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Duffy et al.

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(54) **MODULAR CAMERA SYSTEM**

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(73) Assignee: **GOOGLE INC.**, Mountain View, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 53 days.

This patent is subject to a terminal disclaimer.

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Related U.S. Application Data

(63) Continuation of application No. 13/604,399, filed on Sep. 5, 2012, now Pat. No. 9,071,740.

(60) Provisional application No. 61/552,821, filed on Oct. 28, 2011.

(51) **Int. Cl.**

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H04N 5/232	(2006.01)
H04N 7/18	(2006.01)
G03B 17/00	(2006.01)

(52) **U.S. Cl.**

CPC ***H04N 5/2251*** (2013.01)

(58) **Field of Classification Search**

CPC H04N 5/2252; H04N 5/23206; H04N 5/23241

USPC 248/231.71, 688; 361/679; 348/14.01, 348/14.02, 211.1, 211.2, 211.3, 207.1, 348/143, 373, 376; 396/535–541

See application file for complete search history.

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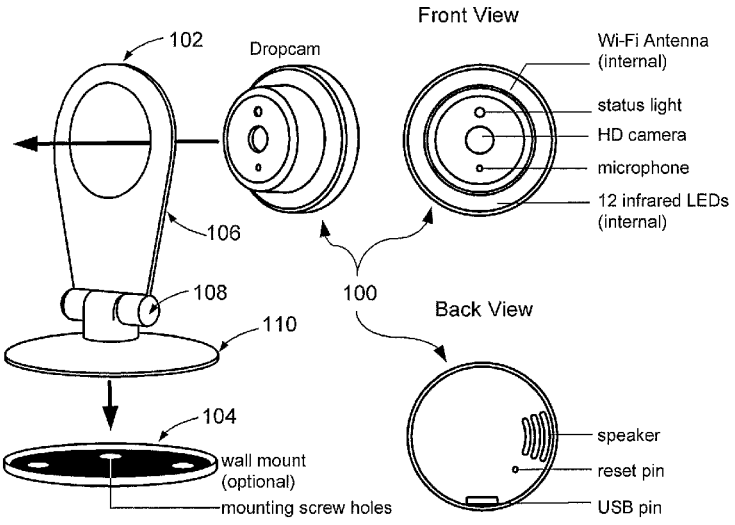
Primary Examiner — Xi Wang

(74) *Attorney, Agent, or Firm* — Morgan, Lewis & Bockius LLP

(57) **ABSTRACT**

What is described herein is a system which includes an arm where the arm includes a cutout which is a same shape as at least some part of a video camera and which is configured to hold the video camera. The system further includes a base which is configured to be placed on a surface. The system further includes a joint which is configured to be connected to the arm and the base.

30 Claims, 14 Drawing Sheets



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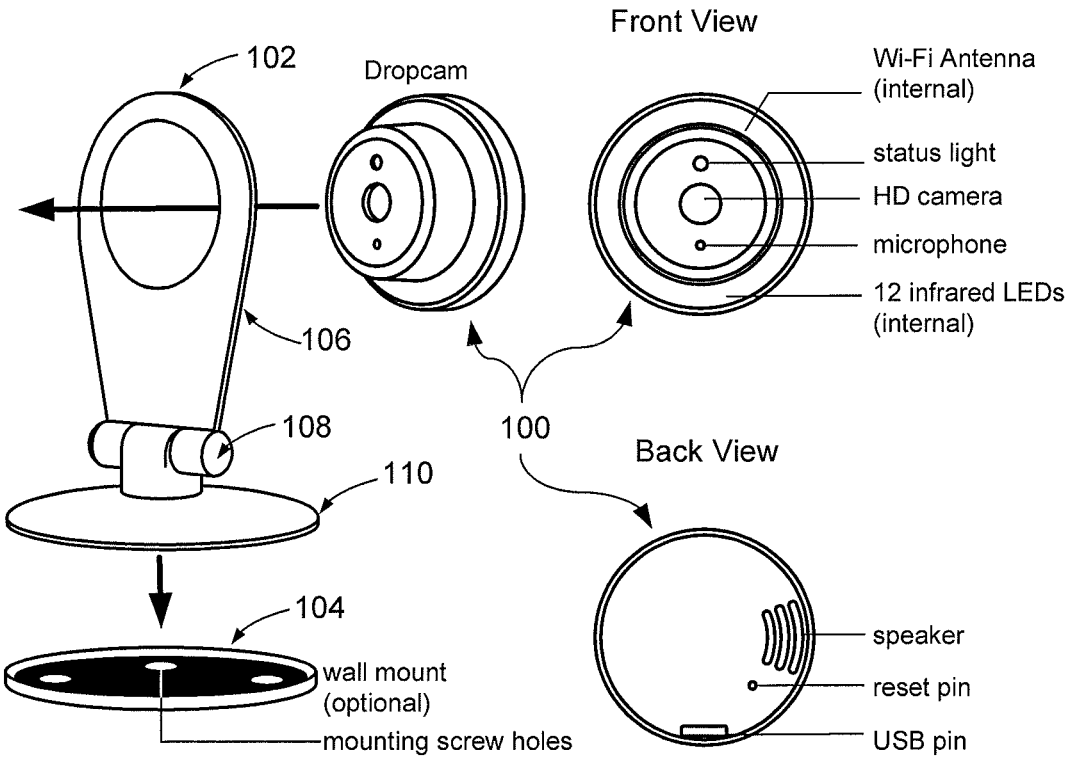

Front View
102
Dropcam
Wi-Fi Antenna
(internal)
status light
HD camera
microphone
12 infrared LEDs
(internal)
106
108
100
110
Back View
104
speaker
reset pin
wall mount
(optional)
mounting screw holes
USB pin

FIG. 1

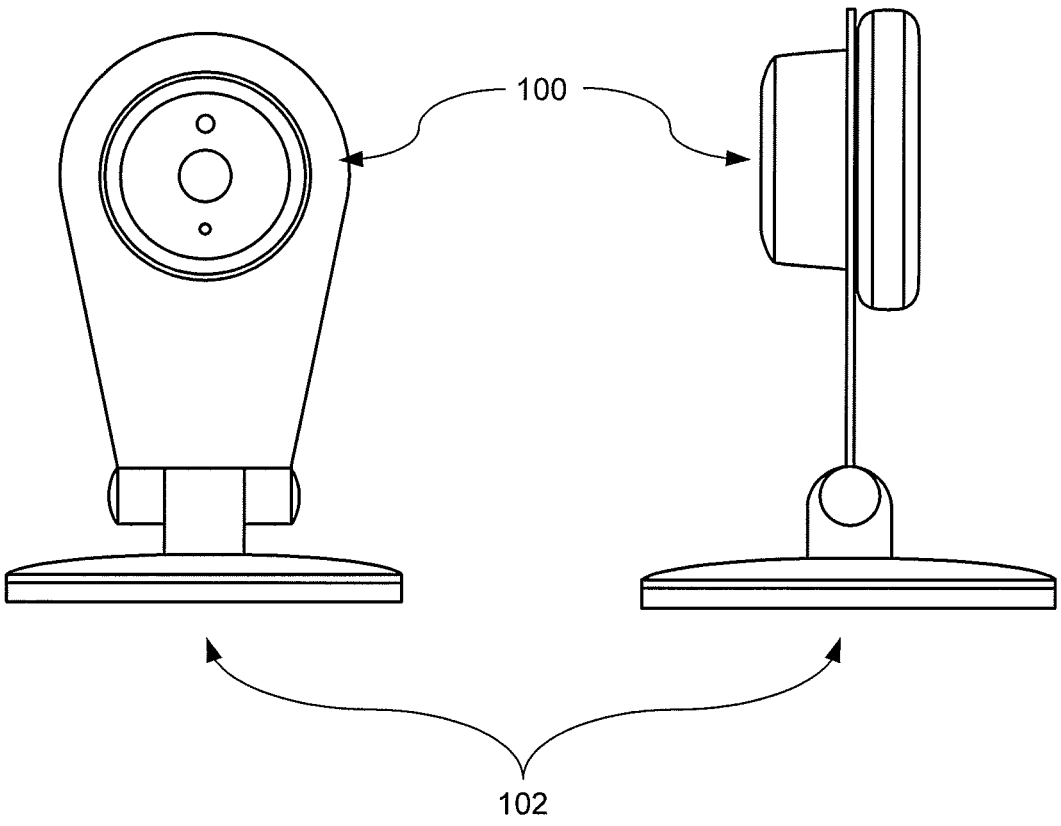
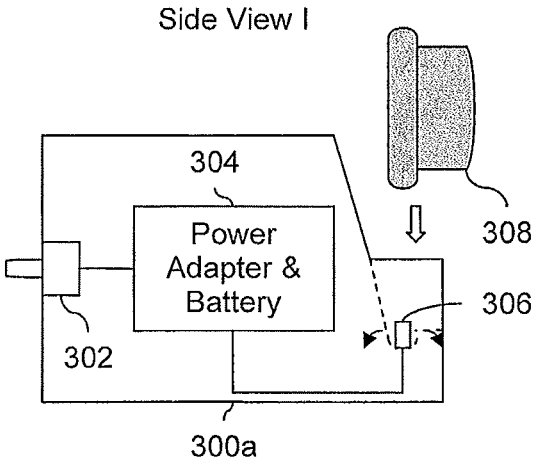
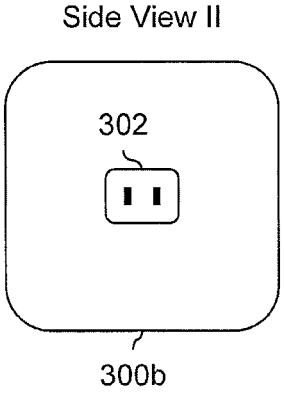


FIG. 2


Side View I
304
Power
Adapter &
Battery
308
306
302
300a


Side View II
302
300b

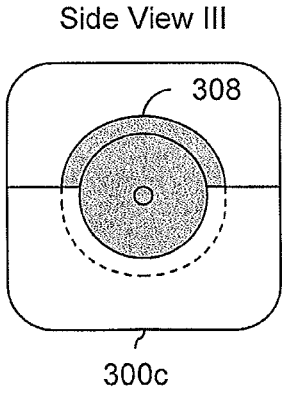

Side View III
308
300c

FIG. 3

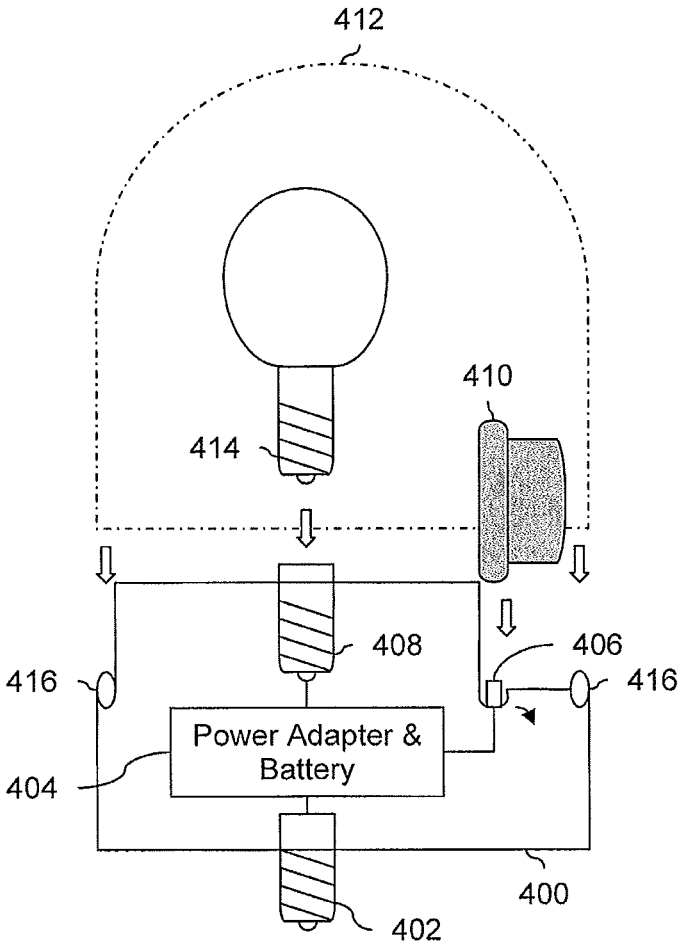
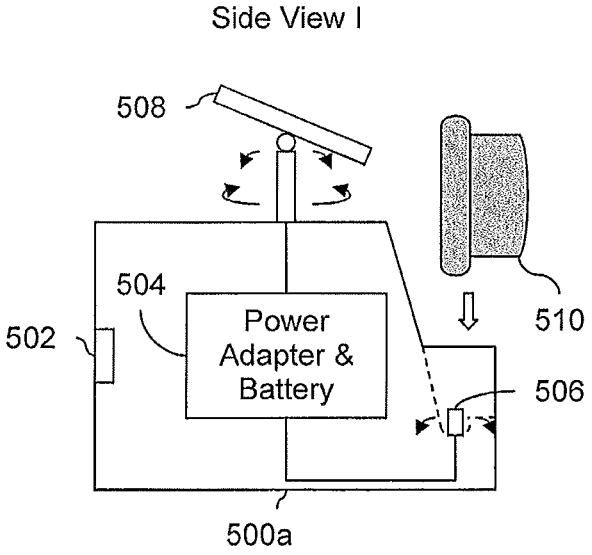


FIG. 4


Side View I
508
504
Power
Adapter &
Battery
502
510
506
500a

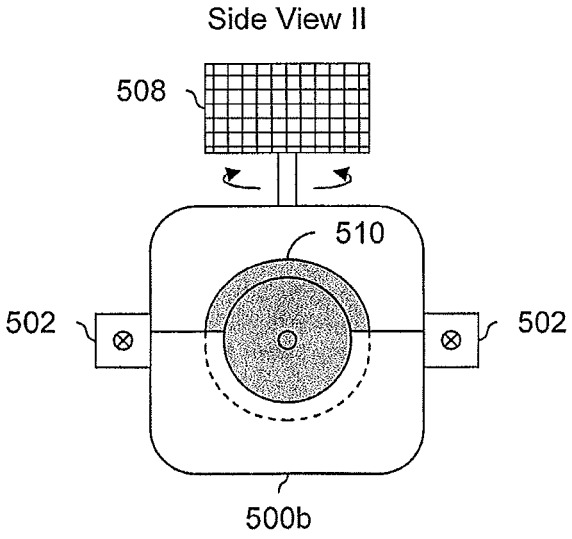

Side View II
508
510
502
502
500b

FIG. 5

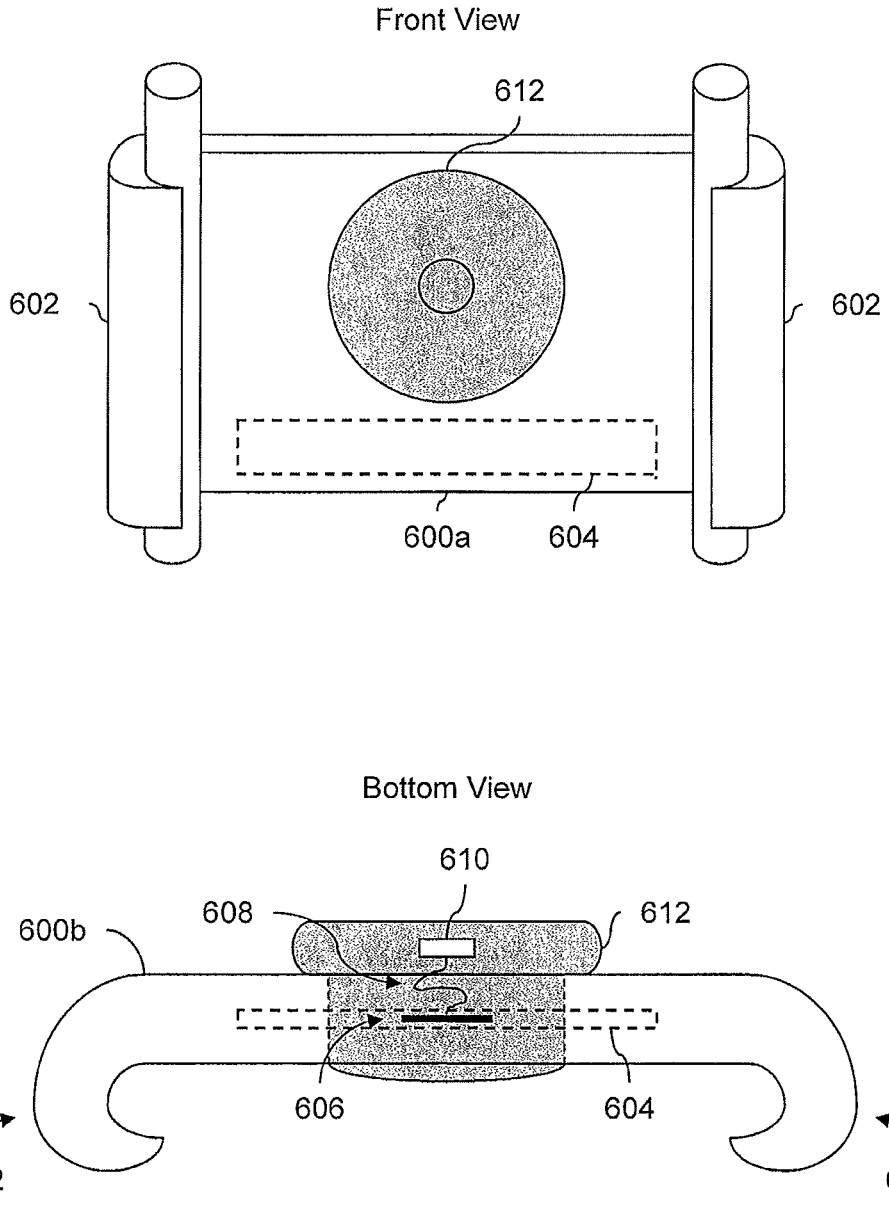
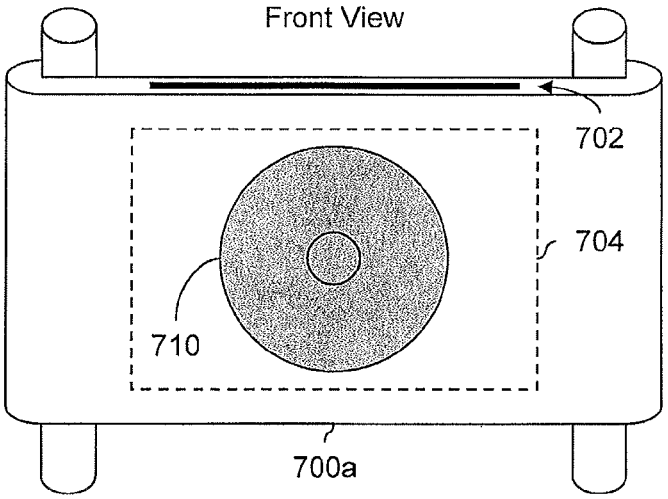

Front View
612
602
602
600a
604
Bottom View
610
608
612
600b
606
604
602
602

FIG. 6


Front View
702
704
710
700a

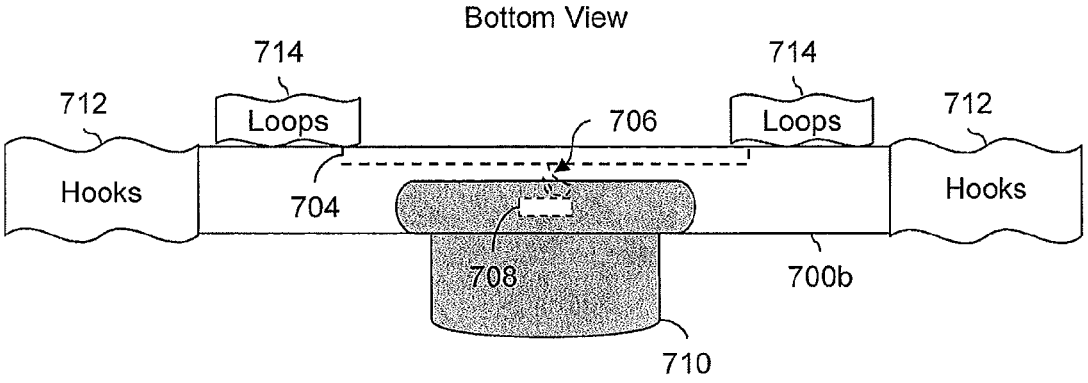

Bottom View
714
714
712
712
Loops
706
Loops
Hooks
704
Hooks
708
700b
710

FIG. 7

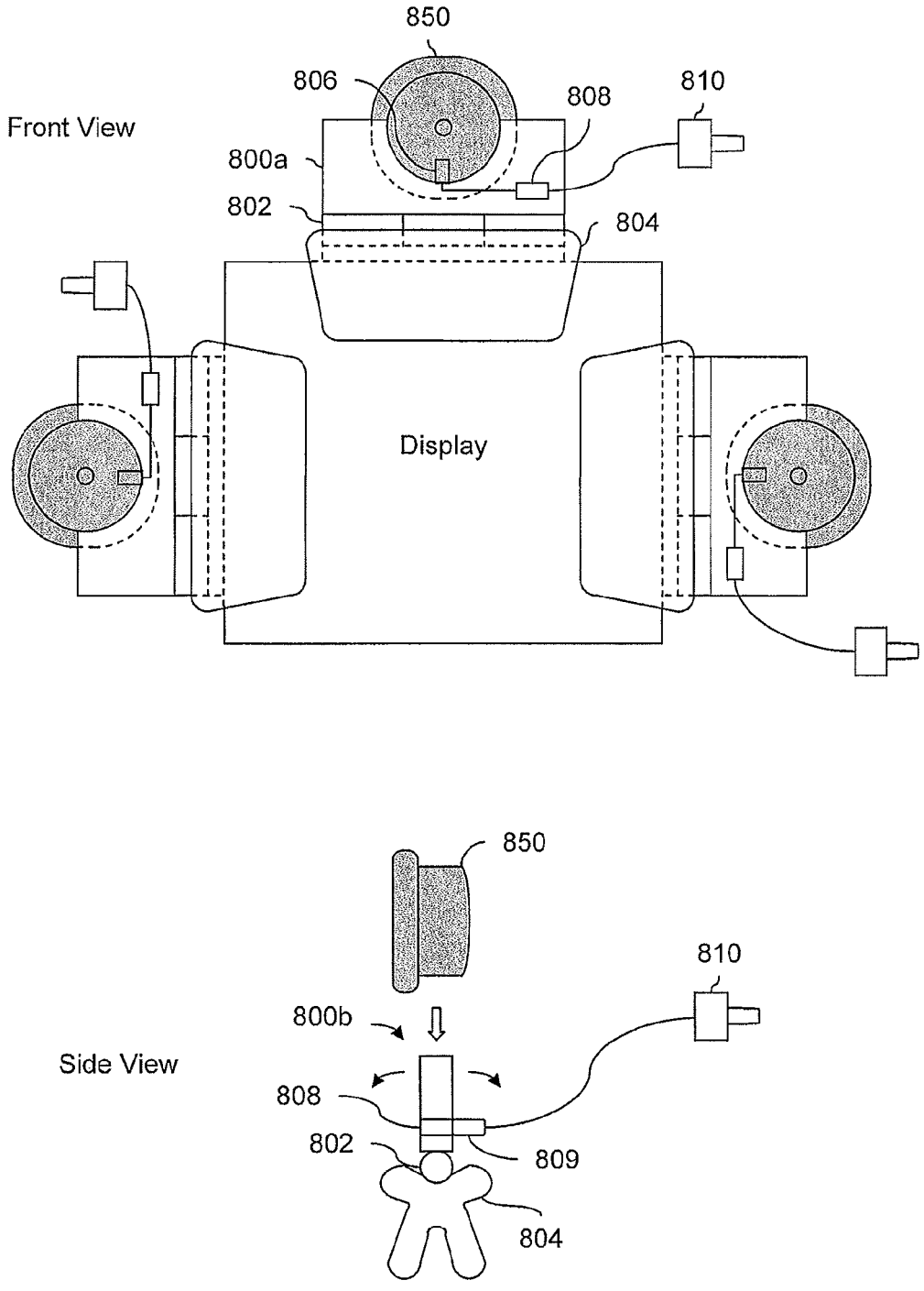

Front View
850
806
808
810
800a
802
804
Display
Side View
850
810
800b
808
802
809
804

FIG. 8

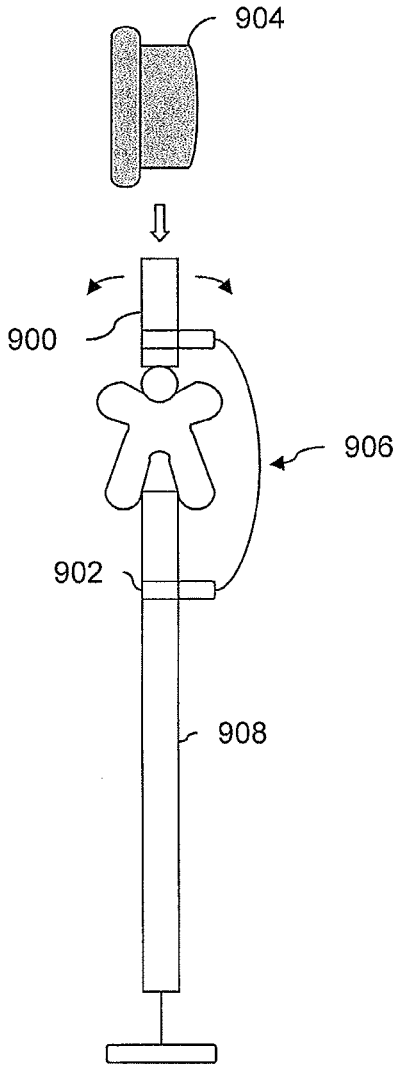


FIG. 9

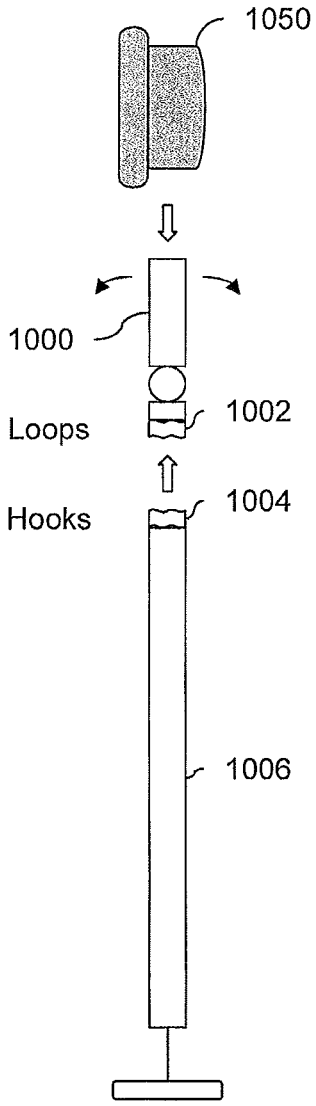


FIG. 10

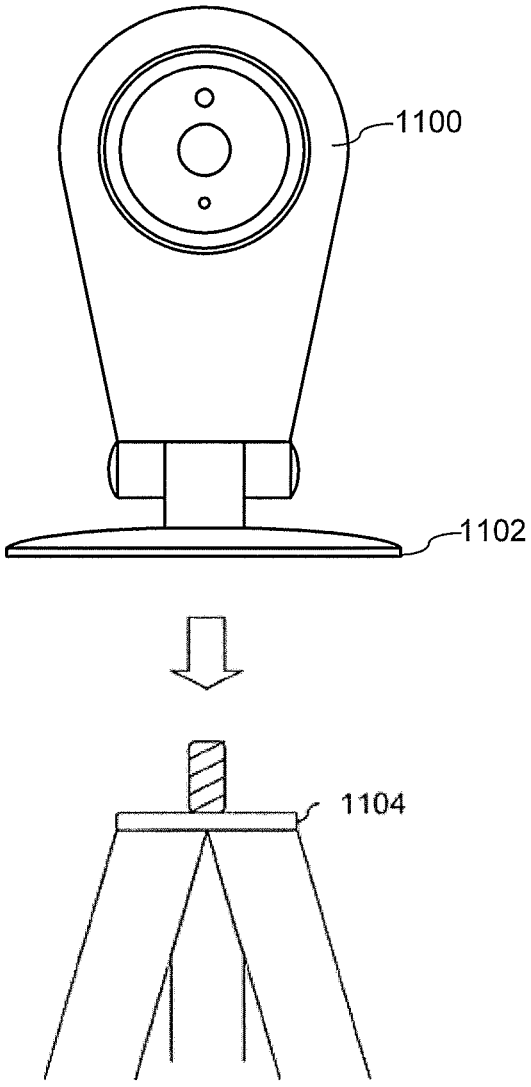


FIG. 11

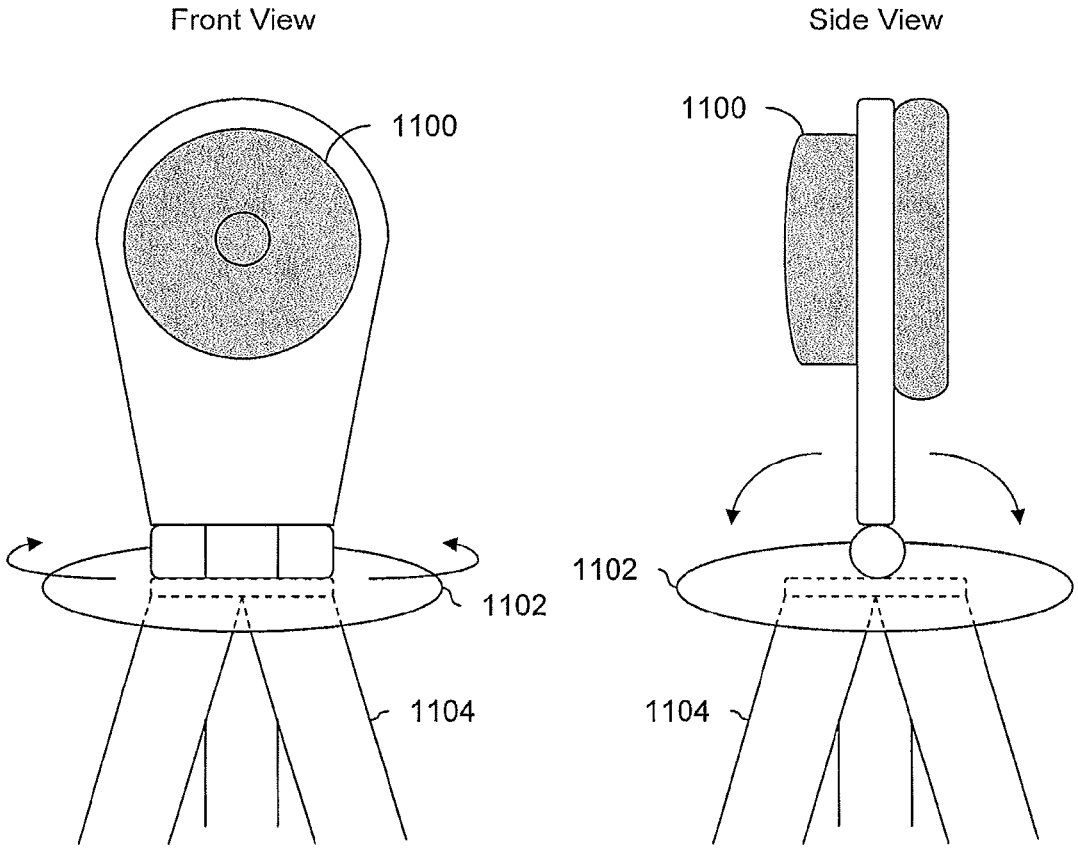


FIG. 12

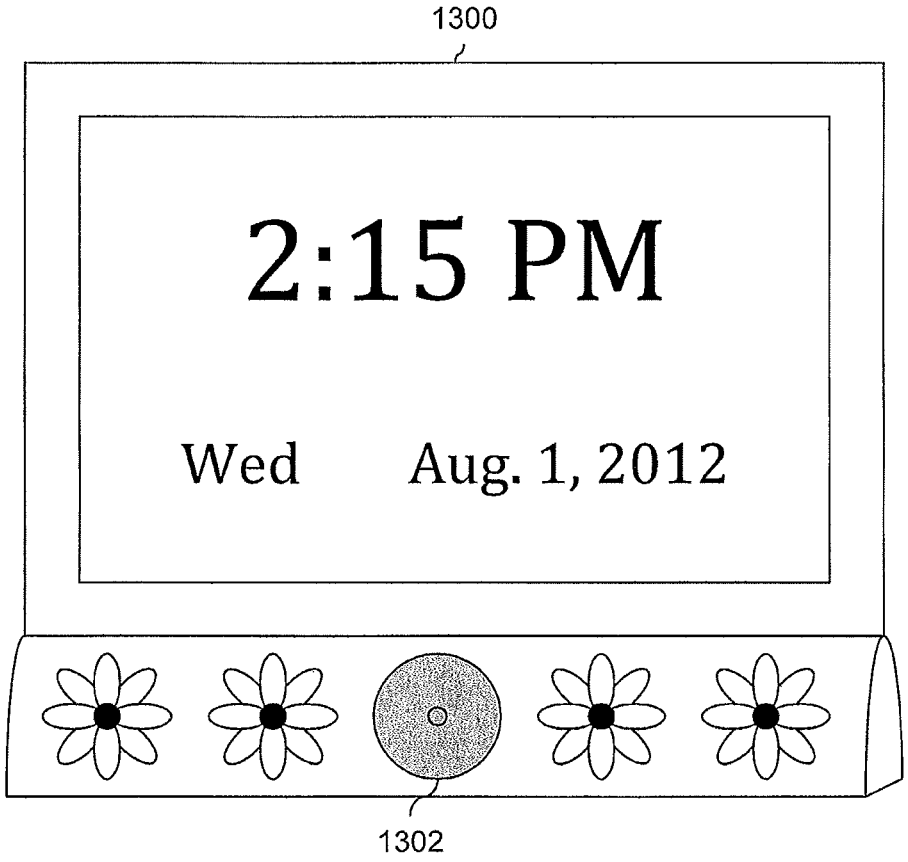


FIG. 13

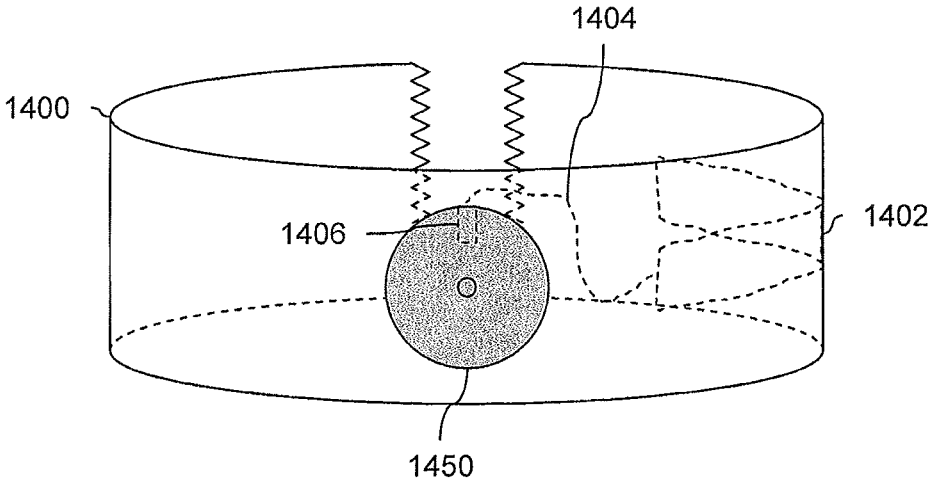


FIG. 14

MODULAR CAMERA SYSTEM

CROSS REFERENCE TO OTHER APPLICATIONS

The present application is a continuation of U.S. Utility patent application Ser. No. 13/604,399, filed Sep. 5, 2012, entitled "Modular Camera System," which claims priority to U.S. Provisional Patent Application No. 61/552,821, filed Oct. 28, 2011, entitled "Modular Camera System," all of which are hereby incorporated by reference in their entirety.

BACKGROUND

Internet Protocol (IP) cameras connect to a network and transmit data using networking protocols. Many IP cameras are designed to be placed on a surface (e.g., a desktop) and as such include a flat base (which comes into contact with the desktop or other surface) which supports the camera. IP cameras so constructed cannot be easily mounted to different locations or surfaces (e.g., to a wall where drilling a hole is not possible or permitted) or used in different conditions (e.g., indoor/outdoor, night/day, mobile/stationary, etc.). New cameras and/or camera accessories which overcome some or all of these shortcomings would be desirable.

BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments of the invention are disclosed in the following detailed description and the accompanying drawings.

FIG. **1** is a diagram showing an embodiment of a housing which includes an arm, joint, and base.

FIG. **2** shows a front view and a side view of an embodiment of a camera inserted in a housing.

FIG. **3** is a diagram showing an embodiment of an outdoor housing for a camera with an AC power plug.

FIG. **4** is a diagram showing an embodiment of an outdoor housing for a camera with light bulb connectors.

FIG. **5** is a diagram showing an embodiment of an outdoor housing with a solar panel.

FIG. **6** is a diagram showing an embodiment of a housing with side grippers.

FIG. **7** is a diagram showing an embodiment of a housing with hook and loop fasteners.

FIG. **8** is a diagram showing an embodiment of a housing with a clip.

FIG. **9** is a diagram showing an embodiment of a housing which is configured to be connected to a port of a display.

FIG. **10** is a diagram showing an embodiment of a housing which is configured to be connected to a display using hooks and loops.

FIG. **11** is a diagram showing an embodiment of a housing and a tripod prior to being coupled together.

FIG. **12** is a diagram showing an embodiment of a housing and a tripod after being coupled together.

FIG. **13** is a diagram showing an embodiment of a housing associated with a clock.

FIG. **14** is a diagram showing an embodiment of a housing associated with a pet collar.

DESCRIPTION OF IMPLEMENTATIONS

The invention can be implemented in numerous ways, including as a process; an apparatus; a system; a composition of matter; a computer program product embodied on a computer readable storage medium; and/or a processor, such as a processor configured to execute instructions stored on and/or provided by a memory coupled to the processor. In this specification, these implementations, or any other form that the invention may take, may be referred to as techniques. In general, the order of the steps of disclosed processes may be altered within the scope of the invention. Unless stated otherwise, a component such as a processor or a memory described as being configured to perform a task may be implemented as a general component that is temporarily configured to perform the task at a given time or a specific component that is manufactured to perform the task. As used herein, the term 'processor' refers to one or more devices, circuits, and/or processing cores configured to process data, such as computer program instructions.

A detailed description of one or more embodiments of the invention is provided below along with accompanying figures that illustrate the principles of the invention. The invention is described in connection with such embodiments, but the invention is not limited to any embodiment. The scope of the invention is limited only by the claims and the invention encompasses numerous alternatives, modifications and equivalents. Numerous specific details are set forth in the following description in order to provide a thorough understanding of the invention. These details are provided for the purpose of example and the invention may be practiced according to the claims without some or all of these specific details. For the purpose of clarity, technical material that is known in the technical fields related to the invention has not been described in detail so that the invention is not unnecessarily obscured.

Various embodiments of housings for a video camera are described herein. Oftentimes video cameras (especially high definition (HD) video cameras) are relatively expensive (e.g., as high as $500) and a user may not want to buy multiple cameras for different purposes. In some embodiments, a user purchases multiple housings (e.g., priced on the order of $30 or less) and uses the same camera with a selected one of the housings when a certain utility or application is desired (e.g., depending upon the location to be captured by the camera or the nature of the video recording). In some cases, a housing is semi-permanently installed or mounted in a location. For example, a user may use a camera as a security camera when the user is away on vacation or traveling for work. An outdoor housing may be kept installed or mounted near a front door or other entrance to the home, even though the user may not always use the camera as a security monitor and/or the camera may not always be in the outdoor housing. This may make it easier when the camera is used for that purpose since the camera will be pointing in the desired direction and the user does not have to re-mount the outdoor housing each time.

The housings described herein are exemplary and are not intended to be limiting. For example, any dimensions, shapes, styles, and/or materials described herein are exemplary and are not intended to be limiting. Drawings are not to scale. For brevity, features or characters described in association with one embodiment may not necessarily be repeated or reiterated when describing another embodiment. Even though it may not be explicitly described therein, a feature or characteristic described in association with one embodiment may be used by another embodiment.

FIG. **1** is a diagram showing an embodiment of a housing which includes an arm, joint, and base. In the example shown, camera **100** is a camera which is configured to be housed in or otherwise coupled to a variety of enclosures or housings, for example, at least temporarily until it is removed from a first housing and (if desired) placed in

another housing. In some embodiments, module camera **100** is used as-is, without any housing.

Housing **102** and wall mount **104** show embodiments of a housing and mounting hardware, respectively. Housing **102** includes arm **106**, joint **108**, and base **110**. Housing **102** is one example of a camera holder which includes a (in this case, circular) cutout configured to hold or otherwise support the video camera and/or point the video camera in a desired direction. To mount the camera on a wall, screws are drilled through the mounting screw holes to attach wall mount **104** to a wall in the desired location. Then, housing **102** is "popped" into wall mount **104**. The proper angle for video recording by camera **100** is achieved by rotating the housing within mount **104** and/or by pivoting housing **102** forwards or backwards (e.g., bending at joint **108**). In various embodiments, camera **100** is inserted into housing **102** before housing **102** is coupled with mount **104**, or afterwards as desired.

Compared to some other cameras, camera **100** when used with housing **102** and mount **104** may have a much lower profile, so that it is closer to the wall than some other cameras. Also, installation may be much easier using housing **102** and mount **104**. Some other cameras may require screws to be installed alone (e.g., without any guide or mount as shown here) and then the camera is positioned so that the screw heads fit into openings in the housing of the camera, mounting the camera to the wall. One problem with this is that it may be difficult to insert the screw heads into the opening and get the camera to mount to the wall snugly (e.g., because the user cannot see inside the camera). In contrast, the example system shown herein permits housing **102** to rotate within mount **104**.

In this embodiment, camera **100** includes a Wi-Fi antenna and includes a Wi-Fi transceiver (not shown) for communicating in a Wi-Fi network. In some embodiments, a user is able to view video captured by camera **100** remotely and/or via a network, for example from an Internet browser application (e.g., Microsoft's Internet Explorer or Mozilla Firefox) running on a computer, from a dedicated and/or downloaded application running on a smart phone, etc. Camera **100** includes a status light, indicating when the device is powered on and/or filming. For example, one color light may indicate the device is powered on but not recording and another color light may indicate filming; no light may indicate the device is powered off Camera **100** further includes an HD (e.g., 720p, 1080p, or higher) camera, microphone, and 12 infrared (IR) light emitting diodes (LEDs). (Exemplary configurations or features described in association with this figure (such as the pixel resolution of camera **100** or the number of LEDs) are exemplary and are not intended to be limiting.) If light is low, camera **100** is configured to use the IR LEDs to operate in a nighttime mode. In this particular example, the IR LEDs are not visible from the exterior since they are enclosed with a dark-colored, IR-transparent plastic. Since the plastic permits infrared light to pass through it, the camera can function when the lighting is poor and the IR LEDs are used. Camera **100** further includes a speaker (e.g., so a person viewing video from the camera can talk to someone being filmed by the camera). Camera **100** includes a Universal Serial Bus port (i.e., female adapter) to which a USB plug (i.e., male adapter) is able to be coupled in order to supply power and (during an installation mode) is used as an input/output interface via which information about the Wi-Fi network is supplied to camera **100** (e.g., name of the Wi-Fi network to become a member of, an encryption key, etc.). In various embodiments, a USB connector is a Type A, Type B, Mini-A, Mini-B, Micro-A, or Micro-B connector. The USB port may be used at other times and/or for other purposes. For example, batteries or solar power generators with USB connections may be used to power the device and make it portable. The USB port may also be used as an I/O interface for control or display. In some embodiments, video captured by camera **100** is stored and may be accessed and manipulated (e.g., copied to another storage devices, etc.) as desired.

FIG. **2** shows a front view and a side view of an embodiment of a camera inserted in a housing. In the example shown, camera **100** and housing **102** from FIG. **1** are shown. Camera **100** combined with housing **102** (and optionally further combined with mount **104**, not shown) may be used in a variety of applications. In some embodiments, camera **100** is used as a baby camera, for example to monitor an already-sleeping child or to confirm that a child has gone to sleep. Camera **100** may be free standing (e.g., on a dresser) or may be mounted on a wall using mount **104**. Other example uses include monitoring unsupervised nannies or maids, monitoring latchkey children before parents come home from work, video conferencing, pet cameras, as a store security camera to deter shoplifting or record evidence, etc.

Although the embodiments described herein show a circular camera and circular cutouts, in some embodiments, a camera may be some other shape. In such embodiments, the housings which are configured to house the camera correspondingly have different cut-outs or couplings for the camera.

In some cases, it may be desirable to use a camera outdoors and a housing is designed to withstand the elements and/or for outdoor mounting. The following figures show some embodiments of an outdoor housing for a camera.

FIG. **3** is a diagram showing an embodiment of an outdoor housing for a camera with an AC power plug. In the example shown, views **300***a*-**300***c* show an outdoor housing for a camera from first, second, and third side views, respectively. As shown in view **300***a*, the housing includes AC power plug **302**, power adapter and battery **304**, and mini-USB plug **306** Electrically, power is received from AC power plug **302** which is used to charge a battery within power adapter and battery **304**. AC power plug **302** and power adapter and battery **304** are two examples of a power supply which is electrically coupled to a video camera.

In the event there is a power outage (or, for whatever reason, AC power plug **302** no longer supplies power), camera **308** will be able to operate for at least some additional time with the power stored in power adapter and battery **304**. Power is supplied to camera **308** from power adapter and battery **304** via USB plug **306**. As described above, the configurations and features described in association with this figure are merely exemplary and are not intended to be limiting. For example, although this exemplary camera system has a USB connection, other embodiments use other types of connections to exchange power (e.g., Power over Ethernet (POE)) and/or to exchange data (e.g., Ethernet).

Mechanically, camera **308** is coupled to the housing in view **300***a* by inserting camera **308** into an opening of the housing so that USB plug **306** is inserted into the USB port (not shown) of camera **308**. USB plug **306** is one example of a connector in a housing which is configured to be physically coupled to a camera. In this particular example, USB plug **306** is not designed to be pulled out of the housing in view **300***a* and the housing of view **300***a* has a cutout matching the shape of camera **308** to aid in insertion of

camera **308**. In some other embodiments, there is some slack in a wire connecting a USB plug to a power adapter and battery; this permits a USB plug to be pulled out of a housing (e.g., for improved visibility and easy insertion). Connection occurs by pulling out a USB plug, inserting the plug into a camera (while being able to view and align the USB plug and port), and then inserting the coupled USB plug and camera into the opening of the outdoor housing. To attach or connect the system to a wall or other surface, AC power plug **302** is inserted into an AC power outlet. AC power plug **302** is one example of a surface mount which is configured to (at least temporarily) connect the system to a wall or other surface.

Since outdoor power outlets are located at various heights above ground, USB plug **306** is adjustable and the outdoor housing in view **300***a* has a slanted surface, permitting camera **308** to be angled forward or backward. If the housing in view **300***a* is coupled to an outdoor power outlet which is relatively high above ground (e.g., close to a roofline), then camera **308** may be angled forward using adjustable USB plug **306** in order to monitor things below. Conversely, camera **308** may be angled backwards if an outdoor power outlet is located relatively low to the ground. In various embodiments, a housing may be configured to permit a variety of adjustments in a variety of directions or axes (e.g., horizontally from left to right).

Although view **300***a* shows AC power plug **302** as being side mounted, in some other embodiments, some other orientation or placement is used (e.g., a top mounted or a side mounted AC power plug).

View **300***b* shows a second side view of the example housing, looking at it from the side that includes AC power plug **302**. View **300***c* shows a third side view of the example housing, looking at it from the side that includes camera **308**. For clarity, camera **308** is shaded.

FIG. **4** is a diagram showing an embodiment of an outdoor housing for a camera with light bulb connectors. In the example shown, housing **400** includes light bulb outlet plug **402**, power adapter and battery **404**, USB plug **406**, and light bulb port **408**. Housing **400** is designed to screw into a light bulb outlet, such as a porch light or other outdoor lighting fixture, using light bulb outlet plug **402**. Since many outdoor light outlets are designed to have a light bulb oriented upwards, light bulb outlet plug **402** is on the bottom of housing **400**. Alternatively, a light bulb outlet plug may be on some other surface (e.g., side or top mounted). Light bulb outlet plug **402** is another example of a surface mount which (at least temporarily) connects the system to a lighting fixture (or, more generally, a surface).

Electrically, power goes from light bulb outlet plug **402** to power adapter and battery **404**. As in the housing embodiments described above, the battery in power adapter and battery **404** permits a camera to operate even if power from light bulb outlet plug **402** is lost. Power adapter and battery **404** powers both USB plug **406** and light bulb port **408**. Light bulb **414** is coupled to and powered by light bulb port **408**. This permits a camera to be powered using an outdoor lighting fixture (such as a porch light), without depriving the area of light.

Camera **410** is coupled to housing **400** via USB plug **406**. As described above, USB plug **406** and/or the wire between power adapter and battery **404** and USB plug **406** may be configured in a variety of ways to make insertion of camera **410** easier. For example, porch lights tend to be relatively high off the ground and even tall people may have difficulty inserting camera **410** into housing **400** when housing **400** is already coupled to an outdoor lighting fixture. (Housing **400** may, for example, be coupled to a lighting fixture all the time and camera **410** is only inserted when the homeowners plan to be away from home for an extended period of time.) Easy insertion and removal of camera **410** would be desirable.

In this particular example, USB plug **406** is able to be bent forward so that camera **410** can be angled forward. As described above, most outdoor lighting fixtures are relatively high off the ground and an expected configuration may be to angle camera **410** downwards. Although not shown herein, in some embodiments a housing is configured so that a camera can be angled backwards (i.e., to look up) and/or adjusted horizontally (i.e., left/right).

Dome **412** encloses light bulb **414** and is connected to housing **400**. The rounded shape of dome **412** is merely exemplary and in some embodiments a variety of covers in different colors, styles, finishes, and so on are available so that people can choose the cover that suites the style of a house and/or a homeowner's taste. Similarly, housing **400** may be available in a variety of colors, styles, and finishes. Universal connectors **416** ensure that any of the housings will be able to fit any of the covers. The shape of universal connectors **416** is merely exemplary and a variety of connectors (e.g., nuts and bolts, clamps, etc.) may be used.

In some embodiments, housing **400** further includes a light sensor (not shown) which turns off the power supplied to light bulb port **408** (and thus light bulb **414**) from power adapter and battery **404** when it is light outside and turns on power when it is dark outside. This (for example) permits a light switch controlling a porch light or other outdoor light fixture to always be on without wasting power to power light bulb **414** when not needed.

If left outdoors for an extended period of time, dome **412** may become dirty and affect the quality of the video captured by camera **410**. In some embodiments, a monitoring process is performed, which alerts a user when the monitoring process determines a dome or other cover to be too dirty. In various embodiments, a monitoring process is performed on camera **410** or at a server to which video is uploaded (e.g., www.dropcam.com). In some embodiments, video captured by camera **410** is analyzed to detect when dome **412** is too dirty. For example, an amount of light may be measured or otherwise determined from the video. In some embodiments, if an amount of light at a fixed or predefined time of day (e.g., noon) drops below a threshold, then it is determined a cover is getting dirty. The threshold may vary based on location and/or time of year (e.g., Ohio in winter versus Florida in summer). In some embodiments, a monitoring process looks for a drop in light levels by comparing amounts of light at the same time of day and/or time of year (e.g., an amount of light at 2 PM on Aug. 1, 2012 versus an amount of light at 2 PM on Aug. 1, 2009, or an amount of light at 2 PM on August of 2012 versus an amount of light at 2 PM on August of 2009). In some embodiments, the first few minutes captured by the camera are set to be a clean image or clean level and a monitoring process measures a change between current conditions and the clean image or level. In various embodiments, an email notification is sent and/or a user is presented with a warning message when logging on to a (e.g., cloud-based) video system.

FIG. **5** is a diagram showing an embodiment of an outdoor housing with a solar panel. In the example shown, views **500***a* and **500***b* show the first and second side view, respectively, of an outdoor housing with a solar panel. In some embodiments, the housing shown is used where there is no outdoor AC power outlet or outdoor lighting fixture (e.g., a shed or other structure with no power supply).

As shown in view **500***a*, the exemplary housing includes wall mounting hardware **502**, power adapter and battery **504**, USB plug **506**, and solar panel **508**. The position of solar panel **508** is able to be adjusted (e.g., forwards/backwards as well as pivoting on the stand) so that light exposure is maximized. Power from solar panel **508** is passed to and stored by power adapter and battery **504**. From there, power is supplied to USB plug **506** for camera **510** operation.

View **500***b* shows how wall mounting hardware **502** is used to mount the exemplary housing to an outdoor wall or other surface. In this example, screws are used to hold the housing of view **500***b* in place. In some other embodiments, some other connectors or hardware may be used.

In some cases, it may be desirable to use a camera indoors but a flat surface is not available. Alternatively, a flat surface is available but it is undesirable to place a camera there. The following figures show some embodiments of indoor housings which may be used in such situations.

FIG. **6** is a diagram showing an embodiment of a housing with side grippers. In the example shown, view **600***a* shows a front view of the exemplary housing, which includes side grippers **602** which are designed to wrap around vertical poles or bars. Some examples include attaching the exemplary housing to the side of a crib, or to the handrail of a staircase, balcony, or landing. Side grippers **602** (and in some embodiments, the entire housing) are made of flexible and/or material that grips, such as rubber. Side grippers **602** are bent backwards, wrapped around the desired poles or bars, and released. The exemplary housing and the camera are relatively light so the surface friction of side grippers **602** is sufficient to hold the housing in place.

View **600***b* shows a bottom view. As shown in view **600***b*, camera **612** is inserted from the back of the housing through a hole in the housing. Battery **604** is inside of the housing in view **600***b* and is not visible from the exterior. Wire **608** connects battery **604** to USB plug **610**, which in turn is plugged into camera **612** to supply power. View **600***b* includes opening **606** where excess wire can be tucked back into the body of the housing in view **600***b*. In some embodiments, the edge of **606** is elastic so that opening **606** can be stretched open when wire **608** is being inserted or removed but otherwise remains relatively closed, keeping excess wire inside the exemplary housing.

In some embodiments, battery **604** is charged using USB plug **610**. In some embodiments, battery **604** is removable so that charged batteries can be swapped in for discharged batteries with minimal interruption to camera **612**. In such embodiments, opening **606** may be wider to accommodate the insertion and removal of battery **604**. In some embodiments, power is able to be supplied from an AC power source and/or via a power cord (e.g., in addition to or as an alternative to battery power). For example, when used as a baby monitor, it may be desirable to have an unlimited power supply without worrying about how long a battery will last.

FIG. **7** is a diagram showing an embodiment of a housing with hook and loop fasteners. In the example shown, the housing is similar to that shown in FIG. **6**, in that they both are designed to be attached to vertical poles or bars, with some differences. View **700***a* shows a front view of the exemplary housing. Camera **710** is top loaded into a pocket or cavity in the housing of view **700***a* via opening **702**. A round, front cutout in the housing permits at least part of camera **710** to be exposed on the front side of the housing. As described above, in some embodiments, the opening is elasticized. Since camera **710** is top loaded and not rear-loaded through a hole in the housing, battery **704** in this figure may be larger than battery **604** in FIG. **6**. Another benefit to top loading is that the camera may be less likely to fall out of the housing.

View **700***b* shows a bottom view of the exemplary housing. When coupling camera **710** to the housing, USB plug **708** is pulled out of the body of the housing (e.g., via opening **702**) and is connected to the USB port (not shown) of camera **710**. Once coupled, USB plug **708** and camera **710** (plus any excess wire **706**) are put in the body of the housing.

Hooks **712** and loops **714** (e.g., Velcro) are used to fasten the housing to vertical bars or poles by wrapping hooks **712** around the bar or pole and attaching it to loops **714**. Naturally, the positioning of hooks **712** and loops **714** may be reversed. In some cases, hooks and loops may be preferred over the side grippers shown in FIG. **6** because hooks and loops may permit a wider range of distances between the bars or poles to which a housing is attached and/or a wider range of circumferences of such bars or poles.

FIG. **8** is a diagram showing an embodiment of a housing with a clip. In the example shown, housing in views **800***a* and **800***b* include clip **804** which is used to attach the housing to a display (e.g., a television or a computer monitor). Naturally, housing in views **800***a* and **800***b* may be attached to some other surfaces or things besides televisions or computer monitors.

Electrically, power is input from AC power plug **810**. The power is passed to power adapter **808**. In some embodiments, power adapter **808** includes a battery (e.g., in case there is a power outage). Power is passed from power adapter **808** to USB plug **806** of the housing in view **800***a*, which is connected to the USB port (not shown) of camera **850**.

View **800***a* shows that the example housing has no top, which may be attractive for a variety of reasons. Camera **850** is relatively light, so the coupled USB port and plug are sufficient to hold camera **850** in place even when the coupled camera **850** and the housing in view **800***a* are attached to the left side or right side of the display. This design feature may make insertion/removal easier, may keep costs down, and produces a smaller and easier to store housing.

View **800***b* shows a side view of the example housing. To attach the housing of view **800***b*, the arms of clip **804** are pinched and the housing of view **800***b* is attached to the desired surface or object. Joint **802** permits the housing of view **800***b* (and camera **850**, when coupled to the housing) to be angled forward or backward, so that the camera (when inserted in the housing) can be aimed at a desired object or space. View **800***b* also shows plug **809**, which connects AC power plug **810** to power adapter **808**. In this example, the wire which includes plug **809** and AC power plug **810** may be decoupled from the housing in view **800***b* for easier storage or transport. In some embodiments, a housing includes storage space for excess wire, such as a cavity with guides around which excess wire can be wrapped.

FIG. **9** is a diagram showing an embodiment of a housing which is configured to be connected to a port of a display. In the example shown, display **908** includes port **902**. Wire **906** connects housing **900** and display **908**. In this particular example, wire **906** may be decoupled from housing **900** and/or display **908** (e.g., for easy storage).

In various embodiments, port **902** includes a power connection (e.g., from which camera **904** can be powered by display **908**) and/or a data connection (e.g., via which video data captured by camera **904** can be sent over or to a network via display **908**). Some examples of port **902** include (but are

not limited to) a USB port (e.g., in a computer monitor), an Ethernet port (e.g., in a television with built-in networking capabilities), or a High-Definition Multimedia Interface (HDMI) port.

As an example of a port (**902**) which is capable of exchanging data, a user may subscribe to both television service and cable-based Internet service from a cable company and display **908** includes a built-in cable modem (not shown) or, more generally, a transceiver. In some such configurations, video data from camera **904** is uploaded to a server (e.g., www.dropcam.com) via port **902** and the built-in cable transceiver (not shown). A user may then (e.g., at some later time) access the uploaded video data by logging on to the server (not shown). In another example, display **908** may have built-in wireless capabilities (e.g., a built-in IEEE 802.11 a/b/g/n, also referred to as WiFi, transceiver). Display **908** may (e.g., if the system is so configured) send video data from camera **904** to a local display and/or receiver, such as a computer or smart phone on the same WiFi network as display **908** and/or a computer or smart phone in the same room or house as display **908**. In yet another example, video data from camera **904** may be shown (e.g., directly) on display **908**. The examples above are not intended to be mutually exclusive and the system may be configured to perform any combination of the above.

In order to communicate according to the protocols and/or communications interfaces supported by port **902**, housing **900** may include appropriate components (e.g., encoders/decoders, modulators/demodulators, and/or communications interfaces) as needed. For example, housing **900** may include components and/or hardware associated with HDMI, USB, and so on. In some embodiments, these components are implemented as semiconductor devices, such as an application-specific integrated circuit (ASIC) or a field-programmable gate array (FPGA).

A housing which is configured to be connected to a power and/or data port of a display may be attractive for a variety of reasons. For example, it may be unsightly to have cables or wires running from camera **904** to an AC power outlet (e.g., if display **908** is a wall-mounted television and there are no other visible wires). AC power outlets may also be at a premium and using display **908** to power camera **904** frees up an AC power outlet for another device. Although camera **904** includes wireless capabilities and can transmit video data wirelessly, it may be desirable to transmit video data over a wire line connection via display **908** (e.g., over cable-based Internet service) since a wire line connection may be less noisy and/or may have higher data transmission rates than a wireless connection.

FIG. **10** is a diagram showing an embodiment of a housing which is configured to be connected to a display using hooks and loops. In the example shown, loops **1002** are coupled to housing **1000** and hooks **1004** are coupled to display **1006**. In some embodiments, an easily detachable adhesive (e.g., 3M Command™ strips) adheres loops **1002** to housing **1000** and hooks **1004** to display **1006**. Loops **1002** and hooks **1004** are coupled to attach display **1006** to housing **1000** (and camera **1050**, when further connected). The combined weight of camera **1050** and housing **1000** is relatively light, so hooks and loops are sufficient to hold camera **1050** and housing **1000** in place. Although this figure shows housing **1000** attached to the top of display **1006**, housing **1000** and camera **1050** may be attached to a side, front, bottom, or back surface of display **1006** if desired.

In some embodiments, a housing for a camera may be (if desired) further coupled to other accessories or add-ons. The following figures show some examples of housing **102** from FIGS. **1** and **2** to which an add-on may be further coupled.

FIG. **11** is a diagram showing an embodiment of a housing and a tripod prior to being coupled together. In the example shown, camera **1100** is coupled to housing **1102**; housing **1102** is similar to housing **102** shown in FIGS. **1** and **2**. The bottom of housing **1102** is screwed into tripod **1104** when desired. In some embodiments, some other connector is used to couple housing **1102** and tripod **1104**. Tripod **1104** may provide a more stable base than housing **1102** alone and/or permit usage of camera **1100** on an uneven surface.

FIG. **12** is a diagram showing an embodiment of a housing and a tripod after being coupled together. As shown in the front view, housing **1102** may be pivoted on tripod **1104** so that camera **1100** can be directed (e.g., to the left or right) to point in a desired direction. As shown in the side view, housing **1102** may be angled forwards or backwards, also to direct camera **1100** in a desired direction.

In some embodiments, it may be desirable to house a camera in a discreet or hidden housing. For example, a person may wish to monitor their cubicle or office to ensure that someone is not going through their possessions at night. Alternatively, a parent of a toddler (who is able to get out of bed by themselves) may wish to hide a camera so the child is not attracted to the camera and plays with it. In some cases, it may be desirable to have a multipurpose housing which performs some other task (e.g., in addition to housing a camera and/or supplying power to the camera). Multipurpose housings may be attractive because of their ability to reduce clutter and/or if there is a limited amount of space. The following figure shows one embodiment of a housing which may be used in such scenarios.

FIG. **13** is a diagram showing an embodiment of a housing associated with a clock. In the example shown, housing **1300** includes a clock which displays the time, day of the week, and date. It is not necessary for camera **1302** to be coupled to or inserted in housing **1300** in order for the time and date features of housing **1300** to operate properly. For brevity and clarity, components (e.g., electronic components) of housing **1300** associated with displaying the exemplary time and date information are not shown in FIG. **13**.

In this particular example, the housing of housing **1300** includes an opening or hole via which camera **1302** is exposed. In some embodiments, the material and/or color of the base of housing **1300** matches the material and/or color of camera **1302** so that camera **1302** is not as noticeable. In some embodiments, a housing has no hole or opening through which a camera is exposed (e.g., the base of housing **1300** is smooth and unbroken and camera **1302** resides completely within the base of housing **1300**). In some embodiments, the base of housing **1300** is made of a transparent material (e.g., so that if needed, the camera is able to capture video through housing **1302**).

Pet owners may wish to use their cameras to capture what their pet does throughout the day. The following figure shows an embodiment of a housing which may be used to record the indoor or outdoor activities of a pet, such as a dog or a cat.

FIG. **14** is a diagram showing an embodiment of a housing associated with a pet collar. In the example shown, housing **1400** is designed to be worn by a pet, such as a dog or a cat. Camera **1450** is coupled to housing **1400** and is exposed via a hole or opening in housing **1400**. This permits camera **1450** to record what a pet is looking at or facing towards. For brevity, some details associated with a collar are not shown herein but are not necessarily excluded from

the housing. For example, a variety of fasteners (not shown herein) may be used to close a collar, including buckles, hooks and loops, clips, etc.

Housing **1400** includes battery **1402**, wire **1404**, and USB plug **1406**. In some embodiments, the material of housing **1400** is washable and battery **1402**, wire **1404**, USB plug **1406**, and camera **1450** may be removed from housing **1400** so that it can be washed in a washing machine. For example, housing **1400** may have one or more zippers or hook and loop fasteners which, when opened, permit the removal of delicate components before cleaning. In some embodiments, this also permits battery **1402** and/or camera **1450** to be easily removed or inserted (e.g., in order to download video captured by camera **1450** or replace a depleted battery with a charged battery).

Although the foregoing embodiments have been described in some detail for purposes of clarity of understanding, the invention is not limited to the details provided. There are many alternative ways of implementing the invention. The disclosed embodiments are illustrative and not restrictive.

What is claimed is:

1. A system, comprising:

an integrated video camera module;

an arm including a cutout opening, wherein the cutout opening substantially conforms to a contour of the video camera module, the arm being configured to entirely surround and hold the video camera module when the video camera module is assembled within the cutout opening in the arm;

a base; and

a joint that connects the arm and the base and that provides at least one degree of motion of the arm and the video camera module mounted therein with respect to the base, allowing the arm to rotate around a rotational axis that passes through the joint.

2. The system of claim **1**, wherein the arm is substantially flat.

3. The system of claim **1**, wherein both the contour of the video camera module and the cutout opening have a respective substantially circular shape.

4. The system of claim **1**, wherein the joint is adjustable, at least in a forwards direction.

5. The system of claim **1**, wherein the video camera module further includes a high definition camera portion, an antenna, a wireless transceiver, a microphone and a speaker.

6. The system of claim **1**, wherein the video camera module further includes one or more of a reset pin, a status light, and one or more infrared light emitting diodes.

7. The system of claim **1**, wherein the video camera module includes one or more of the following: a Universal Serial Bus (USB) port, a Power over Ethernet (POE) port, or an Ethernet port.

8. The system of claim **1**, wherein the video camera module is powered via an electrical connection external to the arm, the base, and the joint.

9. The system of claim **1**, wherein the video camera module includes a wireless transceiver for exchanging video data between the video camera module and a remote server.

10. The system of claim **1**, further comprising a tripod which is configured to be connected to the base.

11. The system of claim **1**, wherein the joint is configured to adjust the field of view direction of the camera module by changing angle of a substantially flat surface of the arm with respect to the base.

12. A system, comprising:

an integrated video camera module;

a housing including a cutout opening and a bottom surface, wherein the cutout opening conforms to a contour of a video camera module, the housing being configured to entirely enclose and hold the video camera module when the video camera module is assembled within the cutout opening in the housing;

a plug that is mechanically coupled on the cutout opening;

a wire that is further coupled to the plug, wherein the plug is configured to couple to a port of the video camera module when the video camera module is assembled within the cutout opening, and electrically connect the video camera module to a power supply via the wire;

a surface mount that is configured to be placed on a surface; and

a joint that provides at least one degree of motion of the video camera module with respect to the bottom surface of the housing, allowing the video camera module to rotate around a rotational axis that passes through the joint.

13. The system of claim **12**, wherein the video camera module further includes a high definition camera portion, an antenna, a wireless transceiver, a microphone and a speaker, and one or more of a reset pin, a status light and one or more infrared light emitting diodes.

14. The system of claim **12**, wherein the plug includes one or more of the following: a Universal Serial Bus (USB) plug, a Power over Ethernet (POE) plug, or an Ethernet plug.

15. The system of claim **12**, wherein the power supply includes a battery and the system further includes the battery.

16. The system of claim **12**, wherein the power supply includes one or more of the following: an AC power supply, a battery, a solar power supply, or a power supply associated with a television.

17. The system of claim **12**, wherein video data is exchanged between the video camera module and a server via the wire.

18. The system of claim **17**, wherein the video data is exchanged using one or more of the following: a Universal Serial Bus (USB) connection, an Ethernet connection, a High-Definition Multimedia Interface (HDMI) connection, a television, or a cable modulator-demodulator (modem).

19. The system of claim **12**, wherein the surface mount is selected from a group consisting of an AC power plug, a light bulb outlet plug, wall mounting hardware, side grippers, a hook and loop connector, and a clip.

20. The system of claim **12**, wherein the power supply includes a lighting fixture, and the surface mount is configured to match the lighting fixture.

21. A system, comprising:

a holding means for holding an integrated video camera module, wherein the holding means includes a cutout opening, and the cutout opening substantially conforms to a contour of the video camera module, the holding means being configured to entirely surround and hold the video camera module when the video camera module is assembled within the cutout opening in the holding means;

a base means for contacting a surface; and

a joining means for connecting the holding means and the base means, wherein the joining means provides at least one degree of motion of the holding means and the video camera module mounted therein with respect to

the base means, allowing the holding means to rotate around a rotational axis that passes through the joint means.

22. The system of claim **21**, wherein the holding means is substantially flat.

23. The system of claim **21**, wherein both the contour of the video camera module and the cutout opening have a respective substantially circular shape.

24. The system of claim **21**, wherein the joining means is adjustable, at least in a forwards direction.

25. The system of claim **21**, wherein the video camera module further includes a high definition camera portion, an antenna, a wireless transceiver, a microphone and a speaker.

26. The system of claim **21**, wherein the video camera module further includes one or more of a reset pin, a status light, and one or more infrared light emitting diodes.

27. The system of claim **21**, wherein the video camera module is powered via an electrical connection external to the holding means, the base means, and the joining means.

28. The system of claim **21**, wherein the video camera module includes a wireless transceiver for exchanging video data between the video camera module and a remote server.

29. The system of claim **21**, further comprising a tripod which is configured to be connected to the base means.

30. The system of claim **21**, wherein the joining means is configured to adjust the field of view direction of the camera module by changing angle of a substantially flat surface of the holding means with respect to the base means.

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