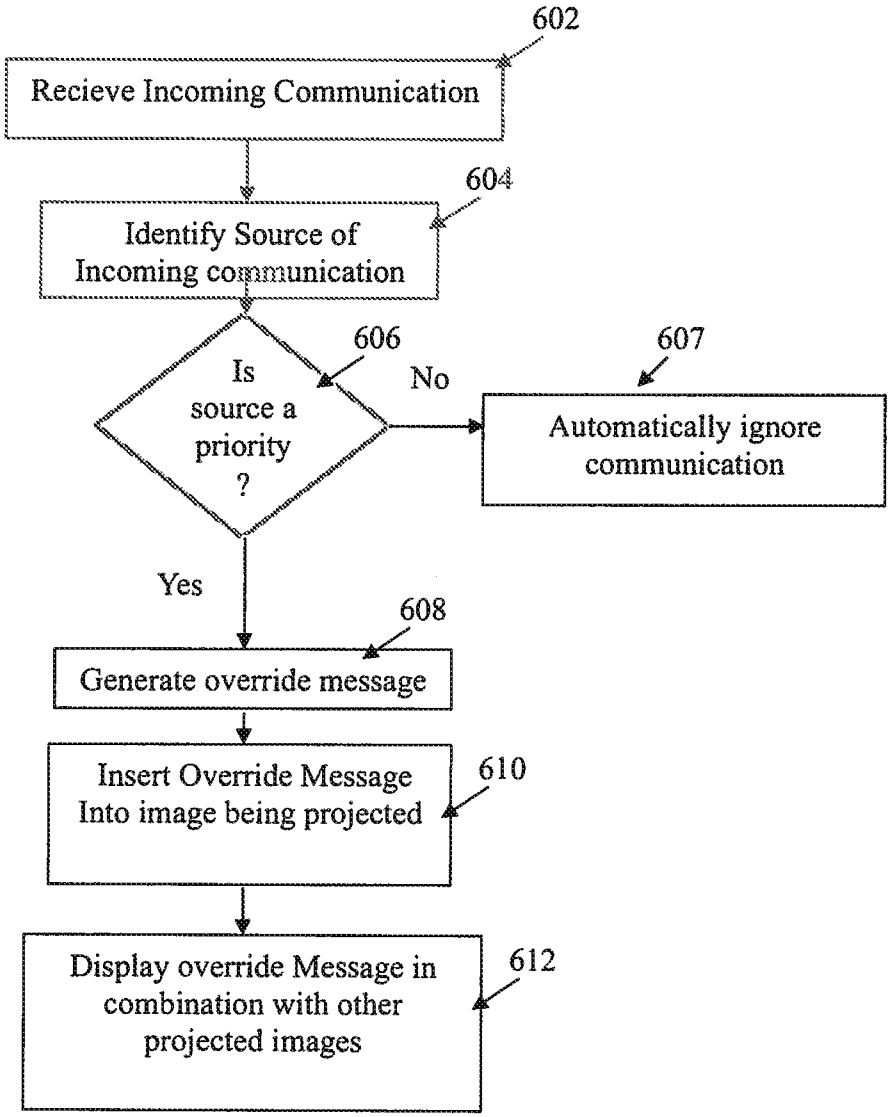
602
Recieve Incoming Communication
604
Identify Source of Incoming communication
606
Is source a priority ?
No
607
Automatically ignore communication
Yes
608
Generate override message
Insert Override Message Into image being projected
610
Display override Message in combination with other projected images
612

Fig. 6

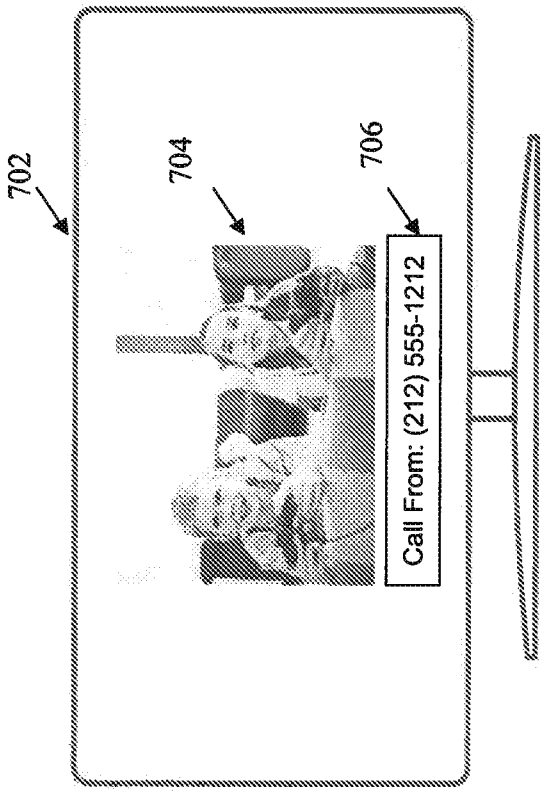

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/048523

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N5/74 H04N9/31
ADD.

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)
H04N

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2011 138019 A (SANYO ELECTRIC CO) 14 July 2011 (2011-07-14) paragraph [0106]; figure 22 paragraph [0088] paragraph [0127] paragraph [0019] paragraph [0022] paragraph [0020] paragraph [0064] paragraph [0109] paragraph [0108] ----- -/--	1-9, 18-26, 35-43

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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

"E" earlier application or patent but 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, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 September 2013	02/01/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Thieme, Markus

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/048523

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"Projector EPSON EMP-735" In: "Images of the Projector EPSON EMP-735 including images of the projected graphical user interface", 31 December 2010 (2010-12-31), XP055074531, page 1 - page 3 -----	1,18,35

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/048523

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-9, 18-26, 35-43

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/048523

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2011138019 A	14-07-2011	NONE	

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9, 18-26, 35-43

   Projecting an image and a GUI. Special technical feature: User is instructed to configure the projector according to position and orientation. Solved technical problem: Achieve a good quality of the projected image.

   ---

2. claims: 10-17, 27-34, 44-51

   Projecting an image and a GUI. Special technical feature: Projecting an alert according to received communication data. Solved problem: The user does not miss an important phone call or instant message.
