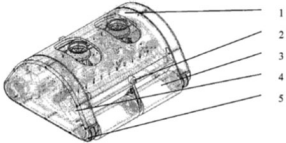
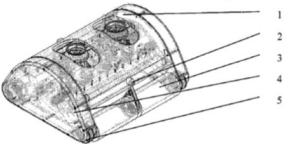
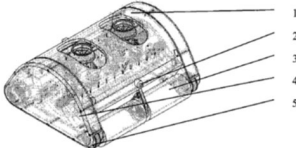
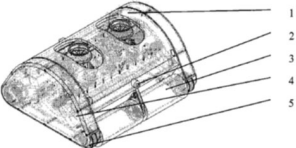


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Section II.A.: A. Summary Of The '207 Patent The '207 Patent, entitled “Pool Cleaning System and Method to Automatically Clean Surfaces of a Pool Using Images from a Camera,” issued with 20 total claims, of which claims 1, 2, and 12 are independent. EX1005, (54), claims 1-20. The claims are directed broadly to systems and methods that use an image captured by a camera to control a pool system or equipment, such as a pool cleaner. <i>Id.</i>, claims 1-20. The '207 Patent generally relates to “a robotic pool cleaner” comprising a vehicle 30 with propulsion mechanisms, a filter, a camera, and a controller. <i>Id.</i>, 2:67-3:3, 3:7-21, 3:31-43. Vehicle 30 uses propulsion mechanisms to move along submerged pool surfaces. <i>Id.</i>, 3:33-45. Using its filter, the pool cleaner draws water from the pool and retains any debris present in the water. <i>Id.</i>, 3:11-16. Cameras 32 capture an image of submerged pool surfaces, and Controller 42 “generate[s] control signals for steering vehicle 30 based upon signals received from cameras 32.” <i>Id.</i>, 3:46-55, 4:46-48.	Section VII.C. C. '207 Patent 72. The '207 Patent, entitled “Pool Cleaning System and Method to Automatically Clean Surfaces of a Pool Using Images from a Camera,” issued with 20 total claims, three of which are independent. EX1005, (54), claims 1-20. The claims are directed broadly to systems and methods that use an image captured by a camera to control a pool system or equipment, such as a pool cleaner. <i>Id.</i>, claims 1-20. . . . 73. The '207 Patent generally relates to “a robotic pool cleaner” that comprises a vehicle 30 with one or more propulsion mechanisms, a filter, a camera, and a controller. <i>Id.</i>, 2:67-3:3, 3:4-19, 3:31-43. The vehicle 30 uses the propulsion mechanisms, such as “wheels, rollers, tracks, or other surface contacting members powered by a motor,” to move along the submerged surfaces of the pool. <i>Id.</i>, 3:31-43. Using its filter, the pool cleaner draws water from the pool and retains any debris present in the water. <i>Id.</i>, 3:8-14. One or more cameras 32 “capture images of submerged surfaces . . . of [the] pool,” and the images are used by the controller 42 “to generate control signals for steering vehicle 30 based upon signals received from cameras 32.” <i>Id.</i>, 3:51-53, 4:44-46.
Section IV.A.1. 1. Summary Of Fu Fu, entitled “Underwater Cleaning Robot,” was filed on July 31, 2007 as Application No. 200710119800.5 in China. EX1007, (54), (21), (22). Fu issued as Grant Publication No. CN 101139007B, and published on June 15, 2011. <i>Id.</i>, (10), (45). Fu is therefore prior art under at least pre-AIA 35 U.S.C. §§ 102(a) and (b).	Section X.A. A. Fu 90. Fu, entitled “Underwater Cleaning Robot,” was filed on July 31, 2007 as Application No. 200710119800.5 in China. EX1007, (19), (21), (22). Fu issued as Grant Publication No. CN 101139007 B, and published on June 15, 2011. <i>Id.</i>, (10), (45). Fu is therefore prior art under at least pre-AIA 35 U.S.C. §§ 102(a) and (b).

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Fu describes a robot designed “for the underwater cleaning of swimming pool floors and walls.” <i>Id.</i>, Abstract.  Fig. 1 <i>Id.</i>, Fig. 1. The underwater cleaning robot has two operational modes: (i) manual mode, where a control keypad is used to send control signals to the robot; and (ii) autonomous mode, where the control system controls the robot’s operations based on data received from cameras. <i>Id.</i>, ¶[0025]. The robot “comprises a drainage mechanism, a cleaning and mobility platform, and a control system.” <i>Id.</i>, ¶[0024], Abstract.. These three units coordinate to “perform cleaning tasks autonomously or via remote control underwater on horizontal, vertical, and inclined surfaces.” <i>Id.</i>, Abstract. The drainage mechanism filters pool water by drawing in water, filtering it to remove any debris, and discharging the filtered water into the pool. <i>Id.</i>, ¶[0024]-[0026]. The cleaning and mobility platform provides structural support and propulsion to the robot, while also performing “brush-cleaning” of pool surfaces via cleaning driving wheels 3. <i>Id.</i>	91. Fu describes a robot that is designed “for the underwater cleaning of swimming pool floors and walls.” <i>Id.</i>, Abstract. An example of Fu’s underwater cleaning robot is depicted in Figure 1:  Fig. 1 <i>Id.</i>, Fig. 1. 92. Fu describes two operational modes for cleaning: manual and autonomous. <i>Id.</i>, ¶[0025]. In the manual mode, a control keypad is used to manually send control signals to the robot. <i>Id.</i> In the autonomous mode, the control system autonomously plans and controls the robot’s movement and cleaning operations based on data received from sensors and cameras. <i>Id.</i> 93. The robot “comprises a drainage mechanism, a cleaning and mobility platform, and a control system.” <i>Id.</i>, ¶[0024]. These three units work in coordination to “perform cleaning tasks autonomously or via remote control underwater on horizontal, vertical, and inclined surfaces.” <i>Id.</i>, Abstract. 94. The drainage mechanism performs a cleaning function by drawing pool water into the robot, filtering it to remove any debris, and discharging the filtered water back into the pool. <i>Id.</i>, ¶[0024]-[0026]. ... 97. . . . In this way, the cleaning and mobility platform provides structural support and propulsion to the robot, while also performing “brush-cleaning” of the pool surface via the cleaning driving wheels 3. <i>Id.</i>, ¶[0024], [0026].

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The control system autonomously controls the robot's operations by generating control signals based on an image received from monitoring cameras 2, that are installed on the robot's housing. <i>Id.</i>	98. The control system autonomously controls the robot's operation by generating control signals that drive the robot's movement and cleaning. <i>Id.</i> . . .
Section IV.A.2. Claim 1 (a) Preamble: "A self-propelled pool cleaning system for cleaning debris from a submerged surface of a swimming pool, comprising:" To the extent limiting, claim 1's preamble is disclosed by Fu. EX1010, ¶¶359-363. Fu discloses "an underwater cleaning robot" designed "for the underwater cleaning of swimming pool floors and walls." EX1007, Abstract.  Fig. 1 <i>Id.</i>, Fig. 1 (underwater cleaning robot). Fu's robot comprises "a drainage mechanism [and] a cleaning and mobility platform." <i>Id.</i>, ¶[0024]. The cleaning and mobility platform enables the robot to move around the pool and remove debris from its surfaces, <i>e.g.</i>, using brushes. <i>Id.</i>, ¶¶[0010], [0024]-[0026] ("brush-cleaning"). The drainage mechanism "draws pool water from the bottom of the robot" such that the "water passes through the water flow filter screen 23, which filters out debris, and the clean water is then discharged." <i>Id.</i>, ¶[0026]. Thus, Fu's robot is a "pool cleaning	Section XIII.A.1 a. Preamble: "A self-propelled pool cleaning system for cleaning debris from a submerged surface of a swimming pool, comprising:" 359. To the extent limiting, the preamble of claim 1 is disclosed by Fu. Fu discloses "an underwater cleaning robot" designed "for the underwater cleaning of swimming pool floors and walls." EX1007, Abstract. An example of Fu's underwater cleaning robot is depicted in Figure 1:  Fig. 1 <i>Id.</i>, Fig. 1. 360. Fu's robot includes, among other components, "a drainage mechanism [and] a cleaning and mobility platform." <i>Id.</i>, ¶[0024]. The cleaning and mobility platform enables the robot to move around the pool and remove debris from its surfaces, <i>e.g.</i>, using brushes. <i>Id.</i>, ¶¶[0010], [0024]-[0026] ("brush-cleaning"). The drainage mechanism "draws pool water from the bottom of the robot" such that the "water passes through the water flow filter screen 23, which filters out debris, and the clean water is then discharged." <i>Id.</i>, ¶[0026]. Thus, Fu's

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system for cleaning debris from a submerged surface of a swimming pool.” Fu’s robot is also self-propelled. The robot’s cleaning and mobility platform comprises “four independent cleaning driving wheels 3” that “are controlled by their respective motor drivers, allowing for independent movement.” <i>Id.</i>, ¶[0026]. In the autonomous mode, “control signals are generated by the central processor, which autonomously plans paths and actions ... to drive the robot’s execution layer and complete the underwater cleaning task.” <i>Id.</i>, ¶[0025]. The execution layer comprises motor drivers and cleaning driving wheel DC motors 7, which drive cleaning driving wheels 3. <i>Id.</i>, ¶[0024]. Fu’s robot is thus “self-propelled” because it moves without external propulsion. Fu also describes various components for powering such movement, including an onboard “rechargeable battery box.” <i>Id.</i>, ¶¶[0007], [0008], [0024], [0025]. As detailed below for elements 1a-1f, Fu’s robot discloses all the features of claim 1, thus, Fu discloses a “self-propelled pool cleaning system [underwater cleaning robot] for cleaning debris from a submerged surface of a swimming pool.”	underwater cleaning robot is “for cleaning debris from a submerged surface of a swimming pool.” 361. Fu further discloses that its robot is self-propelled. The robot’s cleaning and mobility platform comprises “four independent cleaning driving wheels 3” that “are controlled by their respective motor drivers, allowing for independent movement.” <i>Id.</i>, ¶[0026]. In the autonomous mode, “control signals are generated by the central processor, which autonomously plans paths and actions ... to drive the robot’s execution layer and complete the underwater cleaning task.” <i>Id.</i>, ¶[0025]. The execution layer comprises the motor drivers and the cleaning driving wheel DC motors 7, which drive the cleaning driving wheels 3. <i>Id.</i>, ¶[0024]. Fu’s robot is thus “self-propelled” because it moves without external propulsion. Fu also describes various components for powering such movement, including an onboard “rechargeable battery box.” <i>Id.</i>, ¶¶[0007], [0008], [0024], [0025]. 362. As detailed below for elements 1a-1f, Fu’s underwater cleaning robot discloses all the features recited in claim 1 (“vehicle body,” “means for moving the vehicle body,” “filter,” “at least one camera,” and “controller”), and thus discloses the “pool cleaning system” recited in the preamble.
Section IV.A.3. (d) Element 2c: “a controller in communication with the at least one piece of equipment and the one or more cameras, the controller configured to receive visual data from the one or more cameras and determine a control action for the at least one piece of equipment based on the received visual data.” Fu discloses element 2c. EX1010, ¶¶396-403. As explained for element 1e, Fu teaches a controller (control system with central processor) in communication with one or more cameras (monitoring cameras 2). Section IV.A.2.f.	Section XIII.A.2. d. Element 2c: “a controller in communication with the at least one piece of equipment and the one or more cameras, the controller configured to receive visual data from the one or more cameras and determine a control action for the at least one piece of equipment based on the received visual data.” 396. Fu discloses element 2c of claim 2. As explained above with respect to element 1e, Fu’s control system, comprising the central processor and motor drivers, teaches the claimed “controller.” EX1007, ¶[0024], Fig. 6.

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<pre> graph LR Camera --> IAC[Image Acquisition Card] IAC --> CP[Central Processor] INC[Inertial Navigation Component] --> CP RCS[Remote Control Signal (Optional)] --> CP PMS[Power Management Module] --> CP CP --> MD1[Motor Driver 1] CP --> MD2[Motor Driver 2] CP --> MD3[Motor Driver 3] CP --> MD4[Motor Driver 4] CP --> MD5[Motor Driver 5] CP --> MD6[Motor Driver 6] CP --> MD7[Motor Driver 7] CP --> MD8[Motor Driver 8] CP --> MD9[Motor Driver 9] MD1 --> DM1[DC Motor 1] MD2 --> DM2[DC Motor 2] MD3 --> DM3[DC Motor 3] MD4 --> DM4[DC Motor 4] MD5 --> S1[Servo 1] MD6 --> S2[Servo 2] MD7 --> HSDC1[High-Speed DC Motor 1] MD8 --> HSDC2[High-Speed DC Motor 2] MD9 --> CRM[Cable Reeling Motor] </pre> Fig. 6 EX1007, Fig. 6. Additionally, “[t]he underwater cleaning robot controls its actions according to control commands issued by the central processor,” which establishes communication between controller and the robot (<i>i.e.</i>, “piece of equipment”) via control commands. <i>Id.</i>, ¶¶[0010], [0026]. Accordingly, Fu discloses “a controller [control system with central processor] in communication with the at least one piece of equipment [underwater cleaning robot] and the one or more cameras [monitoring cameras 2], the controller configured to receive visual data [images] from the one or more cameras and determine a control action [control signals regarding cleaning movements and wheel adjustments] for the at least one piece of equipment based on the received visual data.” Fu anticipates claim 2. <i>Id.</i>, ¶¶389-403. Section IV.A.4. 4. Claim 3	Fig. 6 398. Fu also confirms that the controller is in communication with the underwater cleaning robot. Specifically, “[t]he underwater cleaning robot controls its actions according to control commands issued by the central processor,” which establishes communication between Fu’s control system and the underwater cleaning robot via control commands. <i>Id.</i>, ¶¶[0010], [0026]. Accordingly, Fu discloses “a controller [control system with central processor] in communication with the at least one piece of equipment [underwater cleaning robot] and the one or more cameras [monitoring cameras 2], the controller configured to receive visual data [images] from the one or more cameras and determine a control action [control signals regarding cleaning movements and wheel adjustments] for the at least one piece of equipment based on the received visual data.” 403. Fu anticipates claim 2. Section XIII.A.3.

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Fu discloses claim 3. <i>Id.</i>, ¶¶404-408. As explained for element 2a, Fu's robot teaches "at least one piece of equipment." Section IV.A.3.b. The robot is designed for cleaning a swimming pool by, for <i>e.g.</i>, filtering pool water and brush-cleaning pool surfaces, so it constitutes "a cleaning device." EX1007, Abstract, ¶¶[0010], [0024]-[0026]. As explained for element 1b, the robot includes "one or more propulsion mechanisms," <i>e.g.</i>, driving wheels 3 powered by cleaning driving wheel DC motors 7. Section IV.A.2.c. Additionally, Fu's robot "possesses autonomous mobility and can be used for cleaning underwater horizontal, vertical, and inclined surfaces via remote or autonomous control, enabling it to autonomously complete underwater cleaning tasks in place of human labor." <i>Id.</i>, ¶[0001], Abstract. The robot "can adhere to the vertical walls of a swimming pool for cleaning, achieving vertical wall-climbing movement" because of "the high negative pressure within its water flow channel 24 and the force from the drainage mechanism." <i>Id.</i>, ¶¶[0011],[0026]. For vertical wall-climbing, the robot adjusts the position and discharge direction of water outlets 10 to generate a propulsive force for upward movement. <i>Id.</i>, claim 9, ¶¶[0012], [0026] ("The coordinated movement or positioning of multiple water outlets 10 along the water outlet sliding grooves 9 changes the discharge direction of the water outlets 10, generating different forces that affect the robot's movement. . . . Particularly when the robot is climbing a wall, factors such as pool steps may cause the chassis to be lifted,	3. Dependent Claim 3: "The pool system of claim 2, wherein the at least one piece of equipment comprises a cleaning device with one or more propulsion mechanisms, the cleaning device configured to travel adjacent to submerged or water-containing surfaces of the swimming pool or spa and to perform a cleaning operation." 404. Fu discloses the limitations added in dependent claim 3. As explained above with respect to element 2a, Fu's underwater cleaning robot teaches the claimed "at least one piece of equipment." Fu describes the robot as specifically designed for cleaning a swimming pool by performing operations such as filtering the pool water and brush-cleaning the pool surfaces. EX1007, Abstract, ¶¶[0010], [0024]-[0026]. Thus, the robot constitutes "a cleaning device." 405. As explained above for element 1b, Fu discloses "means for moving the vehicle body within the swimming pool," and also discloses that the robot includes "one or more propulsion mechanisms," <i>e.g.</i>, driving wheels 3 powered by cleaning driving wheel DC motors 7. 406. . . . Fu states that its robot "possesses autonomous mobility and can be used for cleaning underwater horizontal, vertical, and inclined surfaces via remote or autonomous control, enabling it to autonomously complete underwater cleaning tasks in place of human labor." <i>Id.</i>, ¶[0001], Abstract. . . . For vertical wall-climbing movement, Fu explains that the robot adjusts the position and discharge direction of the water outlets 10 to generate a propulsive force to ensure that the robot can continue its upward movement. <i>Id.</i>, claim 9, ¶¶[0012], [0026] ("The coordinated movement or positioning of multiple water outlets 10 along the water outlet sliding grooves 9 changes the discharge direction of the water outlets 10, generating different forces that affect the robot's movement. . . . Particularly when the robot is climbing a wall, factors such as pool steps may cause the chassis to be lifted, rendering the four cleaning driving wheels 3 ineffective. In this situation, the position of the water outlets must be

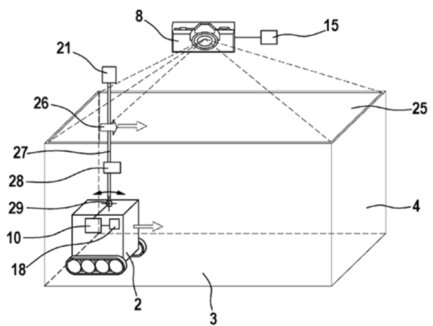
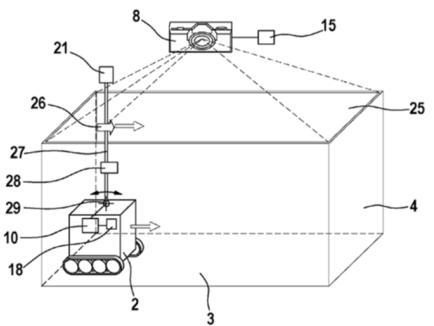
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rendering the four cleaning driving wheels 3 ineffective. In this situation, the position of the water outlets must be adjusted to provide a propulsive force to the robot, returning it to a normal operating state.”). Because Fu’s robot travels underwater on the pool floor as well as vertical walls, it travels “adjacent to submerged or water containing surfaces of the swimming pool” just like the '207 Patent’s pool cleaning system 20 with vehicle 30. Thus, Fu anticipates claim 3: “the at least one piece of equipment comprises a cleaning device [underwater cleaning robot] with one or more propulsion mechanisms [driving wheels 3 powered by cleaning driving wheel DC motors 7], the cleaning device configured to travel adjacent to submerged or water-containing surfaces of the swimming pool [pool floor and vertical pool walls] or spa and to perform a cleaning operation [filtering pool water and brush-cleaning pool surfaces].” EX1010, ¶¶404-408.	adjusted to provide a propulsive force to the robot, returning it to a normal operating state.”). 407. Because Fu’s robot travels underwater along the pool floor and/or vertical walls, it travels “adjacent to submerged or water containing surfaces of the swimming pool” just like the pool cleaning system 20 with vehicle 30 of the '207 Patent. . . . 408. In sum, Fu anticipates “[t]he pool system of claim 2, wherein the at least one piece of equipment comprises a cleaning device [underwater cleaning robot] with one or more propulsion mechanisms [driving wheels 3 powered by cleaning driving wheel DC motors 7], the cleaning device configured to travel adjacent to submerged or water-containing surfaces of the swimming pool [pool floor and vertical pool walls] or spa and to perform a cleaning operation [filtering the pool water and brush-cleaning the pool surfaces].”
Section IV.A.7. 7. Claims 7-8 Fu discloses claims 7-8. EX1010, ¶¶412-415. As explained for element 2c, Fu’s central processor receives captured images (<i>i.e.</i>, “visual data”) from monitoring cameras 2, and assesses the “level of	Section XIII.A.6. 6. Dependent Claim 7: “The pool system of claim 2, wherein the controller is configured to detect a characteristic of the location based on the visual data and control the piece of equipment based on the detected characteristic.” Dependent Claim 8: “The pool system of claim 7, wherein the characteristic comprises a cleanliness of a surface of the swimming pool, and wherein the controller is configured to control the piece of equipment based on the detected cleanliness being outside of a threshold.” 412. Fu discloses dependent claims 7 and 8. As explained with respect to element 2c, Fu’s control system receives visual data, such as captured images of the pool floor, from the monitoring cameras 2. The

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cleanliness” of the pictured region by comparing the image with the “pool cleanliness image threshold.” Section IV.A.3.d. Based on that cleanliness assessment, <i>i.e.</i>, determining whether the captured image falls above or below the pool cleanliness image threshold, the central processor generates control signals to drive the robot’s “cleaning movements and adjusts the working state of the four cleaning driving wheels 3.” <i>Id.</i> Thus, Fu anticipates claim 7: “[t]he pool system of claim 2, wherein the controller is configured to detect a characteristic of the location [level of cleanliness of pictured region] based on the visual data and control the piece of equipment [adjust cleaning movements and wheel speeds of the underwater cleaning robot] based on the detected characteristic.” Fu also anticipates claim 8: “the characteristic comprises a cleanliness of a surface of the swimming pool [level of cleanliness of pictured region], and wherein the controller is configured to control the piece of equipment [adjust cleaning movements and wheel speeds of the underwater cleaning robot] based on the detected cleanliness being outside of a threshold [pool cleanliness image threshold].”	control system compares that visual data against a “pool cleanliness image threshold” to determine the “level of cleanliness” of the pictured region of the pool, <i>i.e.</i>, whether the cleanliness level of the pictured region of the pool falls above or below the “pool cleanliness image threshold.” This “level of cleanliness” constitutes “a characteristic of the location” as recited in claim 7, and “a cleanliness of a surface of the swimming pool” as recited in claim 8. . . . 414. Thus, Fu anticipates claim 7: “[t]he pool system of claim 2, wherein the controller is configured to detect a characteristic of the location [level of cleanliness of the pictured region of the pool] based on the visual data and control the piece of equipment [adjust cleaning movements and wheel speeds of the underwater cleaning robot] based on the detected characteristic.” 415. Accordingly, Fu also anticipates claim 8: “[t]he pool system of claim 7, wherein the characteristic comprises a cleanliness of a surface of the swimming pool [level of cleanliness of the pictured region of the pool], and wherein the controller is configured to control the piece of equipment [adjust cleaning movements and wheel speeds of the underwater cleaning robot] based on the detected cleanliness being outside of a threshold [pool cleanliness image threshold].”
Section IV.A.8. (c) Element 12b: “determining a target area and detecting a characteristic of the target area based on the images; and” Fu discloses element 12b. EX1010, ¶¶422-424. Fu’s robot “uses its monitoring cameras 2 to capture images of the pool floor and compares them with the [pool cleanliness image] threshold to determine the level of cleanliness.” EX1007, ¶[0026]. The robot analyzes the specific region of the pool captured in the images to determine whether that region meets the cleanliness threshold. <i>Id.</i> That	Section XIII.A.7. c. Element 12b: “determining a target area and detecting a characteristic of the target area based on the images; and” 422. Fu discloses element 12b of claim 12. Fu’s underwater cleaning robot “uses its monitoring cameras 2 to capture images of the pool floor and compares them with the [pool cleanliness image] threshold to determine the level of cleanliness.” <i>Id.</i>, ¶[0026]. In Fu, the robot analyzes a specific region of the pool, the region pictured in the captured images, to determine whether that region meets the preset

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region corresponds to the “target area” because it is the specific area identified, <i>i.e.</i>, “determine[ed]” for assessing the level of cleanliness. <i>Id.</i>	cleanliness threshold. The area of the pool floor that is captured in the images and subjected to this cleanliness analysis corresponds to the claimed “target area” because it is the specific area that is identified, <i>i.e.</i>, “determine[ed]” for evaluation.
Section IV.B.1. 1. Claim 1 Fu anticipates claim 1. Section IV.A.2. However, to the extent the Board finds that Fu does not anticipate claim 1 for allegedly lacking at least one control signal that causes movement of the body “to, or away from, the first object,”¹ Fu nevertheless would have rendered obvious this claim. EX1010, ¶¶437-440. Fu already teaches acquiring an image of submerged pool surfaces, comparing the image to a cleanliness image threshold, and “plan[ning] ... cleaning movements” and “adjust[ing] the working state of the four cleaning drive wheels 3 ... to complete the cleaning task” based on this comparison. EX1007, ¶[0026]. A POSA would have found it obvious to implement motion control in Fu to direct the cleaning robot toward (i) pictured regions containing a first object falling below the cleanliness threshold, and (ii) away from pictured regions containing the first object falling above the cleanliness threshold. EX1010, ¶¶437-440. Given Fu’s use of image-based cleanliness determination to adjust wheel speeds and movement paths, it would have been a routine and predictable application for a POSA to configure Fu’s central processor to generate control signals directing the robot toward the first object when it is in a subthreshold (<i>i.e.</i>, relatively dirty) area. <i>Id.</i> A POSA would have been motivated to do so because moving the robot toward dirtier areas improves cleaning efficiency and task completion time. <i>Id.</i> Likewise, it would have been a routine and predictable application	Section XIII.B.1. 1. Claim 1 437. Fu anticipates claim 1 of the '207 Patent. <i>See</i> Ground 1a above. However, should the Board find that Fu does not anticipate claim 1 because it allegedly lacks at least one control signal that causes movement of the body “to, or away from, the first object,”¹⁵ Fu nevertheless would have rendered obvious this claim. 438. Fu already teaches acquiring images of submerged pool surfaces (EX1007, ¶[0026]), comparing these images to a cleanliness image threshold (<i>id.</i>), and “plan[ning] ... cleaning movements” and “adjust[ing] the working state of the four cleaning drive wheels 3 ... to complete the cleaning task” based on this comparison (<i>id.</i>). A POSA would have found it obvious to implement motion control in Fu to direct the cleaning robot toward (i) pictured regions containing a first object falling below the cleanliness threshold, and (ii) away from pictured regions containing the first object falling above the cleanliness threshold. 439. Given Fu’s use of image-based cleanliness determination to adjust wheel speeds and movement paths, it would have been a routine and predictable application for a POSA to configure Fu’s central processor to generate control signals directing the robot toward the first object when it is in subthreshold (<i>i.e.</i>, relatively dirty area). A POSA would have been motivated to do so because moving the robot toward dirtier areas improves cleaning efficiency and task completion time. Likewise, it would have been a routine and predictable

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to configure Fu's central processor to generate control signals directing the robot away from the first object when it is present in an above-threshold (<i>i.e.</i>, relatively clean) area. <i>Id.</i> As explained by Dr. Reinholtz, implementing such control behaviors in Fu would have required no more than routine software configuration within a POSA's skill. <i>Id.</i> Such implementation would reflect routine, predictable applications of well-known control techniques, requiring no new hardware and instead leveraging Fu's disclosed central processor. <i>Id.</i> A POSA would have thus had a reasonable expectation of success in implementing Fu with the "at least one control signal to cause movement of the body within the swimming pool to, or away from, the object." <i>Id.</i> Accordingly, Fu would have rendered obvious claim 1. <i>Id.</i>	application to configure Fu's central processor to generate control signals directing the robot away from the first object when it is present in above-threshold (<i>i.e.</i>, relatively clean) photographed regions. Implementing such control behaviors in Fu would have required no more than routine software configuration within a POSA's skill. Such implementation would reflect only routine, predictable applications of well-known control techniques, requiring no new hardware and instead leveraging Fu's disclosed central processor. A POSA would have thus had a reasonable expectation of success in implementing Fu with the claimed "at least one control signal to cause movement of the body within the swimming pool to, or away from, the object." 440. Accordingly, even if Fu were found not to anticipate, it would have rendered obvious claim 1 for at least these reasons.
Section IV.B.2. 2. Claims 2, 3, 5-8, 12-14, And 19 Independent claims 2 and 12 recite limitations similar to claim 1's, and are obvious over Fu for the reasons explained for claim 1. Fu also discloses the imitations added in dependent claims 3, 5-8, 13, 14, and 19 (<i>see</i> Ground 1a in Section IV.A), such that these dependent claims are likewise obvious over Fu. EX1010, ¶441.	Section XIII.B.2. 2. Claims 2, 3, 5-8, 12-14, And 19 441. Independent claims 2 and 12 recite limitations similar to those of claim 1 and are obvious over Fu for the reasons explained in the preceding section for claim 1. Fu also discloses the limitations added in dependent claims 3, 5-8, 13, 14, and 19 (<i>see</i> Section XIII.A.1.b above for Ground 1a), such that these dependent claims are likewise obvious over Fu.
Section IV.C.1. 1. Summary Of Benzler Benzler, EX1013, entitled "Activation System for a Robotic Vehicle," was filed on May 16, 2008 as PCT/EP08/56016, and published on Nov. 25, 2010 as U.S. Patent Pub. No. 2010/0299016. EX1013, (10), (22), (43), (86). Benzler is therefore prior art under at least pre-AIA 35 U.S.C. §§ 102(a), (b), and (e).	Section X.C. C. Benzler 114. Benzler, EX1013, entitled "Activation System for a Robotic Vehicle," was filed on May 16, 2008 as PCT/EP08/56016, and published on Nov. 25, 2010 as US Patent Pub. No. 20100299016. EX1013, (10), (22), (43), (86). Benzler is therefore prior art under at least pre-AIA 35 U.S.C. §§ 102(a), (b), and (e).

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Benzler describes “an activation system (1) for a robotic vehicle (2)” that uses image-based navigation to autonomously control movement of vehicle (2) within a work area 3. <i>Id.</i>, ¶[0037], Abstract. The system includes at least one “camera (8) configured for generating image data of a work area (3),” and a “logic unit (10) configured for determining the position of the at least one robotic vehicle (2) based on the image data generated by the camera (8).” <i>Id.</i>, Abstract. “The logic unit 10 calculates driving instructions for the robotic vehicle 2 based on the image data,” and the driving instructions are transmitted to robotic vehicle 2 for execution. <i>Id.</i>, ¶¶[0044]-[0046]. Benzler describes several example embodiments of the activation system, such as “a snow cleaning vehicle, [a] leaf collecting vehicle, [a] grass collecting vehicle, thatching vehicle, or [a] weeding vehicle ...[and] as a lawnmower.” <i>Id.</i>, ¶[0023]. In a “particularly preferred” embodiment, “the robotic vehicle is construed as [a] poolrobotic vehicle, thus in particular as [a] filter vehicle and/or cleaning or purifying vehicle ... [that] drive[s] in particular on the bottom of a pool, which then creates the work area.” <i>Id.</i>, ¶[0028]. In this pool embodiment, “[t]he external border 4 of the work area 3 is created by the surrounding pool walls.” Figure 3 illustrates the activation system as pool robotic vehicle 2 (<i>id.</i>, ¶¶[0036], [0051]-[0056]):	115. Benzler describes “an activation system (1) for a robotic vehicle (2)” that uses image-based navigation to autonomously control movement of the vehicle (2) within a work area 3. <i>Id.</i>, ¶[0037]. The system includes at least one “camera (8) configured for generating image data of a work area (3)” and a “logic unit (10) configured for determining the position of the at least one robotic vehicle (2) based on the image data generated by the camera (8).” <i>Id.</i>, Abstract. 116. “The logic unit 10 calculates driving instructions for the robotic vehicle 2 based on the image data,” and the driving instructions are transmitted to the robotic vehicle 2 for execution. <i>Id.</i>, ¶¶[0044]-[0046]. ... 117. Benzler describes several example embodiments of the activation system, such as “a snow cleaning vehicle, [a] leaf collecting vehicle, [a] grass collecting vehicle, thatching vehicle, or [a] weeding vehicle ...[and] as a lawnmower.” <i>Id.</i>, ¶[0023]. 118. In a “particularly preferred” embodiment, “the robotic vehicle is [constructed] as [a] pool-robotic vehicle, thus in particular as [a] filter vehicle and/or cleaning or purifying vehicle ... [that] drive[s] in particular on the bottom of a pool, which then creates the work area.” <i>Id.</i>, ¶[0028]. In this underwater embodiment, “[t]he external border 4 of the work area 3 is created by the surrounding pool walls.” Figure 3 illustrates a schematic of the activation system construed as a pool robotic vehicle 2 (<i>id.</i>, ¶¶[0036], [0051]-[0056]):

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Fig. 3  <i>Id.</i>, Fig. 3. Camera 8 transmits data via logic unit 10 to “control unit 18, which controls the not shown drive means” for driving robotic vehicle 2. <i>Id.</i>, ¶[0054].	Fig. 3  <i>Id.</i>, Fig. 3. 119. Benzler discloses a camera 8 for guiding the pool cleaning implementation of robotic vehicle 2. <i>Id.</i>, ¶[0053].
Section IV.C.2. 2. Motivation To Combine The similar disclosures of Fu and Benzler would have motivated a POSA to consider them together. EX1010, ¶¶442-443. Fu discloses capturing an image of the pool floor, comparing it to a cleanliness threshold to determine a level of cleanliness, and then adjusting the robot’s operations accordingly. EX1007, ¶[0026]. Likewise, Benzler describes an autonomous robotic cleaning system, with a pool cleaning embodiment, that makes movement and cleaning decisions based on an image of the work area. Section IV.C.1; EX1013, Abstract, ¶¶[0016], [0018], [0028], [0037], [0044]-[0046], [0053].	Section XIII.C.1. 1. Motivations To Combine 442. The similar disclosures of Fu and Benzler would have motivated a POSA to consider these references together. As detailed in Section X.A above, Fu discloses capturing an image, comparing it to a cleanliness threshold to determine a level of cleanliness, and then planning movement and adjusting the working state of a robot’s drive wheels to complete a cleaning task. EX1007, ¶[0026]. Benzler, like Fu, describes an autonomous robotic cleaning system that makes movement and cleaning decisions based on an image of the cleaning surface or work area, including “differently conditioned” sections of the work area. EX1013, Abstract, ¶¶[0016], [0018], [0028], [0037], [0044]-[0046], [0053]. . . . 443. . . .These disclosures confirm that Benzler, like Fu, is directed to an autonomous robotic cleaner that uses image-derived information to

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Thus, Benzler, like Fu, is directed to an autonomous robotic cleaner that uses an image to guide its operations, particularly in a pool-cleaning embodiment.	guide its movement and cleaning, and in particular, includes an embodiment where the cleaning is performed in a pool environment using camera-based navigation.
Section IV.C.3. 3. Claim 1 To the extent the Board determines that Fu alone does not anticipate or render obvious the “at least one control signal to cause movement of the body within the swimming pool to, or away from, the first object,” claim 1 is nonetheless obvious over Fu in combination with Benzler. EX1010, ¶¶444-448. Benzler describes various embodiments of its robotic vehicle, such as an autonomous lawnmower. In this embodiment, “the logic unit ... is ... [constructed] in such a way that differently conditioned sections (mowed/not mowed) ... are detected and the driving instructions are calculated in such a way that preferably the mowed section ... is driven along.” EX1013, ¶¶[0018], [0023], [0045]. In embodiments, “the logic unit detects differently conditioned sections of the work area, for example a mowed or a not mowed section of the work area based on the image data and then considers this information when calculating the driving instructions, in particular in such a way that the robotic vehicle does only or preferably move on one of those sections, in particular the not mowed lawn section.” <i>Id.</i>, ¶[0016]. Thus, Benzler uses an image to cause motion “only or preferably” toward target sections and away from non-target sections. <i>Id.</i>, ¶¶[0016], [0018], [0045].	Section XIII.C.2. 2. Claim 1 444. To the extent that the Board determines that Fu alone does not anticipate or render obvious the claimed “at least one control signal to cause movement of the body within the swimming pool to, or away from, the first object,” claim 1 is nonetheless obvious over Fu in combination with Benzler. 445. . . . Benzler describes embodiments in which its robotic vehicle is implemented as an autonomous lawnmower, a snow cleaning vehicle, a gas collecting vehicle, a thatching vehicle, a weeding vehicle, etc. <i>Id.</i>, ¶[0023]. In the autonomous lawnmower embodiment, for instance, “the logic unit ... is ... construed in such a way that differently conditioned sections (mowed/not mowed) ... are detected and the driving instructions are calculated in such a way that preferably the mowed section ... is driven along.” <i>Id.</i>, ¶¶[0018], [0045]. Benzler also discloses that in embodiments, “the logic unit detects differently conditioned sections of the work area, for example a mowed or a not mowed section of the work area based on the image data and then considers this information when calculating the driving instructions, in particular in such a way that the robotic vehicle does only or preferably move on one of those sections, in particular the not mowed lawn section.” <i>Id.</i>, ¶[0016]. Thus, Benzler uses image-based classification of differently conditioned sections to cause motion “only or preferably” toward target sections and away from non-target sections. <i>Id.</i>, ¶¶[0016], [0018], [0045].

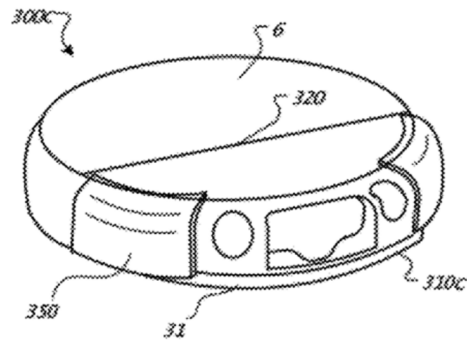
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A POSA would have been motivated to incorporate Benzler's image-based classification-driven motion control into Fu because it is a known technique for improving coverage efficiency and cleaning performance, satisfies design needs to prioritize dirty areas and reduce redundant cleaning, and represents one of a finite, predictable set of control options once regions are classified with respect to a threshold. EX1010, ¶¶444-448. Applying Benzler's classification-driven motion to Fu's thresholded cleanliness determinations would have yielded the control signal for causing movement "to, or away from" a portion of the submerged surface captured by the camera, with the robot moving toward sub-threshold (dirtier) regions and away from above-threshold (cleaner) regions. <i>Id.</i> A POSA would also have had a reasonable expectation of success. The combination does not require new hardware or unconventional algorithms; Fu already discloses cameras, processor, and wheels, and it "plans" movement and "adjusts" wheel states based on cleanliness determinations. Implementing Benzler's classification-based movement entails routine controller configuration that would have been within a POSA's skill. <i>Id.</i> Thus, Fu in view of Benzler renders obvious claim 1's "to, or away from" control-signal limitation by teaching and motivating use of image-based region classification to control motion toward target (dirtier) regions and away from non-target (cleaner) regions. <i>Id.</i> Claim 1 would have been obvious over Fu in view of Benzler. <i>Id.</i>, ¶¶442-448.	446. A POSA would have been motivated to incorporate Benzler's classification-driven motion control into Fu because it is a known technique for improving coverage efficiency and cleaning performance, satisfies design needs to prioritize dirty areas and reduce redundant cleaning, and represents one of a finite, predictable set of control options once regions are classified with respect to a threshold. EX1010, ¶¶444-448. Applying Benzler's classification-driven motion to Fu's thresholded cleanliness determinations would have yielded the claimed control signal for causing movement "to, or away from" a portion of the submerged surface captured by the camera, with the robot moving toward sub-threshold (dirtier) regions and away from above-threshold (cleaner) regions. A POSA would also have had a reasonable expectation of success. The combination does not require new hardware or unconventional algorithms; Fu already discloses the cameras, processor, and wheels, and it "plans" movement and "adjusts" wheel states based on cleanliness determinations. Implementing Benzler's classification-based movement entails routine controller configuration that would have been within a POSA's skill. 447. In sum, even if Fu alone were deemed insufficient, the combination of Fu with Benzler renders obvious the "to, or away from" control-signal limitation of claim 1 by teaching and motivating the use of image-based region classification to control motion toward target (dirtier) regions and away from non-target (cleaner) regions, with a reasonable expectation of success. 448. Claim 1 would have been obvious over Fu in view of Benzler.
Section IV.C.4. 4. Claim 4	Section XIII.C.3. 3. Dependent Claim 4: "The pool system of claim 2, wherein the one or more cameras are mounted external to the swimming pool or spa."

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Claim 4 would have been obvious over Fu in view of Benzler. <i>Id.</i>, ¶¶449-453. While Fu's robot comprises onboard cameras that are submerged in the pool, Benzler's pool robotic vehicle 2 uses external camera 8. Sections IV.A.5-6, IV.C.1. A POSA would have recognized the advantages of implementing Fu with Benzler's external camera 8. Benzler emphasizes that external camera 8 is positioned above the work area, <i>i.e.</i>, pool, so it can capture a broad, global view of the entire pool. Ex. 1013, ¶[0010] ("The camera is preferably arranged above the work area, so that a section of the work area can be detected that is as big as possible with the camera ... It is furthermore possible to arrange the at least one camera ... in such a way that it follows the movement of the robotic vehicle.").A POSA would understand that this overhead perspective provides additional information that Fu's submerged, onboard cameras cannot capture; while Fu's onboard cameras observe only a partial, local region within the pool, Benzler's external camera provides a complete, unobstructed view of the entire pool along with the robot's exact location, orientation, and trajectory. EX1010, ¶¶449-453. A POSA would have had a reasonable expectation of success in making this combination because Fu already provides an existing communication infrastructure for easily integrating Benzler's external camera 8 into Fu. Figure 7 illustrates a "control and power management system" that is external to the pool, including components such as signal relay and cable manager 28, and signal and power cable 33:	449. Claim 4 would have been obvious over Fu in view of Benzler. As explained with respect to claim 2, Fu discloses a pool system comprising an underwater cleaning robot with onboard cameras that are submerged in the pool. Benzler demonstrates that the use of off-board, external cameras for pool-cleaning was also well-known in the art, and a POSA would have been motivated to implemented Fu's pool-cleaning system with external cameras like those taught in Benzler. 450. . . . ("The camera is preferably arranged above the work area, so that a section of the work area can be detected that is as big as possible with the camera It is furthermore possible to arrange the at least one camera ... in such a way that it follows the movement of the robotic vehicle."). A POSA would understand that this overhead perspective provides additional information that Fu's submerged, onboard cameras cannot capture; while Fu's onboard cameras observe only a partial, local region within the pool, Benzler's external camera provides a complete, unobstructed view of the entire pool along with the robot's exact location, orientation, and trajectory. A POSA would therefore understand that the external camera thus facilitates a more accurate monitoring and control of the robot. 451. A POSA would also have had a reasonable expectation of success in making this combination because Fu already provides an existing communication infrastructure that is external to the pool. For instance, Figure 7 illustrates a "control and power management system" that is external to the pool, and includes components such as the signal relay and cable manager 28 and the signal and power cable 33:

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Fig. 7 <i>Id.</i>, Fig. 7. This system establishes a communication path for transmitting controls signals and power between external hardware and the underwater robot. EX1007, ¶[0024] (e.g., floating antenna 27 relays signals from keypad 31 to the robot via cable 33). A POSA would understand that this same communication path could be used to transmit data from Benzler's camera 8, and/or control signals derived from images captured by camera 8, to the robot. As explained by Dr. Reinholtz, this would be a straightforward integration well within a POSA's skill. EX1010, ¶¶449-453. Thus, Fu in view of Benzler renders obvious claim 4: "the one or more cameras [Benzler's camera 8] are mounted external to the swimming pool or spa." <i>Id.</i>	Fig. 7 <i>Id.</i>, Fig. 7. 452. This system already establishes a communication path that is utilized to transmit controls signals and power between the external hardware and the underwater robot. A POSA would readily understand that this same communication path could be used to transmit data from Benzler's camera 8, and/or control signals derived from images captured by the camera 8, to the underwater robot. Fu's architecture thus provides an existing communication infrastructure that could easily be used to integrate Benzler's external camera 8. This would be a straightforward integration that is well within a POSA's skill. 453. Thus, Fu in view of Benzler renders obvious "[t]he pool system of claim 2, wherein the one or more cameras [Benzler's camera 8] are mounted external to the swimming pool or spa." Claim 4 would have been obvious over Fu in view of Benzler.
Section IV.C.5. 5. Claim 11 Claim 11 would have been obvious over Fu in view of Benzler. <i>Id.</i>, ¶¶454-455. Fu discloses an onboard controller (control system with central processor) in communication with the camera. EX1007, ¶¶[0024]-[0026]. A POSA would have recognized the advantages of implementing Benzler's external camera 8 with Fu's onboard	Section XIII.C.4. 4. Dependent Claim 11: "The pool system of claim 2, wherein the controller is remote from the camera." 454. Claim 11 would have been obvious over Fu in view of Benzler. As explained above for claim 4, a POSA would have recognized the advantages of implementing Fu with Benzler's external camera 8. Fu discloses an onboard controller (control system with the central

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controller (Section IV.C.4), making “the controller [onboard control system with central processor] [] remote from the camera [Benzler’s camera 8]” in Fu’s robot. Thus, Fu in view of Benzler renders obvious claim 11. EX1010, ¶¶454-455.	processor) in communication with the camera to process the camera’s images and guide the robot. A POSA would have been motivated to implement Benzler’s external camera 8 with Fu’s onboard controller, making “the controller [] remote from the camera” in Fu’s underwater robot. 455. Thus, Fu in view of Benzler renders claim 11.
Section IV.C.6. 6. Claims 2, 3, 5-8, 12-14, And 19 Independent claims 2 and 12 recite limitations similar to claim 1’s, and are obvious over Fu in view of Benzler for the reasons explained in Sections IV.C.2-3 for claim 1. Fu also discloses the limitations added in dependent claims 3, 5-8, 13, 14, and 19 (see Section IV.A for Ground 1a), such that these dependent claims are likewise obvious over Fu in view of Benzler. EX1010, ¶456.	Section XIII.C.5. 5. Claims 2, 3, 5-8, 12-14, And 19 456. Independent claims 2 and 12 recite limitations similar to those of claim 1 and are obvious over Fu in view of Benzler for the reasons explained in Sections XIII.C.1-2 for claim 1. Fu also discloses the limitations added in dependent claims 3, 5-8, 13, 14, and 19 (<i>see</i> Section XIII.A above for Ground 1a), such that these dependent claims are likewise obvious over Fu in view of Benzler.
Section IV.D.1. 1. Summary Of Schnittman Schnittman, EX1008, entitled “Debris Monitoring,” was filed December 30, 2011, and published July 5, 2012. EX1008, (22), (43). Schnittman incorporates by reference and claims priority to U.S. Provisional Application No. 61/428,808 (the “’808 provisional”), filed December 30, 2010. <i>Id.</i>, (60). Schnittman is prior art under at least pre-AIA 35 U.S.C. §§ 102(a) and (e). Schnittman discloses an autonomous cleaning robot having a debris monitoring system and onboard sensing for navigation and safety. <i>Id.</i>, Abstract, ¶¶[0002], [0004]-[0006].	Section X.B. B. Schnittman 101. Schnittman, EX1008, entitled “Debris Monitoring,” was filed December 30, 2011, and published July 5, 2012. EX1008, (22), (43). Schnittman incorporates by reference and claims priority to U.S. Provisional Application No. 61/428,808 (the “’808 provisional”), filed December 30, 2010. <i>Id.</i>, (60). Schnittman is prior art under at least pre-AIA 35 U.S.C. §§ 102(a) and (e). 102. Schnittman discloses an autonomous cleaning robot having a debris monitoring system and onboard sensing for navigation and safety. <i>Id.</i>, Abstract, ¶¶[0002], [0004]-[0006]. An example of Schnittman’s autonomous cleaning robots is depicted in Figure 3C:

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Id., Fig. 3C (example cleaning robot). Embodiments of Schnittman's cleaning robot include a drive assembly, cleaning assemblies, and a sensor suite, enabling behaviors such as debris-dependent spot cleaning, edge/cliff avoidance, and autonomous return to a maintenance/charging station. *Id.*, Fig. 2; ¶¶[0113], [0118]-[0119], [0191]-[0203], [0216]-[0227].

In embodiments, Schnittman's cleaning robot further includes a microprocessor 245 that executes routines and issues control signals to move the robot (*id.*, ¶¶[0118]-[0119]):

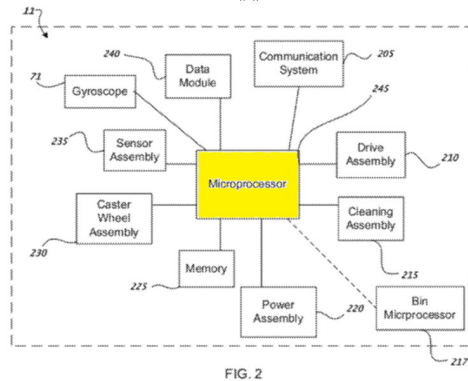
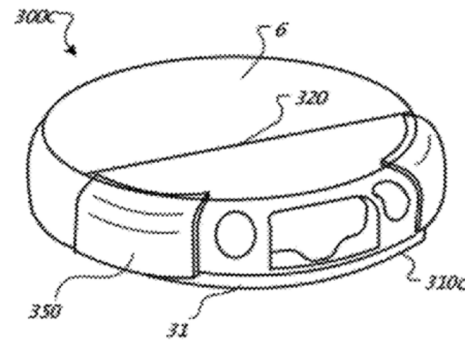


FIG. 2

Id., Fig. 2 (annotated).

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Id., Fig. 3C.

103. Embodiments of Schnittman's cleaning robot include a drive assembly, cleaning assemblies, and a sensor suite, enabling behaviors such as debris-dependent spot cleaning, edge/cliff avoidance, and autonomous return to a maintenance/charging station. *Id.*, Fig. 2; ¶¶[0113], [0118]-[0119], [0191]-[0203], [0113], [0216]-[0227]. 104. In embodiments, Schnittman's cleaning robot further includes a dedicated microprocessor 245 that executes routines and issues control signals to move the robot (*id.*, ¶¶[0118]-[0119]):

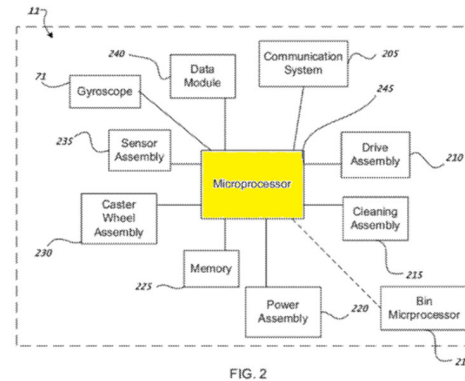
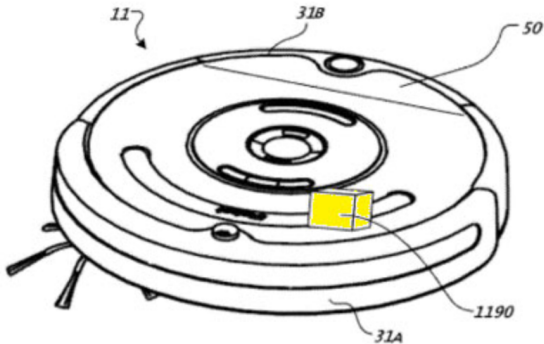
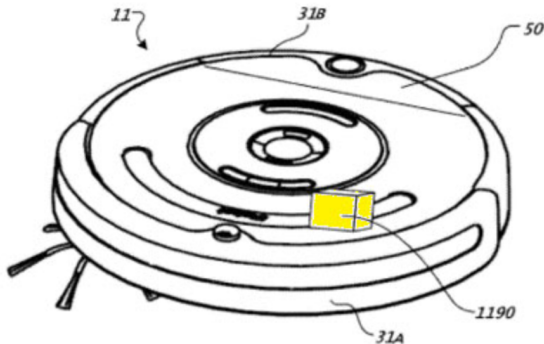


FIG. 2

Id., Fig. 2.

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Microprocessor 245 is connected to drive assembly 210, which includes differentially driven right and left wheels, wheel motors, and encoders. <i>Id.</i>, ¶[0119]. “The drive assembly 210 is operable to receive commands from the microprocessor 245.” <i>Id.</i> Additionally, “in some implementations, the robot 11 includes a camera 1190 disposed toward the forward portion of the robot 11, with a field of view beyond the perimeter of the robot 11” (<i>id.</i>, ¶[0204]):  FIG. 11 <i>Id.</i>, Fig. 11; see also <i>id.</i>, ¶[0045] (“In some implementations, the debris sensor includes a camera directed substantially forward of the cleaning apparatus. In certain implementations, the camera is movable to scan an area substantially forward of the cleaning apparatus.”). Camera 1190 is “in communication with the microprocessor 245,” which controls the robot based on signals received from the camera. <i>Id.</i>, ¶[0204]. Schnittman is analogous art to the '207 Patent because (1) it is from the same field of endeavor as the '207 Patent, and (2) it is reasonably pertinent to the problem faced by the inventors of the '207 Patent. EX1010, ¶109; see <i>Airbus S.A.S. v. Firepass Corp.</i>, 941 F.3d 1374,	105. As seen above, the microprocessor 245 is connected to drive assembly 210, which includes differentially driven right and left wheels, wheel motors, and encoders. <i>Id.</i>, ¶[0119]. “The drive assembly 210 is operable to receive commands from the microprocessor 245.” <i>Id.</i> 106. Schnittman further discloses that “in some implementations, the robot 11 includes a camera 1190 disposed toward the forward portion of the robot 11, with a field of view beyond the perimeter of the robot 11” (<i>id.</i>, ¶[0204]):  FIG. 11 <i>Id.</i>, Fig. 11. 107. Further, “[i]n some implementations, the debris sensor includes a camera directed substantially forward of the cleaning apparatus. In certain implementations, the camera is movable to scan an area substantially forward of the cleaning apparatus.” <i>Id.</i>, ¶[0045]. 109. Schnittman is analogous art to the challenged patents because (1) it is from the same field of endeavor as the challenged patents, and (2) it is reasonably pertinent to the problem faced by the inventors of the challenged patents. <i>First</i>, the challenged patents and Schnittman are in

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1379 (Fed. Cir. 2019). <i>First</i>, the '207 Patent and Schnittman are in the same field of endeavor: autonomous cleaning robots. Compare EX1005, 1:26-2:36 (automated, robotic cleaners for cleaning surfaces) with EX1008, ¶¶[0002]-[0003] (“This application relates to robots, and more particularly to autonomous coverage robots” for “removing debris from a surface.”). <i>Second</i>, Schnittman is reasonably pertinent to at least one problem purportedly addressed by the '207 Patent: ensuring “that all portions of ... pool surfaces are satisfactorily cleaned.” EX1005, 1:26-31. Schnittman describes adaptive cleaning based on detected debris: In response to an identification of debris on a surface, Schnittman’s autonomous cleaning robot can perform various actions, including altering its path, running spot cleaning patterns, and steering toward the debris. EX1008, Figs. 10A-10B; ¶¶[0024], [0191]-[0203]. This focuses cleaning efforts where they are most necessary and enables better cleaning coverage, thus ensuring satisfactory cleaning of a surface. EX1010, ¶109.	the same field of endeavor: autonomous cleaning robots. <i>Compare</i> EX1005, 1:26-2:36 (automated, robotic cleaners for cleaning surfaces) <i>with</i> EX1008, ¶¶[0002]-[0003] (“This application relates to robots, and more particularly to autonomous coverage robots” for “removing debris from a surface.”). <i>Second</i>, Schnittman is reasonably pertinent to at least one problem purportedly addressed by the '207 Patent: ensuring “that all portions of ... pool surfaces are satisfactorily cleaned.” EX1005, 1:26-31. Schnittman describes adaptive cleaning based on detected debris: In response to an identification of debris on a surface, Schnittman’s autonomous cleaning robot can perform various actions, including altering its path, running spot cleaning patterns, and steering toward the debris. EX1008, Figs. 10A-10B; ¶¶[0024], [0191]-[0203]. This focuses cleaning efforts where they are most necessary and enables better cleaning coverage, thus ensuring satisfactory cleaning of a surface.
Section IV.D.3. 3. Motivation To Combine Schnittman discloses an autonomous cleaning robot 11 with movement and cleaning decisions tied to an image received from a debris sensor, including embodiments where the debris sensor is a camera 1190. Section IV.D.1. Likewise, Benzler describes an autonomous robotic cleaning system, with a pool cleaning embodiment, that makes movement and cleaning decisions based on an image of the work area. Section IV.C.1. POSA would have understood that robotics principles underlying image-based cleaners, like those developed by leading manufacturers such as iRobot (assignee of Schnittman), are readily adaptable to different environments. EX1010, ¶¶457-466. Robotics, like any other technology, develops by building on existing technology and adapting	Section XIII.D.1. 1. Motivations To Combine 457. Schnittman discloses an autonomous cleaning robot 11 with movement and cleaning decisions tied to an image received from a debris sensor, including embodiments where the debris sensor is a camera 1190. Section X.B. . . . 459. . . .Benzler, like Schnittman, describes an autonomous robotic cleaning system that makes movement and cleaning decisions based on an image of the cleaning surface or work area. Section X.C. . . . 461. A POSA would have been motivated to consider Schnittman and Benzler together because they describe similar technology (<i>e.g.</i>, autonomous cleaning robots that employ computer vision) and address the same problem: enabling a robot to make cleaning and navigation decisions based on an image of the cleaning surface. At the time of the

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existing technology to new contexts. <i>Id.</i> POSAs in the field of autonomous pool cleaners were not working in isolation; they routinely drew on technologies from the broader field of autonomous cleaning. <i>Id.</i> Indeed, Benzler itself confirms this: it describes the same image-driven framework as Schnittman, while applying this framework to both land and water embodiments, such as a lawnmower, a snow cleaning vehicle, a pool cleaning vehicle, etc. Section IV.C.1; EX1013, ¶¶[0028], [0037], [0044]-[0046]. By describing the same image-based system across multiple domains, land and water alike, Benzler demonstrates that a POSA understood how to adapt the principles of image-based robotic navigation and cleaning across various environments. Benzler would have further reinforced a POSA's understanding that Schnittman's cleaning robot could be adapted for underwater use. For example, Benzler's teaching of a "moisture-sealed housing" for the internal logic unit (EX1013, ¶[0011]) contemplates operation in wet environments (<i>id.</i>, Fig. 3 (showing onboard logic unit 10 submerged in a pool)), providing a practical implementation detail that a POSA would have easily incorporated when adapting Schnittman's robot for underwater use. Likewise, Benzler's teaching of "pool robotic vehicles [that] drive in particular on the bottom of a pool" using wheels powered by a drive motor (<i>id.</i>, ¶¶[0028], [0051], Fig. 3) reinforces that Schnittman's similar motor-powered wheels 45 could be readily adapted for underwater use. Schnittman's image-based debris detection and navigation system, combined with Benzler's known underwater implementation of a similar image-based pool cleaner,	'207 Patent, POSAs working in the field of autonomous, image-based cleaning robots, whether for floors, lawns, or pools, were addressing the same core problem: how to use an image to enable a robot to perceive its cleaning surface, and execute cleaning operations autonomously. Both Schnittman and Benzler address that problem, and offer complementary, overlapping teachings that a POSA would have recognized as related. 462. At the time of the alleged invention (July 2012), a POSA would have understood that the robotics principles underlying such image-based cleaners, like those developed by leading cleaning robot manufacturers such as iRobot (assignee of Schnittman), were readily adaptable to different environments and mediums. Robotics, like any other technology, develops by building on existing technology and adapting existing technology to new contexts. POSAs working in the field of autonomous pool cleaners were not working in isolation; they routinely drew on technologies from the broader field of autonomous cleaning robots. Indeed, Benzler itself confirms this: it describes the same image-driven framework as Schnittman, with Benzler applying this framework to both land and water environments. 463. Benzler would have also reinforced a POSA's understanding that Schnittman's cleaning robot could be advantageously adapted for use in a pool-cleaning context. For example, Benzler's teaching of a "moisture-sealed housing" for the internal logic unit (<i>id.</i>, ¶[0011]) explicitly contemplates operation in wet environments, providing a practical implementation detail that a POSA would have readily incorporated when adapting Schnittman's camera-based cleaning robot for underwater use. Likewise, for instance, Benzler's teaching of "pool robotic vehicles [that] drive in particular on the bottom of a pool" using wheels powered by a drive motor (<i>id.</i>, ¶¶[0028], [0051], Fig. 3) reinforces that Schnittman's similar motor-powered wheels 45 could be readily adapted for underwater use. Schnittman's image-based debris detection and navigation system, combined with Benzler's known underwater implementation of a similar image-based robotic

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would predictably yield an image-based underwater pool cleaner that is driven based on an image of the pool surface. A POSA would have had a reasonable expectation of success in making this combination. EX1010, ¶¶457-466. By the time of the '207 Patent, the necessary adaptations to render a system water-ready were straightforward and within a POSA's skill, such as moisture-sealing or potting electronics, waterproofing, ensuring stable mobility and traction along submerged pool surfaces to counter buoyancy and slippage, and applying known image-processing techniques to extract useful information from underwater camera imagery. <i>Id.</i> For example, in the same period, the use of cameras on underwater cleaning vehicles was well known. <i>See, e.g.</i>, EX1014 ("underwater sediment cleaning apparatus ... wherein the controller ... comprises: a camera unit"), EX1015 ("Robotic submersible cleaning system" including "use of an intelligent camera system 81 [to] assist in maintaining the positional accuracy ... along an underwater surface"), EX1016 ("apparatus and method of ... inspecting a submerged surface of a fluid reservoir" including a "navigation camera 6"). Researchers documented effective techniques to improve the effectiveness of underwater imaging. For <i>e.g.</i>, literature from around that time described various normalization, filtering, and color-space methods that extract target information from underwater environments in real time. <i>See</i> EX1017, 7. These developments would have reinforced a POSA's motivation to extend the teachings of Schnittman to the underwater context, with Benzler providing clear guidance and confirmation that such an adaption was both known and would be successful.	pool cleaner, would predictably yield an image-based underwater pool cleaner that is driven based on an image of the pool surface. 465. Furthermore, a POSA would have had a reasonable expectation of success in making this combination. By the time of the '207 Patent, the necessary adaptations to render a system water-ready were straightforward and within a POSA's skill, with such adaptations including moisture-sealing or potting electronics, waterproofing housings, ensuring stable mobility and traction along submerged pool surfaces to counter buoyancy and slippage, and applying known image-processing techniques to extract useful information from underwater camera imagery. 466. For example, in the same period, the use of cameras on underwater vehicles was known (<i>see, e.g.</i>, EX1014, EX1015, EX1016), and researchers documented techniques to improve the effectiveness of underwater imaging. Literature from around the time of the '207 Patent described various normalization, filtering, and color-space methods that robustly extract target information from underwater environments in real time. <i>See</i> EX1017, 7. These developments would have reinforced a skilled artisan's motivation and reasonable expectation of success in adapting Schnittman to Benzler's pool-cleaning context. Thus, a POSA seeking to develop an autonomous pool-cleaning robot would have been motivated to extend the teachings of Schnittman to the underwater context, with Benzler providing clear guidance and confirmation that such an adaption was both known and would be successful.
Section IV.D.8. 8. Claim 5	Section XIII.D.6. 6. Dependent Claim 5: "The pool system of claim 2, wherein the one or more cameras are mounted on the at least one piece of equipment."

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Schnittman in view of Benzler would have rendered obvious claim 5. <i>Id.</i>, ¶514. Schnittman's "camera 1190 [is] disposed toward the forward portion of the robot 11": EX1008, Fig. 11, ¶[0204]. Thus, Schnittman in view of Benzler renders obvious claim 5: "the one or more cameras [camera 1190] are mounted on the at least one piece of equipment [robotic cleaner 11]." EX1010, ¶514.	514. Schnittman in view of Benzler would have rendered obvious claim 5. As explained above for element 1d, the Schnittman/Benzler pool-cleaning robot includes an onboard camera, <i>i.e.</i>, camera 1190 of Schnittman. Schnittman in view of Benzler thus renders obvious "wherein the one or more cameras are mounted on the at least one piece of equipment."
Section IV.D.15. 15. Claim 19 Schnittman in view of Benzler would have rendered obvious claim 19. <i>Id.</i>, ¶¶534-536. As explained for claim 3, implementation of Schnittman's robotic cleaner 11 in view of Benzler renders obvious a "cleaning device" "configured to travel adjacent to submerged or water-containing surfaces of the swimming pool or spa and to perform a cleaning operation." Section IV.D.6. Further, microprocessor 245 causes robot 11 to move based on detected debris and/or in different cleaning patterns (<i>id.</i>, ¶¶[0177], [0191]-[0203]): Accordingly, Schnittman in view of Benzler renders obvious claim 19: "generating the control response comprises controlling operation of a cleaning device [robotic cleaner 11] configured to travel adjacent to	Section XIII.D.13. 13. Dependent Claim 19: "The method of claim 12, wherein generating the control response comprises controlling operation of a cleaning device configured to travel adjacent to submerged or water-containing surfaces of the swimming pool or spa and to perform a cleaning operation, wherein controlling operation of the cleaning device comprises one or more of controlling a path or route of the cleaning device, an aggressiveness of cleaning chemicals deployed, an aggressiveness of mechanical cleaning, or a speed of the cleaning device." 534. Schnittman in view of Benzler would have rendered obvious claim 19. As explained above for claim 3, the combination of Schnittman and Benzler renders obvious controlling a pool-cleaning robot such that it "travel[s] adjacent to submerged or water-containing surfaces of the swimming pool or spa and [] perform[s] a cleaning action." <i>See</i> Section XIII.D.4 above. Accordingly, Schnittman in view of Benzler renders obvious "wherein generating the control response comprises controlling operation of a cleaning device configured to travel adjacent to submerged or water-containing surfaces of the swimming pool or spa and to perform a cleaning operation" of claim 19. 535. Further, as explained above for claim 14, Schnittman in view of Benzler renders obvious generating control signals that cause the robot

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submerged or water-containing surfaces of the swimming pool [pool surfaces] or spa and to perform a cleaning operation, wherein controlling operation of the cleaning device comprises one or more of controlling a path or route of the cleaning device [maneuvering robot 11 based on detected debris or cleaning patterns], an aggressiveness of cleaning chemicals deployed, an aggressiveness of mechanical cleaning, or a speed of the cleaning device.” EX1010, ¶¶534-536.	to move towards or away from debris, thus “controlling a path or route of the cleaning device,” as claimed and as shown in Figures 10A and 10B of Schnittman: 536. Accordingly, Schnittman in view of Benzler renders obvious “wherein controlling operation of the cleaning device comprises one or more of controlling a path or route of the cleaning device, an aggressiveness of cleaning chemicals deployed, an aggressiveness of mechanical cleaning, or a speed of the cleaning device.”