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DISPLAY PANELS, METHODS OF MANUFACTURING THE SAME, AND ELECTRONIC DEVICES

Abstract

The present application discloses a display panel, a method of manufacturing the same, and an electronic device. The display panel includes an array substrate, a light blocking matrix, and a backlight module, wherein the array substrate, the light blocking matrix, and the backlight module are stacked in sequence, and the light blocking matrix includes light shielding columns in a grid-like arrangement.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS [0001] The disclosure is a divisional of U.S. patent application Ser. No. 18/236,968, filed on Aug. 23, 2023, titled “DISPLAY PANELS, METHODS OF MANUFACTURING THE SAME, AND ELECTRONIC DEVICES”, which is a continuation application of an International Application No. PCT/CN2021/083355, filed on Mar. 26, 2021, titled “DISPLAY PANELS, METHODS OF MANUFACTURING THE SAME, AND ELECTRONIC DEVICES”, which claims priority to Chinese patent application No. 202110209762.2, filed with the National Intellectual Property Administration on Feb. 24, 2021, which is incorporated by reference in the present application in its entirety.

BACKGROUND OF DISCLOSURE

Technical Field

[0002] Embodiments of the present application relate to display technologies, and more particularly, to display panels, methods for manufacturing the display panel, and electronic devices.

Background

[0003] With the update of display technology, more diversified and personalized display terminals are expected, and a full screen gradually becomes one of the important development trends of the display terminals. Many mobile phone manufacturers design to place a camera module is below the screen to realize the full screen in the real sense.

SUMMARY

[0004] An embodiment of the present application provides a display panel including an array substrate, a light blocking matrix, and a backlight module, the array substrate, the light blocking matrix, and the backlight module are stacked in sequence, and the light blocking matrix includes light shielding columns in a grid-like arrangement.

[0005] In a display panel, the array substrate includes at least a pixel matrix, the pixel matrix includes a plurality of pixel units, a first spacing region is provided between adjacent ones of the plurality of pixel units and between adjacent sub-pixels in each of the plurality of pixel units, pixel isolation walls are provided in the first spacing region, and the pixel isolation walls are located at positions corresponding to that of the light blocking columns, respectively.

[0006] In a display panel, a width of the light blocking column is same as that of the pixel isolation wall.

[0007] In a display panel, the display panel further includes a color filter substrate, and the color filter substrate, the array substrate, the light blocking matrix, and the backlight module are laminated in sequence; [0008] the color filter substrate includes at least a light-filtering matrix including a plurality of light-filtering units, a second spacing region is provided between adjacent ones of the plurality of light-filtering units and between adjacent sub-light-filtering units in each of the plurality of light-filtering units, light-filtering isolation columns are provided in the second spacing region, and the light-filtering isolation columns are located at positions corresponding to that of the light blocking columns.

[0009] In a display panel, the light-filtering isolation column, the pixel isolation wall, and the light blocking column have the same width.

[0010] In a display panel, the array substrate and the backlight module are fixedly connected through a frame sealant, and a height of the light blocking matrix is lesser than or equal to that of the frame sealant.

[0011] In a display panel, the light blocking matrix is a black light blocking matrix.
[0012] The present application also provides a method of manufacturing a display panel, and the method comprises: [0013] providing an array substrate, where the array substrate includes at least a pixel matrix and pixel isolation walls, the pixel matrix includes a plurality of pixel units, a first spacing region is provided between adjacent ones of the plurality of pixel units and between adjacent sub-pixels in each of the plurality of pixel units, and the pixel isolation walls are provided in the first spacing region, and include an opaque material; [0014] forming a photoresist layer on a side of the array substrate away from the pixel isolation wall; and [0015] performing an exposure process on a side of the array substrate close to the pixel isolation wall, and performing a development process to form the light blocking matrix.
[0016] In a method of manufacturing the display panel, the method further includes: after forming the photoresist layer on the side of the array substrate away from the pixel isolation wall, performing a soft baking process to remove a solvent from the photoresist layer.
[0017] In a method of manufacturing the display panel, the forming of the photoresist layer includes: coating photoresist onto the side of the array substrate away from the pixel isolation wall to form the photoresist layer, and the photoresist is positive photoresist.
[0018] In a method of manufacturing the display panel, the coating of the photoresist includes coating the photoresist by spin coating or blade coating.
[0019] In a method of manufacturing the display panel, the method further includes: [0020] providing the array substrate, where the array substrate includes at least the pixel matrix and the pixel isolation walls, the pixel matrix includes the plurality of pixel units, the first spacing region is provided between adjacent ones of the plurality of pixel units and between adjacent sub-pixels in each of the plurality of pixel units, and the pixel isolation walls are provided in the first spacing region, and include the opaque material; [0021] providing a color filter substrate, where the color filter substrate includes at least a light-filtering matrix including a plurality of light-filtering units, a second spacing region is provided between adjacent ones of the plurality of light-filtering units and between adjacent sub-light-filtering units in each of the plurality of light-filtering units, light-filtering isolation columns are provided in the second spacing region, and include an opaque material; the color filter substrate, the pixel isolation wall, and the array substrate are stacked in sequence; [0022] forming the photoresist layer on the side of the array substrate away from the pixel isolation wall; and [0023] performing the exposure process on a side of the color filter substrate away from the pixel isolation wall, and performing the development process to form the light blocking matrix.
[0024] In a method of manufacturing the display panel, the method further includes: [0025] forming a frame sealant on the array substrate by coating, dripping liquid crystal on the color filter substrate to form a liquid crystal layer, forming an alignment film on each of the array substrate and the color filter substrate by coating; [0026] aligning the array substrate and the color film substrate and connecting the array substrate and the color film substrate through the frame sealant by a cell process, to form an LCD cell.
[0027] The present application further provides an electronic device including a display panel, a camera module, and a circuit board, the camera module is disposed below the display panel, and both the display panel and the camera module are electrically connected to the circuit board; and [0028] the display panel includes an array substrate, a light blocking matrix, and a backlight module, the array substrate, the light blocking matrix, and the backlight module are stacked in sequence, and the light blocking matrix includes light shielding columns arranged in a grid-like arrangement.
[0029] In an electronic device, the array substrate includes at least a pixel matrix, the pixel matrix includes a plurality of pixel units, a first spacing region is provided between adjacent ones of the plurality of pixel units and between adjacent sub-pixels in each of the plurality of pixel units, pixel isolation walls are provided in the first spacing region, and the pixel isolation walls are located at

positions corresponding to that of the light blocking columns, respectively.
[0030] In an electronic device, a width of the light blocking column is same as that of the pixel isolation wall.
[0031] In an electronic device, the electronic device further includes a color filter substrate, and the color filter substrate, the array substrate, the light blocking matrix, and the backlight module are laminated in sequence;
[0032] The color filter substrate includes at least a light-filtering matrix including a plurality of light-filtering units, a second spacing region is provided between adjacent ones of the plurality of light-filtering units and between adjacent sub-light-filtering units in each of the plurality of light-filtering units, light-filtering isolation columns are provided in the second spacing region, and the light-filtering isolation columns are located at positions corresponding to that of the light blocking columns.
[0033] In an electronic device, the light-filtering isolation column, the pixel isolation wall, and the light blocking column have the same width.
[0034] In an electronic device, the array substrate and the backlight module are fixedly connected through a frame sealant, and a height of the light blocking matrix is lesser than or equal to that of the frame sealant.
[0035] In an electronic device, the light blocking matrix is a black light blocking matrix.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0036] FIG. **1** is a schematic view of a terminal in which a camera module under a screen according to an embodiment of the present application.
[0037] FIG. **2** is a schematic view of a display panel according to an embodiment of the present application.
[0038] FIG. **3** is a flowchart of a process of manufacturing a display panel according to an embodiment of the present application.
[0039] FIG. **4** is a flowchart of a process of manufacturing a display panel according to an embodiment of the present application.
[0040] FIG. **5** is a flowchart of a process of manufacturing a display panel according to another embodiment of the present application.
[0041] FIG. **6** is a flowchart of a process of manufacturing a display panel according to another embodiment of the present application.
[0042] FIG. **7** is a schematic block diagram of an electronic device according to an embodiment of the present application.
DETAILED DESCRIPTION
[0043] In the description of the present application, it should be understood that orientations or position relationships indicated by the terms “width,” “thickness,” “up,” “down,” “front,” “back,” or the like are based on orientations or position relationships illustrated in the drawings. The terms are used to facilitate and simplify the description of the present disclosure, rather than indicate or imply that the devices or elements referred to herein are required to have specific orientations or be constructed or operate in the specific orientations. Accordingly, the terms should not be construed as limiting the present application. Technical solutions in embodiments of the present application will be clearly and completely described below with reference to the accompanying drawings. It will be apparent that the described embodiments are only a part of the embodiments of the present application, and not all embodiments. Based on the embodiments in the present application, all other embodiments obtained by a person skilled in the art without involving any inventive effort are within the scope of the present application.

[0044] An embodiment of the present application provides a display panel that may address the problem of light leakage and color mixing in an aperture region of a camera module under a screen and the problem with whitening in a larger viewing angle, and may improve the display effect of the display panel. The display panel may be applied to a terminal, such as a smartphone, a tablet, a notebook, or a personal computer. The display panel is described in detail below. It should be noted that the order in which the following embodiments are described is not intended to limit the preferred order of the embodiments.

[0045] The present application will now be described in detail with reference to the accompanying drawings and detailed description. With reference to FIGS. **1** and **2**, an embodiment of the present application provides a display panel **1**, a camera module **2**, and a circuit board (not shown). The camera module **2** is disposed below the display panel **1**, and the display panel **1** and the camera module **2** are both electrically connected to the circuit board. The circuit board includes a driving circuit mainly configured to drive display of the display panel **1**, and a camera circuit mainly configured to control the camera module **2**. The circuit board, the display panel **1**, and the camera module **2** are electrically connected by one or more conductive members. The display panel **1** includes an array substrate **200**, a light blocking matrix, and a backlight module **300**. The array substrate **200**, the light blocking matrix, and the backlight module **300** are stacked in sequence. The light blocking matrix includes light blocking columns **600** in a grid arrangement.

[0046] In an embodiment, the array substrate **200** includes at least a pixel matrix including a plurality of pixel units. A first spacing region is provided between adjacent pixel units and between adjacent sub-pixels in the pixel unit. Pixel isolation walls **201** are provided in the first spacing region. The pixel isolation walls **201** are located at positions facing or corresponding to that of the light blocking column **600**. A width of the light blocking column **600** is same as that of the pixel isolation wall **201**.

[0047] In an embodiment, the pixel isolation wall is configured to isolate individual sub-pixels, and respective sub-pixels are independently controlled through electrodes. The electrode includes a light-opaque material and may include a scanning wiring, a signal wiring, a gate, a source, a drain, or the like, which are generally manufactured by a plurality of photolithographic processes.

[0048] In some embodiments, the display panel **1** further includes a color filter substrate **100**, and the color filter substrate **100**, the array substrate **200**, the light blocking matrix, and the backlight module **300** are laminated in sequence.

[0049] In some embodiments, the color filter substrate **100** includes at least a light-filtering matrix including a plurality of light-filtering units. Light-filtering isolation columns **101** are provided between adjacent light-filtering units and between adjacent sub-light-filtering units in the light-filtering unit, the light-filtering isolation columns **101** are located at positions facing or corresponding to that of the light blocking columns **600**, respectively. The light-filtering isolation column **101**, the pixel isolation wall **201**, and the light blocking column **600** have the same width.

[0050] In some embodiments, the light-filtering matrix may include light-filtering units of primary colors, to form primary colors of light, such as red light, green light, and blue light. The light-filtering isolation column is configured to block light from different light-filtering units, to prevent light mixing and increase the contrast of the displayed picture. The light-filtering isolation column **101** is formed by a metal material such as chromium or a black resin material.

[0051] In some embodiments, a liquid crystal layer **400** is disposed between the color filter substrate **100** and the array substrate **200**, and the liquid crystal layer **400** may be aligned in response to an electric field, thereby achieving display of a predetermined picture. The color filter substrate **100**, the array substrate **200**, and the liquid crystal layer **400** form a color-filter on array (COA) liquid crystal cell.

[0052] In an embodiment, the array substrate **200** and the backlight module **300** are fixedly connected through a frame sealant **500**, and a height of the light blocking matrix is not greater than that of the frame sealant **500**. In an embodiment, the height of the light blocking matrix is equal to

the height of the frame sealant **500**, for example, 50 μm. The frame sealant may be used for fixed connection and light blocking.

[0053] In some embodiments, the light blocking matrix includes a light-opaque material, which may be black material.

[0054] In an embodiment, the light blocking matrix is configured to limit the angle of light emitted by the backlight module **300**, that is, the light blocking matrix may reduce the angle range of the light emitted by the backlight module **300**. For example, the light blocking matrix may limit the angle range of the light emitted by the backlight module **300** from a range of 0° to 180° to a range of 30° to 150°.

[0055] In view of above, an embodiment of the present application provides a display panel including an array substrate, a light blocking matrix, and a backlight module. The array substrate, the light blocking matrix, and the backlight module are stacked in sequence. The light blocking matrix includes light blocking columns in a grid-like arrangement. The array substrate includes at least a pixel matrix and pixel isolation walls, the pixel matrix includes a plurality of pixel units, a first spacing region is provided between adjacent pixel units and between adjacent sub-pixels in the pixel unit, the pixel isolation walls are provided in the first spacing region, and the pixel isolation walls are located at positions facing or corresponding to that of the light blocking columns, respectively. A width of the light blocking column is same as that of the pixel isolation wall. The display panel may address the problem of light leakage and color mixing in an aperture region of the camera module under the screen and the problem with whitening in a larger viewing angle, and improve the display effect of the display panel.

[0056] Another embodiment of the present application provides a method of manufacturing the display panel, which may address the problem of light leakage and color mixing in an aperture region of the camera module under the screen and the problem with whitening in a larger viewing angle, and improve the display effect of the display panel. The display panel may be applied to a terminal, such as a smartphone, a tablet, a notebook, or a personal computer. The method of manufacturing a display panel is described in detail below.

[0057] The present application will now be described in detail with reference to the accompanying drawings and detailed description. with reference to FIGS. **3** and **4**, the method of manufacturing a display panel may include:

[0058] At Step S**101**, an array substrate may be provided. The array substrate includes at least a pixel matrix and a pixel isolation wall. The pixel matrix includes a plurality of pixel units, and a first spacing region is provided between adjacent pixel units and between adjacent sub-pixels in the pixel unit. The pixel isolation walls are provided in the first spacing region, and include an opaque material.

[0059] In an embodiment, the pixel isolation wall is configured to isolate individual sub-pixels, and respective sub-pixels are independently controlled through electrodes. The electrode includes a light-opaque material and may include a scanning wiring, a signal wiring, a gate, a source, a drain, or the like, which are generally manufactured by a plurality of photolithographic processes.

[0060] At Step S**102**, a photoresist layer is formed on a side of the array substrate away from the pixel isolation wall.

[0061] Referring to FIG. **4**, the photoresist layer is formed by coating photoresist onto a side of the array substrate **200** away from the pixel isolation wall **201**.

[0062] In some embodiments, the coating methods may include spin coating or blade coating or the like. The photoresist, also referred to as optical resist, is a light-sensitive organic compound that changes its solubility in the developing solution after absorbing ultraviolet light in an exposure process.

[0063] In some embodiments, the photoresist may be black ink-like, positive photoresist.

[0064] In some embodiments, a soft baking process may be performed first, to remove a solvent from the photoresist layer, and increase the adhesion of the photoresist to the surface of the array

substrate.
[0065] At Step S**103**, an exposure process may be performed on a side of the array substrate close to the pixel isolation wall, and a development process may be performed to form the light blocking matrix.
[0066] In an embodiment, referring to FIG. **4**, the exposure process may be performed on a side of the array substrate close to the pixel isolation wall of a light-opaque material. Therefore, the pixel isolation wall may be used as a mask for exposure.
[0067] In some embodiments, a baking process is further performed on the photoresist layer to eliminate standing wave effects upon exposure and to improve the sidewall profile of the obtained photoresist pattern.
[0068] In some embodiments, the development process may be further performed on the photoresist layer.
[0069] In an embodiment, the development process may include dripping a developing liquid to the surface of the photoresist layer, and the exposed region of the photoresist layer is dissolved by chemical reaction with the developing liquid.
[0070] In some embodiments, a hard baking process may be performed after the development process, so that the light blocking matrix may be formed. The light blocking columns of the light blocking matrix have positions respectively corresponding to that of the pixel isolation walls and each has the same width as that of the pixel isolation.
[0071] In some embodiments, the array substrate is coated with the frame sealant, the liquid crystal is dripped on the color filter substrate to form the liquid crystal layer, and each of the array substrate and the color filter substrate is coated with an alignment film. Through a cell process, the array substrate and the color film substrate are connected by the frame sealant to form the LCD cell.
[0072] In some embodiments, the backlight module is further bonded to the obtain component by a frame sealant to obtain the liquid crystal display panel.
[0073] In some embodiments, in practical applications, the height of the light blocking matrix may be adjusted according to process parameters such as the thickness of the photoresist layer, the type of the photoresist, or the like.
[0074] In view of above, an embodiment of the present invention provides a method of manufacturing the display panel. First, an array substrate may be provided. The array substrate includes at least a pixel matrix and a pixel isolation wall. The pixel matrix includes a plurality of pixel units, and a first spacing region is provided between adjacent pixel units and between adjacent sub-pixels in the pixel unit. The pixel isolation walls are provided in the first spacing region, and include an opaque material. A photoresist layer is formed on a side of the array substrate away from the pixel isolation wall. An exposure process may be performed on a side of the array substrate close to the pixel isolation wall, and a development process may be performed to form the light blocking matrix. The display panel may address the problem of light leakage and color mixing in an aperture region of the camera module under the screen and the problem with whitening in a larger viewing angle, and improve the display effect of the display panel.
[0075] Another embodiment of the present application provides a method of manufacturing the display panel, which may address the problem of light leakage and color mixing in an aperture region of the camera module under the screen and the problem with whitening in a larger viewing angle, and improve the display effect of the display panel. The display panel may be applied to a terminal, such as a smartphone, a tablet, a notebook, or a personal computer. The method of manufacturing a display panel is described in detail below.
[0076] The present application will now be described in detail with reference to the accompanying drawings and detailed description. with reference to FIGS. **5** and **6**, the method of manufacturing a display panel may include:
[0077] At Step S**201**, an array substrate may be provided. The array substrate includes at least a

pixel matrix and a pixel isolation wall. The pixel matrix includes a plurality of pixel units, and a first spacing region is provided between adjacent pixel units and between adjacent sub-pixels in the pixel unit. The pixel isolation walls are provided in the first spacing region, and include an opaque material.

[0078] In an embodiment, the pixel isolation wall is configured to isolate individual sub-pixels, and respective sub-pixels are independently controlled through electrodes. The electrode includes a light-opaque material and may include a scanning wiring, a signal wiring, a gate, a source, a drain, or the like, which are generally manufactured by a plurality of photolithographic processes.

[0079] At Step S**202**, a color filter substrate may be provided. The color filter substrate includes at least a light-filtering matrix including a plurality of light-filtering units. A second spacing region is provided between adjacent light-filtering units and between adjacent sub-light-filtering units in the light-filtering unit. Light-filtering isolation columns are provided in the second spacing region, and include an opaque material.

[0080] In an embodiment, the color filter substrate, the pixel isolation wall, and the array substrate are stacked in sequence.

[0081] In some embodiments, the array substrate is coated with the frame sealant, the liquid crystal is dripped on the color filter substrate to form the liquid crystal layer, and each of the array substrate and the color filter substrate is coated with an alignment film. Through a cell process, the array substrate and the color film substrate are aligned and connected by the frame sealant to form the LCD cell.

[0082] In some embodiments, the color filter substrate includes at least a light-filtering matrix including a plurality of light-filtering units. A light-filtering isolation column is provided between adjacent light-filtering units and between adjacent sub-light-filtering units in the light-filtering unit. The color of the light-filtering matrix may include primary colors, so that primary colors of light is formed, such as red light, green light, and blue light. The light-filtering isolation column is configured to block light from different light-filtering units, to prevent light mixing and increase the contrast of the displayed picture. The light-filtering isolation column is formed by a metal material such as chromium or a black resin material. Therefore, the light-filtering isolation column may be used as a mask plate for exposure. The width of the light-filtering isolation column is same as the width of the pixel isolation wall. The positions of the light blocking column, the pixel isolation wall, and the light-filtering isolation column of the light blocking matrix correspond to each other, and the light blocking column, the pixel isolation wall, and the light-filtering isolation column of the light blocking matrix have the same width.

[0083] At Step S**203**, a photoresist layer may be formed on a side of the array substrate away from the pixel isolation wall.

[0084] In an embodiment, referring to FIG. **6**, the photoresist layer is formed by coating photoresist onto a side of the array substrate **200** away from the pixel isolation wall **201**.

[0085] In some embodiments, the coating methods may include spin coating, blade coating, or the like. The photoresist, also referred to as optical resist, is a light-sensitive organic compound that changes its solubility in the developing solution after absorbing ultraviolet light in an exposure process.

[0086] In some embodiments, the photoresist may be black ink-like, positive photoresist.

[0087] At Step S**204**, an exposure process is performed on a side of the color filter substrate away from the pixel isolation wall, and a development process may be performed to form the light blocking matrix.

[0088] In an embodiment, referring to FIG. **6**, an exposure process is performed on a side of the color filter substrate away from the pixel isolation wall.

[0089] In some embodiments, a soft baking process may be performed first, to remove a solvent from the photoresist layer, and increase the adhesion of the photoresist layer to the surface of the array substrate.

[0090] In some embodiments, the development process may be further performed on the photoresist layer.
[0091] In an embodiment, the development process may include dripping a developing liquid to the surface of the photoresist layer, and the exposed region of the photoresist layer is dissolved by chemical reaction with the developing liquid.
[0092] In some embodiments, the dissolved photoresist is removed by deionized water and a cleaning and drying process is performed;
[0093] In some embodiments, a hard baking process may be performed after the development process, so that the light blocking matrix may be formed. The light blocking columns of the light blocking matrix have positions respectively corresponding to that of the pixel isolation walls and each has the same width as that of the pixel isolation.
[0094] In some embodiments, the backlight module is further bonded to the obtain component by a frame sealant to obtain the liquid crystal display panel.
[0095] In view of above, another embodiment of the present application provides a method of manufacturing the display panel. An array substrate is provided. A color filter substrate is provided. The color filter substrate, the pixel isolation wall, and the array substrate are stacked in sequence. A photoresist layer is formed on a side of the array substrate away from the pixel isolation wall. An exposure process is performed on a side of the color filter substrate away from the pixel isolation wall, and a development process may be performed to form the light blocking matrix. The display panel may address the problem of light leakage and color mixing in an aperture region of the camera module under the screen and the problem with whitening in a larger viewing angle, and improve the display effect of the display panel.
[0096] The foregoing describes a display panel according to an embodiment of the present application. An electronic device according to an embodiment of the present application is described below from the perspective of hardware processing. An embodiment of the present application further provides an electronic device, as shown in FIG. **7**, which shows a schematic block diagram of the electronic device according to the embodiment of the present application. The electronic device may be a mobile phone, a computer, a digital broadcast terminal, a message transceiver device, a game console, a tablet device, a medical device, an exercise device, a personal digital assistant, or the like.
[0097] The electronic device **1200** may include components such as a radio frequency (RF) circuit **110**, a memory **120** including one or more (only one shown in the figure) computer readable storage media, an input unit **130**, a display unit **140**, a sensor **150**, an audio circuit **160**, a transmission module **170**, a processor **180** including one or more (only one shown in the figure) processing cores, or a power supply **190**. It will be appreciated by those skilled in the art that the structure of the electronic device **1200** shown in FIG. **7** is not intended to limit the electronic device according to the embodiments of the present application, and may include more or less components than illustrated, or may combine certain components, or may have different component arrangements.
[0098] The RF circuit **110** is configured to receive and transmit an electromagnetic wave, to realize the mutual conversion of the electromagnetic wave and an electric signal, so as to communicate with a communication network or other equipment. The RF circuit **110** may include various existing circuit elements for performing these functions, such as an antenna, a radio frequency transceiver, a digital signal processor, an encryption/decryption chip, a subscriber identity module (SIM) card, a memory, or the like. The RF circuit **110** may communicate with various networks, such as an internet, an enterprise intranet, a wireless network, or with other devices through the wireless network.
[0099] The memory **120** may be used to store software programs and modules, such as program instructions/modules corresponding to the control method in the above-described embodiments. The processor **180** executes various functional applications and data processing by running the

software programs and modules stored in the memory **120**. The memory **120** may include high speed random access memory, and may also include non-volatile memory, such as one or more magnetic storage devices, flash memory, or other non-volatile solid state memory. In some examples, the memory **120** may further include a memory disposed remotely relative to the processor **180**, which may be connected to the electronic device **1200** via a network. Examples of such networks include, but are not limited to, the internet, the enterprise intranet, local area networks, mobile communication networks, or combinations thereof.

[0100] The input unit **130** is configured to receive input numeric or character information and generate keyboard, mouse, joystick, or optical or trackball signal inputs in relation to user settings and functional control. In an embodiment, the input unit **130** may include a touch-sensitive surface **131** and other input devices **132**. The touch-sensitive surface **131**, also referred to as a touch display screen or a touch pad, may collect a touch operation of a user thereon or in the vicinity of the touch-sensitive surface **131** (such as an operation of the user on or in the vicinity of the touch-sensitive surface **131** by using any suitable object such as a finger, a stylus, or the like, or accessory), and actuate a corresponding connection apparatus according to a preset program. In addition to the touch-sensitive surface **131**, the input unit **130** may also include other input devices **132**. In an embodiment, other input devices **132** may include, but are not limited to, one or more of a physical keyboard, a function key (such as a volume control key, an on-off key, etc.), a trackball, a mouse, a joystick, or the like.

[0101] The display unit **140** may be configured to display information input by or provided to the user and various graphical user interfaces of the electronic device **1200**. The graphical user interfaces may be composed of graphics, text, icons, videos, or any combination thereof. The display unit **140** may include a display panel **141**. Further, the touch-sensitive surface **131** may cover the display panel **141**. When the touch-sensitive surface **131** detects a touch operation on or in the vicinity of the touch-sensitive surface **131**, the touch-sensitive surface transmits a signal to the processor **180** to determine a type of a touch event, and then the processor **180** provides a visual output on the display panel **141** according to the type of the touch event. The display unit **140** is the screen according to one of the above-described embodiments.

[0102] The electronic device **1200** may further include at least one sensor **150**, such as a light sensor, a motion sensor, and other sensors. Other sensors, such as a barometer, a hygrometer, a thermometer, an infrared sensor, or the like, which may be configured in the electronic device **1200**, are not described herein.

[0103] An audio circuit **160**, a speaker **161**, a microphone **162** may provide an audio interface between a user and electronic device **1200**. The audio circuit **160** may transmit an electrical signal converted from the received audio data to the loudspeaker **161**, and convert the electrical signal into a sound signal by the loudspeaker **161** for outputting. On the other hand, the microphone **162** converts the collected sound signal into an electrical signal, the electrical signal is received by the audio circuit **160** and converted into audio data, the audio data is then output and processed by the processor **180**, and then transmitted to, for example, another terminal via the RF circuit **110**, or the audio data is output to the memory **120** for further processing. The audio circuit **160** may also include an earplug jack to provide communication between the peripheral headset and the electronic device **1200**.

[0104] The electronic device **1200** may assist a user in receiving and transmitting e-mail, browsing web pages, accessing streaming media, or the like, via a transmission module **170**, such as a Wi-Fi module. The electronic device **1200** provides the user with wireless broadband Internet access. Although the transmission module **170** is shown in FIG. **7**, it will be appreciated that it does not belong to the necessary constitution of the electronic device **1200**, and may be omitted as necessary without changing the essence of the present application.

[0105] The processor **180** is a control center of the electronic device **1200**, connects various parts of the entire cellphone by various interfaces and lines, executes various functions and processes

data of the electronic device **1200** by running or executing software programs and/or modules stored in the memory **120**, and invoking data stored in the memory **120**, thereby performing overall monitoring on the cellphone. Alternatively, the processor **180** may include one or more processing cores. In some embodiments, the processor **180** may integrate an application processor and a modem processor. The application processor primarily processes an operating system, a user interface, an application program, or the like. The modem processor primarily processes wireless communications. It will be appreciated that the modem processor may not be integrated into the processor **180**.

[0106] The electronic device **1200** further includes a power supply **190** (such as a battery) that supplies power to the various components. In an embodiment, the power supply may be logically connected to the processor **180** through a power management system to perform functions such as managing charging or discharging, or power consumption management through the power management system. The power supply **190** may further include one or more DC or AC power supplies, a recharging system, a power failure detection circuit, a power converter or inverter, a power status indicator, or any other component.

[0107] Although not shown, the electronic device **1200** may also include a camera (e.g., a front-facing camera, a rear-facing camera), a Bluetooth module, or the like, and details are not described herein. In an embodiment, the display unit **140** of the electronic device **1200** is a touch screen display, and the electronic device **1200** further includes a memory **120**, and one or more programs. The one or more programs are stored in the memory **120** and configured to execute the programs stored in the memory **120** by the one or more processors **180**, thereby implementing various functions.

[0108] In the above-mentioned embodiments, the description of each embodiment has its own emphasis, and parts not described in detail in a certain embodiment may be referred to the related description of other embodiments.

[0109] An electronic device according to an embodiment of the present invention has been described in detail. A specific example is used to illustrate the principles and implementations of the present application. The description of the above embodiments is merely provided to help understand the technical solution and the core idea of the present application. It will be appreciated by those of ordinary skill in the art that modifications may be made to the technical solutions described in the foregoing embodiments, or substitutions may be made to some of the technical features therein. These modifications or substitutions fall into the scope of the technical solutions of the embodiments of the present application.

Claims

1. A method of manufacturing a display panel, comprising: providing an array substrate, wherein the array substrate comprises at least a pixel matrix, the pixel matrix comprises a plurality of pixel units, a first spacing region is provided between adjacent ones of the plurality of pixel units and between adjacent sub-pixels in each of the plurality of pixel units, and pixel isolation walls are provided in the first spacing region, and comprise an opaque material; forming a photoresist layer on a side of the array substrate away from the pixel isolation wall; and performing an exposure process on a side of the array substrate close to the pixel isolation wall, and performing a development process to form the light blocking matrix.

2. The method of claim 1, further comprising: after forming the photoresist layer on the side of the array substrate away from the pixel isolation wall, performing a soft baking process to remove a solvent from the photoresist layer.

3. The method of claim 1, wherein the forming of the photoresist layer comprises: coating photoresist onto the side of the array substrate away from the pixel isolation wall to form the photoresist layer, and the photoresist is positive photoresist.

4. The method of claim 3, wherein the coating of the photoresist comprises: coating the photoresist by spin coating or blade coating.

5. The method of claim 1, further comprising: providing the array substrate, wherein the array substrate comprises at least the pixel matrix, the pixel matrix comprises the plurality of pixel units, the first spacing region is provided between adjacent ones of the plurality of pixel units and between adjacent sub-pixels in each of the plurality of pixel units, and the pixel isolation walls are provided in the first spacing region, and comprise the opaque material; providing a color filter substrate, wherein the color filter substrate comprises at least a light-filtering matrix comprising a plurality of light-filtering units, a second spacing region is provided between adjacent ones of the plurality of light-filtering units and between adjacent sub-light-filtering units in each of the plurality of light-filtering units, light-filtering isolation columns are provided in the second spacing region, and comprise an opaque material; stacking the color filter substrate, the pixel isolation walls, and the array substrate in sequence; forming the photoresist layer on the side of the array substrate away from the pixel isolation wall; and performing the exposure process on a side of the color filter substrate away from the pixel isolation wall, and performing the development process to form the light blocking matrix.

6. The method of claim 5, further comprising: forming a frame sealant on the array substrate by coating, dripping liquid crystal on the color filter substrate to form a liquid crystal layer, forming an alignment film on each of the array substrate and the color filter substrate by coating, aligning the array substrate and the color film substrate and connecting the array substrate and the color film substrate through the frame sealant by a cell process, to form an LCD cell.