

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MINKA LIGHTING, LLC
Petitioner,

v.

WANGS ALLIANCE CORPORATION
Patent Owner

U.S. Patent No. 11,028,854

Case IPR2024-01027

**EXHIBIT 1003 – DECLARATION OF DR. PAUL MIN
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 11,028,854**

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Petitioner Minka - EX1003
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PETITIONER'S EXHIBIT LIST

No.	Short Name	Reference
1001	'854 Patent	Certified copy of U.S. Patent No. 11,028,854 to Stefankiewicz et al.
1002	'854 File Hist.	Certified File Prosecution History of the '854 Patent
1003	Min Decl.	Expert Declaration of Paul Min, Ph.D.
1004	Min CV	Curriculum Vitae of Paul Min
1005	Markman Order	Inv. No. ITC-337-TA-1374 – Order Construing Terms of the Asserted Claims
1006	Qirong	Certified translation of Chinese Utility Model Patent No. 206738206
1007	Yun	Certified translation of Chinese Utility Model Patent No. 204783774
1008	McPherson	U.S. Patent Publication No. 2015/0325112
1009	Hunter Fan	Hunter Fan Co., M3602-01 Installation Guide (2016)
1010	Suro	U.S. Patent Publication No. 2013/0073431
1011	Fanimation	Fanimation, 2017 Showroom Collection
1012	Ahmed	Ahmed et al., Design and Construction of a Remote Controlled Fan Regulator, Leonardo Electronic Journal of Practices and Technologies Issue 9 pp. 55-62 (July 2006)
1013	Lach	Lach et al., Smart Home System Operating Remotely Via 802.11b/g Wireless Technology (January, 2007)
1014	Mehta	U.S. Patent No. 5,689,261 to Mehta et al.
1015	Hart	U.S. Patent No. 5,041,825 to Hart et al.
1016	McDonough	U.S. Patent No. 6,120,262 to McDonough et al.
1017	Mangla	Mangla et al., A Comprehensive Review: Internet of Things (IOT), IOSR Journal of Computer Engineering, Vol. 19, Issue 4, pp 62-72 (July, 2017)

1018	Sailaja	Sailaja et al., Literature Survey on Real World Applications using Internet of Things, 2018 IADS International Conference on Computing, Communications & Data Engineering (April, 2018)
1019	Matsuoka	U.S. Patent Publication No. 2014/0101082
1020	Li	Li et al., Research and application on the smart home based on component technologies and Internet of Things, pp 2087-92 (2011)
1021	Haiku Guide	Big Ass Fans, Haiku 60 Installation Guide (2014)
1022	Haiku Case Study	Big Ass Fans, Kinetis MCUs – The Brain Behind a Remarkably Smart Fan (2016)
1023	Bauer	U.S. Patent Publication No. 2015/0137941
1024	Festus	Festus et al., Development of a Rechargeable Fan, pp 43-46 (September, 2017)
1025	Weidong	Certified translation of Chinese Utility Model Patent No. 204716567
1026	Stay Order	<i>Minka Lighting, LLC v. Wangs Alliance Corporation</i> , Case No. 5-23-cv-02493-AB-SHK, (C.D. Cal.) – Order Granting Plaintiff’s Unopposed Motion to Stay Pending Resolution of Related ITC Proceeding
1027	Computer Dictionary	Microsoft Computer Dictionary, Fifth Edition, Microsoft Press (2002)
1028	Oxford Computer Dictionary	Oxford Dictionary of Computer Science, Seventh Edition, Oxford University Press (2016)
1029	Oxford English Dictionary	Oxford English Dictionary, <i>synchronize</i> (2016), https://www.oed.com/dictionary/synchronize_v?tl=true
1030	Haiku Technical Specifications	Big Ass Fans, Haiku 60 Technical Specifications (2015)
1031	’274 Provisional Application	U.S. Provisional Patent Application No. 62/617274

1032	'152 Provisional Application	U.S. Provisional Patent Application No. 62/617152
1033	ARM Spec.	Specfication for ARM Cortex-M4 processor
1034	Mason	U.S. Patent 78,674
1035	Fan History	LA Times, “Whirlwind History of Ceiling Fans” (1997).
1036	WAC Claim Construction	Inv. No. ITC-337-TA-1374 – WAC Opening Claim Construction Brief
1037	Minka Claim Construction	Inv. No. ITC-337-TA-1374 – Minka Opening Claim Construction Brief

I. INTRODUCTION

1. I, Paul Min, have been retained by Minka Lighting, LLC (Petitioner) as an independent, technical expert consultant in this proceeding before the United States Patent and Trademark Office (USPTO).

2. This Declaration is in support of the Petition for *inter partes* review involving U.S. Patent 11,028,854 (the “’854 Patent” or “the Patent”) (EX1001), entitled “Methods and apparatus for controlling fan devices” and listing Eric Stefankiewicz and Shelley Wald as inventors. I have been informed that Wangs Alliance Corporation (“WAC”) is the Patent Owner.

3. This declaration is based on information currently available to me, including the prior art discussed herein. I may also supplement my opinions in response to any additional information that becomes available from Patent Owner and/or any opinions provided by Patent Owner or its expert(s)

4. I am being compensated at my rate of \$500.00 per hour for my services. No part of my compensation is dependent on my opinions or on the outcome of this proceeding. I have no financial interest in any of the parties to this proceeding.

II. QUALIFICATIONS

5. My qualifications for forming the opinions in this report are summarized here and explained in more detail in my curriculum vitae (“CV”), which is submitted as Exhibit 1004.

6. I am currently a Senior Professor in the Department of Electrical and Systems Engineering at Washington University in Saint Louis. I received a B.S. degree in Electrical Engineering in 1982, an M.S. degree in Electrical Engineering in 1984, and a Ph.D. degree in Electrical Engineering in 1987 from the University of Michigan in Ann Arbor. I received several academic honors, including my B.S. degree with honors, a best graduate student award and a best teaching assistant award during my M.S. study, and a best paper award from a major international conference for reporting results from my Ph.D. thesis. After receiving my Ph.D., I worked at Bellcore in New Jersey from August 1987 until August 1990. At Bellcore, I was responsible for evolving the public switched telephone network (PSTN) into a multi-services voice and data network that incorporated packet switches, optical technologies, and wireless technologies. I received an Outstanding Achievement Award for my contributions to Bellcore in 1989.

7. In September 1990, I joined the faculty at Washington University in St. Louis. Upon arriving at Washington University, I developed a communication and computer curricula in the School of Engineering and Applied Science. I

regularly teach undergraduate and graduate courses. In July 1996, I was promoted to an Associate Professor of Electrical Engineering with tenure. I am currently a Senior Professor of Electrical and Systems Engineering at Washington University. I have served as the Chair of the Graduate Curriculum (2000–2002) and the Chair of the Undergraduate Curriculum (2011–2014) for the Department of Electrical and Systems Engineering.

8. At Washington University, I conducted research in communication, computing, and related electronic hardware and software. My research group has pioneered a new paradigm for computing and communication systems that can alleviate the speed and performance mismatch against optical technology. I have received several grants from U.S. Federal Agencies, including the National Science Foundation (NSF), the Defense Advanced Research Project Agency (DARPA), and the Air Force Office of Scientific Research (AFOSR), and numerous contracts from companies and organizations around the world.

9. My research group has significantly contributed to development of future generations of wireless technology. I developed methods that enable coordinated transmission and reception of wireless signals among multiple base stations. Previously, radio signals from multiple base stations were considered as interference. Leveraging my research, a cluster of base stations can work together

as a single resource enhancing the quality of radio signals across extremely noisy wireless channels.

10. I developed and implemented a number of semiconductor integrated circuit chips. These integrated circuit chips include switch fabrics, processors, high-speed interfaces, protocol transposers, controllers, content search engines, look up table processors, and memory cells and arrays.

11. As a faculty member at Washington University, I have taught a number of courses in electronics, communication, and computing at both the undergraduate and graduate levels. For example, I have regularly taught Introduction to Electronic Circuits (Washington University ESE 232), Reliability and Quality Control (Washington University ESE 405), Communication Theory (Washington University ESE 471), Transmission and Multiplexing (Washington University ESE 571), and Signaling and Control of Communication Networks (Washington University ESE 572).

12. I have directly supervised numerous graduate students, a number of whom received a doctoral degree under my guidance. My students and I have published a number of peer-reviewed articles in various topics.

13. In addition to my responsibilities as a university faculty member, I have founded two companies. In May 1997, I founded MinMax Technologies, Inc., a fabless semiconductor company that developed switch fabric integrated

circuit chips for the Internet. In March 1999, I founded Erlang Technology, Inc., a fabless semiconductor company that focused on the design and development of integrated circuit chips and software for the Internet. One of Erlang's products received a best product of the year award in 2004 from a major trade journal for the electronics industry.

14. Outside my own start-up companies, I have also served in various technology and business advisor roles for other companies and organizations around the world. I was the main technical author for one of two winning proposals to the Korean government for CDMA wireless service licenses (1996). I was responsible for designing a commercial-scale IS-95 CDMA cellular network, which I understand to be one of the earliest such networks deployed in the world. I worked with numerous engineers and scientists around the world to implement this commercial-scale cellular network before IS-95 CDMA was widely accepted. This provided me with extensive insight into various components of commercial-scale communication technology used today. I have also been involved in a semiconductor company that specializes in semiconductor memories, such as flash EEPROMs, as a board member and as a technical advisor (2007–2011).

15. Specifically related to the technologies at issue in this *inter partes* review proceedings, I have designed and developed various high-performance computing and wireless communication systems that utilized inter-processor

communication, distributed sensor and actuator processing, power circuitry, circuit switching, Wi-Fi/ZigBee protocols, and RF communication. Some of my former students worked in the smart device and wireless communication industry based on the training received under my guidance.

16. I am a named inventor on eleven U.S. patents. I have authored and co-authored numerous technical papers and memoranda, many of which have appeared in various peer-reviewed international journals and conferences. I have given more than 100 seminars and invited talks around the world. I have organized several international conferences and served as an international journal editor.

17. I am a member of, and have been actively involved in, a number of professional organizations. I have served as the Chair of the St. Louis Section of the IEEE, which has more than 3,000 members (2014), and a member of the Eta Kappa Nu Honor Society for electrical engineers. I have also been an Ambassador of the McDonnell International Scholars Academy (2007-2013).

18. I have received multiple awards for my publications and contributions to technical communication systems. In 1988, I received the Best Paper Award at 18th ISATA Award of Technical Excellence in Florence, Italy. I was also a Rockwell Fellow at the University of Michigan in Ann Arbor in 1988 and 1989. I received a Research Initiation Award in 1993 from the Defense Advance Research Project Agency (DARPA). I received the Best Paper Award at MOBILITY 2011

in Barcelona, Spain. In my more than 30 years of experience with telecommunications technology, I have acquired significant knowledge about wireless communication and remote control systems, their implementation, and the associated industry standards.

19. Additional details of my education and work experience, awards and honors, and publications that may be relevant to the opinions I have formed are set forth in my curriculum vitae, which is submitted as EX1004.

20. I am over 18 years of age and currently reside in the state of Missouri. I have personal knowledge of the facts stated in this declaration and could testify competently to them if asked to do so.

III. LEGAL STANDARDS

21. I am not an attorney and offer no legal opinions, but in the course of my work, I have had experience studying and analyzing patents and patent claims from the perspective of a POSA. I have been informed by counsel of certain legal standards and have applied those standards, described below, in formulating my opinions.

A. Claim Construction

22. I understand that the claims of a patent define the limits of the patentee's exclusive rights. I understand that to determine the scope of the claimed invention, courts typically construe claim terms, the meaning of which the parties

may dispute. I understand that claim terms should generally be given their ordinary and customary meaning as understood by a POSA at the time of filing of the patent application, after reading the patent and its prosecution history. I also understand that a basic tenet of claim construction presumes that different words in a claim have different meanings, unless there is evidence to the contrary. A claim term, for instance, will not receive its ordinary meaning if the patentee acted as his or her own lexicographer and clearly set forth a definition of the claim term in the specification. In that case, the claim term will receive the definition set forth in the patent.

23. I understand that claims must be construed in light of and consistent with the intrinsic evidence. In this context, I understand that intrinsic evidence includes the claims themselves, the written disclosure in the specification, and the patent's prosecution history, including prior art that was considered by the United States Patent and Trademark Office. I understand that the specification is always highly relevant to the claim construction analysis and often is the single best guide to the meaning of a disputed term. I understand that extrinsic evidence may also be considered when construing claims and may include, for example, technical dictionaries, technical publications and books, treatises, and expert testimony, though the intrinsic record will be more persuasive as to the meaning of a particular term.

24. I understand that a claim's preamble is considered to be limiting if it recites essential structure or steps or it is necessary to give life, meaning, and vitality to the claim. On the other hand, I understand that a preamble is not limiting where the body of a claim defines a structurally complete invention and the preamble only states a purpose of intended use for the invention.

B. Person of Ordinary Skill in the Art ("POSA")

25. I understand that certain issues relating to validity must be judged from the perspective of a person of ordinary skill in the art ("POSA") with respect to the claimed subject matter of the '854 Patent. I have been informed and understand that claims are generally given their ordinary and customary meaning as understood by a POSA at the time of the alleged invention, in light of the patent specification and prosecution history. Such an individual is presumed to be aware of all pertinent prior art, thinks along conventional wisdom in the art, and is a person of ordinary creativity. I have been informed and understand that in considering what the claims of a patent require, what was known prior to that patent, what a prior art reference discloses, and whether an invention is obvious or not, one must use the perspective of a POSA.

26. I understand that, when there is a reason to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. I

further understand that, if this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense, which bears on whether the claim would have been obvious.

27. I further understand that the factors that may be considered in determining the level of skill of a POSA include, but are not limited to, (1) the type of problems encountered in the art; (2) prior art solutions to those problems; (3) rapidity with which innovations are made; (4) sophistication of the technology; and (5) the educational level of active workers in the field.

C. Anticipation

28. I have been informed and understand that a patent claim is anticipated under 35 U.S.C. §102, and therefore unpatentable, if every element of the claimed subject matter is described by a single, prior art publication.

D. Obviousness

29. I understand that a prior art reference can render a patent claim obvious (i.e., unpatentable) to one of ordinary skill in the art if the differences between the subject matter set forth in the patent claim and the prior art are such that the subject matter of the claim would have been obvious at the time the claimed invention was made. For example, a combination of familiar elements according to known methods is likely to be obvious if the combination does no more than produce predictable results.

30. In analyzing obviousness, I understand that it is important to consider the scope of the claims, the level of skill in the relevant art, the scope and content of the prior art, the differences between the prior art and the claims, and any secondary considerations. I further understand that the POSA is not an automaton but one having common sense and ordinary creativity. I also understand that a claim is not obvious simply because a combination of prior art references discloses each claim element collectively.

31. I understand that a POSA is assumed to have knowledge of all prior art references. I also understand that when considering the obviousness of a patent claim, one should consider whether a teaching, suggestion, or motivation to combine the references exists so as to avoid impermissibly applying hindsight when considering the prior art. I understand this test should not be rigidly applied, but that the test can be important to avoiding such hindsight.

32. I understand that the claimed subject matter is obvious when an ordinary artisan would have been motivated to combine pre-existing elements and that combination yields no more than would have been expected. I also understand that in assessing whether a claim is obvious, one must consider whether the claimed improvement is more than the predictable use of prior art elements according to their established functions. I understand that a motivation to combine the references may be implicit in the prior art, and there is no requirement that

there be an actual or explicit teaching to combine two references. Thus, one may take into account the inferences and creative steps that a POSA would employ to combine the known elements in the prior art in the manner claimed by the patent-at-issue. I understand that one should avoid “hindsight bias” and ex post reasoning in performing an obviousness analysis. I understand that in an obviousness analysis, neither the motivation nor the avowed purpose of the inventors controls the inquiry. Any need or problem known in the field at the time of the invention and addressed by the patent can provide a reason for combining elements.

33. I further understand that obviousness is a legal conclusion based on the underlying factual issues of the scope and content of the prior art, the differences between the claimed invention and the prior art, the level of ordinary skill in the art, and any objective indicia of non-obviousness. For that reason, I am not rendering a legal opinion on the ultimate legal question of obviousness. Rather, my testimony addresses the underlying facts and factual analysis that would support a legal conclusion of obviousness, and when I use the term obvious, I am referring to the perspective of a POSA at the time of invention.

IV. MATERIALS CONSIDERED

34. In preparing this Declaration, I have reviewed the '854 Patent (EX1001) and its prosecution history (EX1002), the prior art, as well as the patents

and documents cited herein, and I have considered these documents in light of the general knowledge in the art.

35. The '854 Patent is generally directed to a system for controlling fan devices via two or more wireless interfaces. I am familiar with the technology described in the '854 Patent as of the earliest claimed filing date of January 12, 2018. For the purposes of this *inter partes* review, as I discuss later, I have been instructed to assume that the effective filing date of the Claims of the '854 Patent challenged by the Petitioner in this *inter partes* review is January 12, 2018, the filing date of Provisional Application No. 62/617,152. EX1032.

36. In formulating my opinions, I have relied upon my experience in the relevant art. I have also considered the viewpoint of a person of ordinary skill in the art ("POSA") in the relevant field, as of January 12, 2018, who I describe below. For convenience, the materials I considered in arriving at my opinions are listed in Appendix A.

37. The opinions and comments formulated during this assessment are based on observations and information available at the time of the investigation. The findings presented herein are made to a reasonable degree of scientific certainty. My opinions reflect how one of ordinary skill in the art would have understood the '854 Patent, the prior art, and the state of the art at the time of the effective filing date.

V. SUMMARY OF OPINIONS

38. For the reasons I discuss below, it is my opinion that claims 1-4 and 8-10 of the '854 Patent are unpatentable for the following reasons:

- Claims 1-4 and 8-10 are unpatentable as obvious over Yun combined with McPherson.
- Claims 1-4 and 8-10 are unpatentable as obvious over Qirong.
- Claims 1-4 and 8-10 are unpatentable as obvious over Qirong combined with Yun.

VI. '854 PATENT

A. Overview

39. The '854 Patent, entitled “Methods and apparatus for controlling fan devices,” relates to a system for controlling fan devices using two or more interfaces. EX1001, Title, 1:14-18. Specifically, the claimed "fan device includes an RF interface and a WiFi interface.” EX1001, 1:15-18, 2:1-5. The “RF and WiFi control” interfaces replace the “unsightly” pull-cords that are commonly used on ceiling fans. EX1001, 1:39-45, 2:3-5. The RF interface can receive “RF control signals which are sent by control unit[s]” (e.g., wall-controller) to control the fan’s “speed and/or fan light on/off status and intensity.” EX1001, 2:3-5, Abstract, 7:25-26, 2:19-21. Likewise, the WiFi interface receives “WiFi communications ... from a WiFi capable device, e.g., a cell phone, to control the

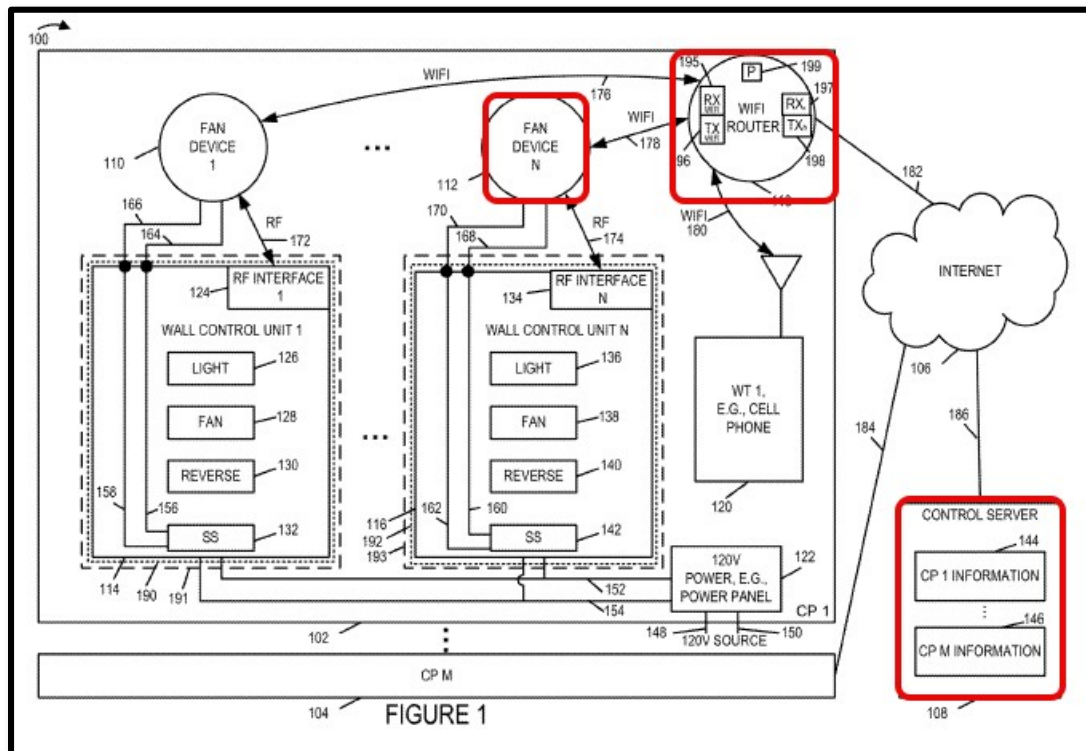
fan device and its various functions.” EX1001, 26:52-54. Therefore, the “fan device can be controlled either by the wall controller or a WiFi device.” EX1001, 27:10-11. The ’854 Patent also states that “[i]n some, but not necessarily all embodiments, the fan device reports its state and/or changes in state due to received commands to a server, e.g., located outside the customer premises.” EX1001, 27:13-15.

40. The ’854 Patent further states that the fan device communicates with an external server. EX1001, Abstract, 2:34-37, 13:21-24, Figure 1.

- A user can login to the control server and once authenticated is allowed to send control commands to devices at the home via the control server and the WiFi router. In this way a user can control devices while away from the home. In the case of commands sent via the server, the server can, and sometimes does, update device state information based on the commands sent from the server to the device to be controlled thereby eliminating the need for the device to report a state change to the server...in other embodiments the devices being controlled, e.g., fan devices, routinely report a state change to the control server regardless of whether the command was from the server, wall controller or WiFi device in the home. EX1001, 3:9-24.

41. The ’854 Patent further states that a user sends control commands to a fan device via the control server and the WiFi router. EX1001, 3:8-11, 15:21-23. Commands sent from the control server cause the server to update stored device state information. EX1001, 3:12-16, 16:31-34; see also 29:35-38 (“the control server allows a user to store setting, instruction, and commands for the operation of one or more of a set of fan devices.”). In other embodiments, the fan devices

report a state change to the control server regardless of whether the command was from the server, wall controller, or WiFi device in the home. EX1001, 3:17-24, 14:1-4. This process is depicted in Figure 1.



(EX1001 Fig. 1) (annotated)

B. Prosecution History

42. I have reviewed the file history of the '854 Patent. EX1002. I summarize the relevant information that I have reviewed pertaining to my opinion.

43. I understand that EX1002 is a true and correct copy of the file history of the '854 Patent. The file history contains application number 15/871,044 ("the '044 Application") and a January 14th, 2018, filing date. The '044 Application claims priority to provisional application 62/617,152 (EX1032) filed on January

12, 2018 and provisional application 62/617,274 (EX1031), filed January 14, 2018.

The '044 Application was filed with 20 total claims. Claims 1 and 10 were independent.

44. On March 26, 2019, the 20 claims as filed in the '044 Application were rejected based on U.S. Patent Application Publication 2013/0073431 (“Suro”) (EX1010). EX1002, 126.¹

45. After amending the claims, Applicants argued that Suro failed to disclose a fan device including “both a radio frequency (RF) signal receiver and a WiFi interface.” EX1002, 152-54. Applicants further argued that the Examiner had failed to identify in their office action, where Suro disclosed a “fan motor,” “radio frequency signal receiver,” and “WiFi interface.” EX1002, 152. On October 2, 2019, the Examiner found the Applicant’s arguments unpersuasive and maintained the rejection. EX1002, 289.

46. Applicants then filed a Notice of Appeal followed by a later Request for Continued Examination (RCE). EX1002, 314, 327. Specifically, in the RCE, Applicants cancelled then-pending claims 1-9 and amended the remaining claims to recite “a fan motor control circuit,” and a first and second: [1] “frequency,” [2] “signal,” [3] “operation,” [4] “indication,” and [5] “processor.” EX1002, 334-38.

¹ All citations to page numbers herein refer to the pagination provided pursuant to 37 CFR §42.63.

The Office subsequently allowed the '044 Application and issued a notice of allowance for the issued '854 Patent. EX1002, 347.

Listing of Claims

1-9 (Cancelled).

10 (Currently amended). A system comprising:
a fan device mounted to a ceiling comprising:
a fan motor;
a fan motor control circuit;
a processor in electrical communication with the fan motor control circuit;
a radio frequency interface (RF)-signal receiver configured to receive, at a first frequency, a signal radio-frequency (RF)-control signals from a control unit, said fan device and said control unit being located at a customer premises; and
a WiFi interface configured to communicate at a second frequency that is different from the first frequency;
wherein:
the fan motor control circuit is configured to cause the fan motor to perform an operation in response to the signal; and
the processor is configured to transmit, via the WiFi interface, to a server, an indication corresponding to the operation
a fan motor control circuit configured to control the fan motor in response to a received first radio-frequency control signal, said first radio-frequency control signal communicating a first command; and
a first processor configured to communicate to a server, located outside the customer premises, via the WiFi interface, information indicating an operation implemented in response to the first command.

11 (Currently amended). The system of claim 10, wherein said fan device further comprises further comprising, when the signal is a first signal, the operation is a first operation, and the indication is a first indication:
a light; and
a light control circuit configured to cause the light to perform a second operation in response to a second signal received by the radio frequency interface control the light in response to a received second radio-frequency control signal, said second radio-frequency control signal communicating a second command; and
wherein said first the processor is further configured to communicate to said transmit to the server, via the WiFi interface, information indicating an operation implemented in response to said first command a second indication corresponding to the second operation.

(EX1002, 334-35) (annotated)

47. As I explain in the rest of the declaration, the particular features that led to the allowance of the application, namely—“a radio frequency interface configured to receive at a first frequency, a signal [and] a WiFi interface configured to communicate at a second frequency different from the first frequency”—were well known in the art.

C. Challenged Claims

48. I understand the Petitioner is challenging the following claims of the '854 Patent:

Reference	
Claim 1	
1[pre]	A system comprising:
1[a]	a fan motor;
1[b]	a fan motor control circuit;
1[c]	a processor in electrical communication with the fan motor control circuit;
1[d]	a radio frequency interface configured to receive, at a first frequency, a signal;
1[e]	a WiFi interface configured to communicate at a second frequency that is different from the first frequency; wherein:
1[f]	the fan motor control circuit is configured to cause the fan motor to perform an operation in response to the signal; and;
1[g]	the processor is configured to transmit, via the WiFi interface, to a server, an indication corresponding to the operation.
Claim 2	
2[a]	The system of claim 1 further comprising, when the signal is a first signal, the operation is a first operation, and the indication is a first

	indication:
2[b]	a light; and
2[c]	a light control circuit configured to cause the light to perform a second operation in response to a second signal received by the radio frequency interface;
2[d]	wherein the processor is further configured to transmit to the server, via the WiFi interface, a second indication corresponding to the second operation.
Claim 3	
3[a]	The system of claim 2 wherein: the first indication corresponds to an operation selected from the group consisting of: fan on, fan off, fan power state change, fan speed-up, fan speed-down, and fan direction-change; and
3[b]	the second indication corresponds to an operation selected from the group consisting of: light on, light off, light power state change, light increase, and light decrease.
Claim 4	
4	The system of claim 1 further comprising a housing; wherein the fan motor, the fan motor control circuit, the processor, the radio frequency interface, and the WiFi interface are disposed in the housing.
Claim 8	
8 [a]	The system of claim 1 further comprising, when the processor is a first processor, the server; wherein the server includes a second processor configured to cause the server to:
8 [b]	receive a command directed to the first processor; and
8 [c]	communicate the command via the Internet and a WiFi router to the first processor.
Claim 9	
9	The system of claim 8 wherein the second processor is further configured to cause the server to update information about a state of a device that is in a wireless local network based on the command.

Claim 10	
10	The system of claim 9 wherein the second processor is further configured to cause the server to update the information in response to transmitting the command from the server.

VII. THE STATE OF THE ART IN JANUARY 2018

49. The '854 Patent broadly describes a remote fan control system wherein fan device can be controlled by WiFi and RF controllers. EX1001, Abstract. The claims of the '854 Patent recite a generic combination of techniques involving: [1] fan mechanics, [2] RF control, [3] WiFi control, [4] mixed signal communications, and [5] Internet of Things ("IoT") technology. As explained below, each was well-understood by a POSA by the earliest priority date of the '854 Patent.

A. Fan Mechanics

50. Electric ceiling fans have been known since the 1800s. EX1034; EX1035, 1. In the 1920s, ceiling fans made their way into the home and were mass produced. EX1035, 2. A POSA would understand the conventional mechanical and electrical principals behind the common-place ceiling fan claimed in the '854 Patent. Electric fan devices and conventional ceiling fans have been prevalent since the 1900s. EX1035, 1; EX1025, [0002] ("a traditional and classical ceiling fan"); EX1024, 2; EX1015, 1:13-18 ("Ceiling fans are often combined with light fixtures"); EX1014, 1:14-15 ("Ceiling fans are typically mounted on the

ceiling of a room for circulating the air in the room.”). Typically, a ceiling fan “is made up of blades, hub, motor, switch, guard, mount and a power cord”. EX1024, 2; *see also* EX1025, Abstract. Conventional fans use a fan motor to move the fan blades and enable rotation. EX1025, [0003]; EX1024, 2; EX1011, 5 (“Our fans are equipped with either an AC motor or DC motor. [] DC motors convert supplied power and regulate speeds by controlling electrical current.”) A fan control circuit enables drives and controls the operation of the fan motor and corresponding fan blades. EX1012, 2; EX1014, 6:47-48 (“a fan speed control circuit 64 that controls the speed of the ceiling fan 2”).

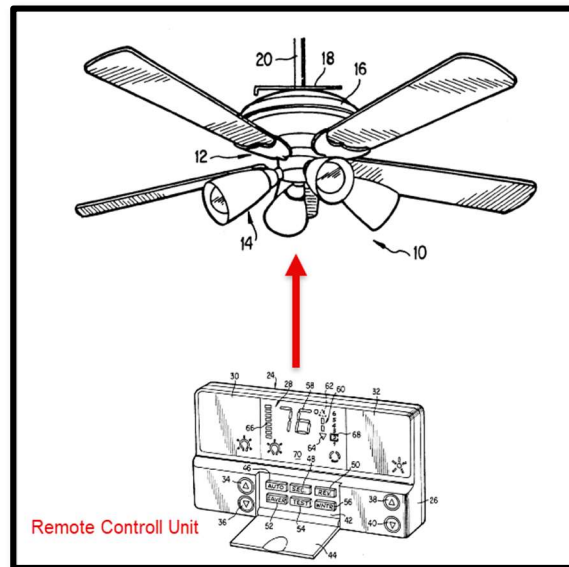
B. RF Control

51. Remote controls have long been standard in consumer electronic products, including VCRs, cable and satellite boxes, digital video disc players, home audio players, and ceiling fans. EX1012, 1-2 (“Remote control facilitates the operation of fan regulators around the home or office from a distance. It provides a system that is simple to understand and also to operate, a system that would be cheap and affordable, a reliable and easy to maintain system of remote control and durable system irrespective of usage.”); EX1014, Abstract, 2:24-39, EX1015, 1:9-10, 1:13-21, EX1016, Abstract, 1:12-13, 2:18-25 (“A common application for a remote control System is an electric ceiling fan”).

52. Moreover, RF remote controls are cheap, reliable, and have been commonplace since the 1990s. EX1014, Abstract (“An RF remote control system for operating a ceiling fan.”); EX1008, [0028], Abstract (“a second radio transmitter/receiver operating at a second frequency suitable for communicating with the one or more ceiling fans.”); EX1012, 1 (“a system that is simple to understand and also to operate, a system that would be cheap and affordable, a reliable and easy to maintain system of remote control and durable system irrespective of usage.”) Conventional RF remote control systems comprise an RF controller communicating over RF frequencies, and a device containing an RF receiver. EX1008, [0025]. RF receivers comprise at least one antenna for receiving an RF signal. EX1015, 3:20-25 (“The ceiling unit circuitry includes a radio receiver, the antenna.”). The RF frequency bands for conventional remote control are characterized as 300 HZ to 3000 GHz, which includes both the sub-GHz RF bands for RF control of electronic devices, and the GHz WiFi bands as stated in the ’854 Patent. EX1027, 10; EX1028; 4.

53. The RF receivers filters unwanted RF frequencies to prevent signal interference and amplifies the attenuated (i.e., desired) signal without introducing noise. EX1008, [0030]. However, a POSA would have understood that the receiving and transmission components in a communication link may rely on any number of protocols of frequency bands. EX1008, [0031-32]. For instance, data

communications between controllers and devices “are generally carried out using any of a large variety of different types of communications media and protocols,” allowing for mixed communication capabilities in a single wireless device. EX1019, [0065]; EX1008, [0028] (“wireless communication link can include any wireless technology standard.”).



(EX1015, Fig. 1 & 3) (combined).

54. Moreover, the mechanism by which RF remote control specific fan functions was well known. “The remote controllers use radio frequency (RF) transmission to send control signals to the receiver. The receiver utilizes a microprocessor to process the control signals.” EX1014, Abstract, Title (“Remote Control System for Ceiling Fan and Light”); EX1015, 3:26-27 (“For convenience, remote control units 24, which control ceiling unit 10.”); EX1016, 1:63-65 (“the user may wish to use the handheld remote to adjust the fan Speed or light intensity.”) RF control systems enable the implementation of complex instructions

compared to traditional in-wall controllers, buttons, and pull-cords. EX1008, [0005-7]. **"In the art**, RF remote control systems may operate various aspects of the ceiling fan and its light. For example, a remote controller may (1) turn the ceiling fan on and off and control the fan rotational speed; (2) turn the ceiling fanlight on and off and control the light illumination level; (3) reverse the fan rotational direction; and (4) activate other fan and light functions." EX1014, 1:33-39; EX1008 [0005-7].

55. Therefore, when applying the principals above, a POSA would have known RF remote controlled fan devices were widely utilized since the late 1990s. EX1008, Abstract; EX1014, Abstract, 2:24-39, EX1015, Abstract, 1:9-10, 1:13-21.

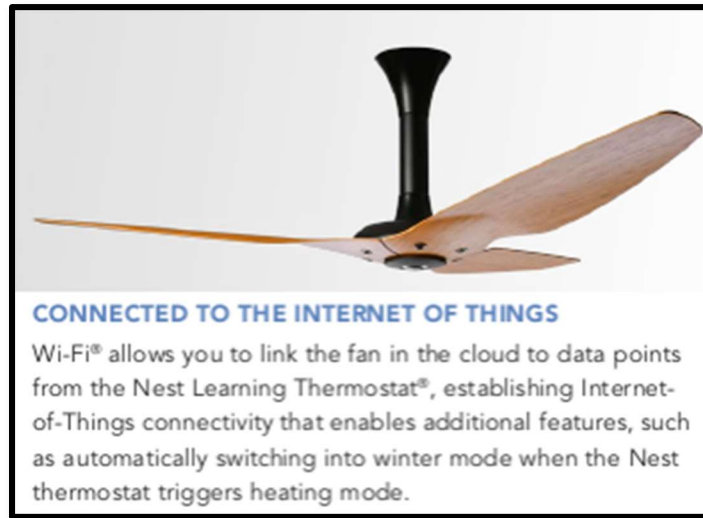
C. WiFi Control

56. WiFi is well understood in the art. A POSA would have known that "WiFi" is a "wireless Ethernet link operating in the 2.4 GHz band and conforming to IEEE 802.11b." EX1028, 4. WLAN or IEEE802.11 are suitable for long range communications up to 100 meters. EX1013, 2. Since WiFi communications occur within RF frequencies, the general overview of wireless communication functionality described for RF communication above applies here as well. EX1027, 10; EX1028, 4. However, WiFi communication is achieved by adhering to specific protocols as defined by relevant WiFi standards. EX1013, 2, EX1028, 4. For instance, a wireless interface communicating 433 MHz is not

applicable to any WiFi communication standard, whereas a frequency of 2.4 GHz qualifies. EX1013, 2-3; EX1028, 4.

57. Moreover, the use of WiFi communications in home devices (i.e., ceiling fans) was commonplace since the 2000s. EX1013, 2. For instance, the use of smartphones and servers to control home devices remotely over WiFi (e.g., 802.11b/g/n) has been known since at least 2007, at which time many home appliances had built-in wireless network capability that allowed users to control and monitor devices remotely. EX1013, 2 (“Our intention in this research was to integrate wireless technology into home devices, using the industry standard IEEE 802.11b/g (Wi-Fi). As these types of devices have become easier to use and less expensive, it gives us the opportunity to deliver a new home automation system that has the ability to control and monitor a house in a convenient way being secure, affordable and efficient.”); EX1017, 2; EX1022, 1-2; EX1010, [0018].

58. Fans adopting WiFi functionality which allow for communications over the Internet were commercially utilized since at least 2014. EX1007, [0023]; EX1011, 152; EX1022, 1-2. WiFi functionality enabled user, appliance, and server-side remote monitoring and control, and allowed for more complex, autonomous control features such as smart timing and intelligent displays. EX1022, 1-2; EX1007, [0041].

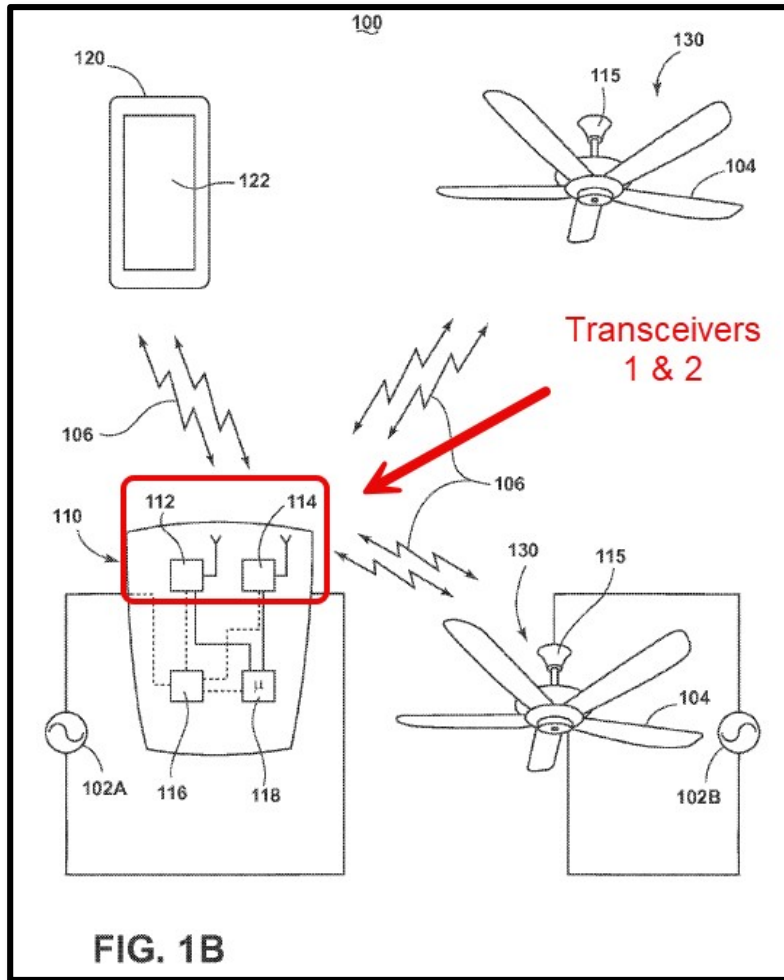


(EX1022) (annotated)

D. Mixed Signal Communication

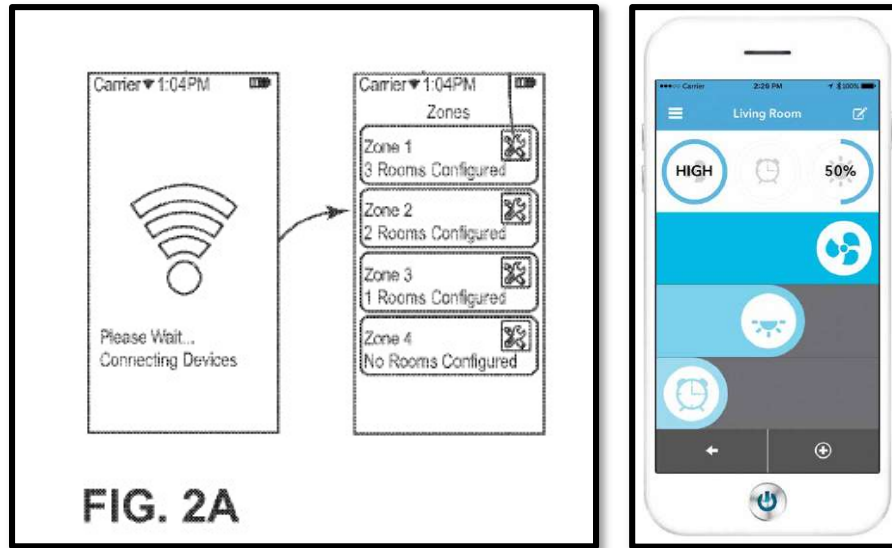
59. Devices comprising both RF and WiFi control functionality were widely utilized for over a decade. The benefits of WiFi functionality in local devices (as described above) resulted in the proliferation of wireless home devices. EX1013, 2. However, legacy remote controls remained popular due to their benefits including: being “cheap and affordable, a reliable and easy to maintain system of remote control and durable system irrespective of usage.” EX1012, 1, 7; *see also* EX1023, [0003]; EX1009, 17-18; EX1007, [0003]; EX1006, [0030] (RF communication “has the advantages of arbitrary directionality, is not obstructed by objects, is less susceptible to interference, and greater stability”). The widespread adoption of WiFi enabled home devices in addition to then existing RF controlled devices resulted in signal rich environments that required the use of multiple transceivers and multiplexing methods in home devices (i.e., ceiling fans) to avoid

signal interference. EX1008, [0025], [0030], Figure 1B. Radio Frequency Identification (“RFID”) and additional multiplexing methods enabled the development of complex communication methods between controllers and devices via a plurality of signaling interfaces (i.e., both WiFi, and RF). EX1020, 2; EX1008, [0030]. A POSA would understand that multiple interfaces may use the same receiver hardware for communicating over both RF and WiFi signals as such use of the same hardware (e.g., antenna) would make the receiver smaller and cheaper, a highly desirable feature in the consumer electronic industry. EX1008, [0034] (“While the [] radio transmitter/receivers 112, 114 have been depicted and described as separate components, one or more of the elements may be implemented with electronic components including, but not limited to, a single application-specific integrated circuit (ASIC).”) For instance, McPherson teaches a fan device wherein any number of communication protocols, including WiFi or RF, may be implemented to enable remote user configuration of the fan’s operation. EX1008, [0031], [0036] (“Wireless control device 120 may pair with any number of fan controllers 110 where pairing is the linking together of electronic devices to allow wireless communications there between...The wireless communication link can include any wireless technology standard for transmitting data between fixed and mobile devices.”); EX1018, 2, EX1020, 1-2.



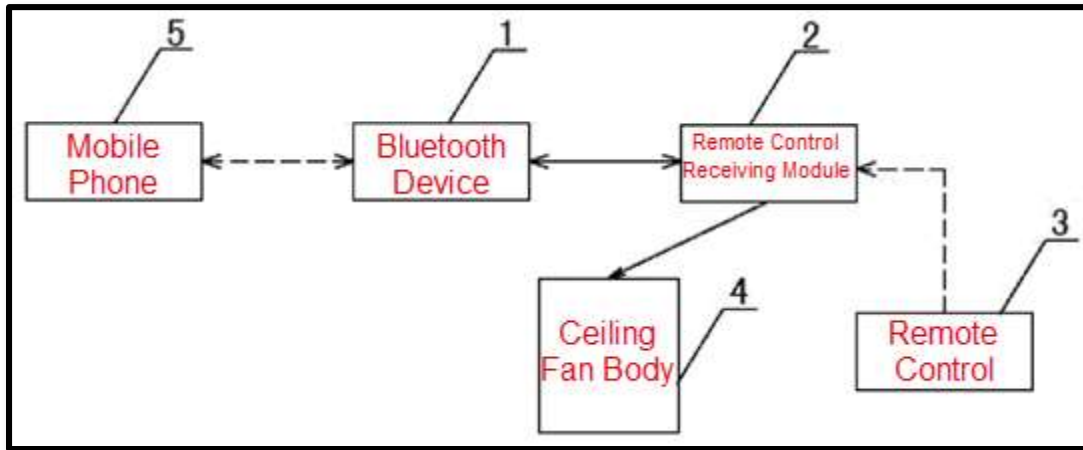
(EX1008 Fig. 1B) (annotated)

60. By 2015, it was commonplace to use a combination of control interfaces to monitor and control ceiling fans. EX1008, [0031], [0036]; EX1025, [0008], Abstract; EX1011, 146-152. Users could control fan status via an app like those shown below, or locally from a remote controller (i.e., in-wall controllers, handheld remotes). EX1008, [0031], [0036]; EX1025, [0008]-[0009]; EX1011, 145-153.



(EX1008 Fig. 2A) (EX1011, 152).

61. For example, Weidong discloses a combined remote control and mobile phone-controlled ceiling fan, wherein “[t]he ceiling fan remote control receiving module 2 sends the current status to the mobile phone via the Bluetooth device 1, the mobile phone application receives the status information sent by the Bluetooth device. The status of the ceiling fan includes the on/off state, speed, forward/reverse direction, remaining timer duration, and light switch status.” EX1025. As explained earlier, a POSA would have understood that “there are various types of wireless communication, such as radio frequency (RF), microwave communication, infrared (IR), IrDA and Bluetooth,” such that the disclosed “remote control” of Weidong could have been RF. EX1013, 2.



(EX1025, Fig. 3) (annotated)

E. Internet of Things (IoT)

62. The concept of IoT has been around for decades. In 1999, Kevin Ashton, MIT's Executive Director of Auto-ID Labs, coined the phrase "Internet of Things" (IoT) to describe devices and objects that connect through a network without human intervention. EX1017, 2. There has already been widespread adoption of IoT functionality across nearly every home electronic device. EX1017, 2. For example, the first internet connected appliance was a coke machine from the 1980s. EX1018, 2. In June 2000, LG released the first Internet refrigerator, the Internet Digital DIOS. EX1017, 2. By 2007, SmartHomeUSA introduced a wireless RF controller to control home appliances and PLUTOHOME introduced a server-side application to control home appliances over Bluetooth and IR. EX1013, 3.

63. Most then existing remote-control products (i.e., fans, garage doors, home security systems, thermostats) quickly adopted IoT technology to enable both internet and RF control of the device. EX1006, [0020] (“first to introduce Internet of Things (IoT) technology to realize remote control of brushless ceiling fan lights.”); EX1007, [0002] (disclosing a WiFi fan adopting “Internet of Things” technology); EX1022, 2 (“Built-in Wi-Fi® allows you to link the fan in the cloud to data points [], establishing Internet-of-Things); EX1023, [0003] (“internet-connected garage door control system is provided comprising a garage door opener for opening and closing a garage door in response to signals received through the internet and in response to RF signals.”), EX1010, [0003], [0022]; EX1011, 146. Smart home networks adopting IoT technology allows for continuous two-way wireless communication between controllers and home devices. EX1022, 1-2.

64. Moreover, the widespread adoption of server-side architecture in IoT devices allowed for improved data storage across network devices, improved processing capabilities with, for instance, autocorrelation algorithms to handle excess device data, and enable complex features such as smart monitoring and control. EX1027, 11; EX1020, 1-2; EX1019 [0072] (“generalized computer architecture that represents an example of the type of computing machinery that may be included in an intelligent controller, server computer, and other processor-based intelligent devices and systems.”). Servers also enabled instant

synchronization of information across devices and user interfaces. EX1019, [0072], [0226]. (“It is a collective function of the central cloud-based management server and the intelligent [device] to ensure that the group-state-information object in each intelligent thermostat is maintained with fresh information”). Fan devices adopting server-side communications existed several years before the priority date. EX1006, [0019] (describing a DC brushless fan in communication with a server); EX1007, Abstract (“a smart fan, which includes: a WiFi fan, a smart terminal, and a cloud server”).

F. Smart Fans

65. Adopting the principals above, smart fans with IoT functionality have been commercially available since at least 2014, when Big Ass Fans (“BAF”) released the Haiku smart fan to allow for wireless monitoring and control of home fan devices. Compare EX1022, 1-2 (Haiku includes “Wi-Fi® [that] allows you to link the fan in the cloud to data points from the Nest Learning Thermostat®, establishing Internet of Things connectivity”) with EX1021, 18-19 (describing Haiku’s remote control); EX1030, 12 (Haiku includes an “RF board and antenna retainer”). Haiku’s SenseMe technology “incorporates advanced sensors, connectivity and machine-learning technologies to dynamically adapt to the environment and the people in it,” enabling real-time fan status conveyance and updates via WiFi communication. EX1022, 1-2. (“Kinetis microcontrollers,

which support a range of real-time operating systems.”). The fan further comprises several processors which enabled broad system support and connectivity over both RF and WiFi. EX1021, 18-19; EX1030, 1, 12 (explaining the fan communicates at “RF Frequency 900 MHz”); EX1022, 1-2. (“Built-in Wi-Fi® allows you to link the fan... Our technology includes a complete range of microcontrollers and application processors built on ARM technology with broad operating system support.”).



(EX1030).

66. Following the release of these early smart fans by BAF, numerous smart fan patents and devices were subsequently published prior to the challenged patent. EX1006 Title, [0020] (“A Brushless Ceiling Fan Light Based on WiFi Smart Remote Control” – “being the first to introduce Internet of Things (IoT) technology to realize remote control of brushless ceiling fan lights”); EX1007, Title, [0003] (“Smart Fan” – “providing a smart fan and using WiFi smart control combined with local control to achieve remote smart control”); EX1008, Title, [0031] (“Ceiling Fan Control System” – “wireless communication link between the fan controller 110 and the one or more receiving units 115 can include any wireless

technology standard and protocol for exchanging data between electronic devices”); EX1009 Title, 19 (“Hunter Ceiling Fan” – “electronic accessory [] designed to connect specifically to iPod, iPhone, or iPad”); EX1011, 152 (“fanSync - control your ceiling fan with your smart devices!”); EX1019, Title, [0065] (“Automated Presence Detection and Presence Related Control Within an Intelligent Controller” – “The Smart-home environment may [] include a variety of different types of legacy appliances [wherein] [d]ata communications are generally carried out using any of a large variety of different types of communications media and protocols”).

67. In other words, by 2018 a POSA would have known the basic and fundamental concepts of RF and WiFi communication in fan devices and would have understood how to incorporate IoT technologies across the full spectrum of smart home appliances. The ‘854 Patent does nothing more than reiterate the known technologies (i.e., electric fans, RF control, WiFi control, mixed signal communication, and IoT) configured in a conventional manner.

VIII. LEVEL OF ORDINARY SKILL IN THE ART

68. I understand that patents are interpreted from the perspective of a hypothetical POSA at the time of the alleged invention. As explained above, I

have applied a priority date of the '854 Patent is January 12, 2018, throughout.² As of this date, I was at least a person of ordinary skill in the art (“POSA”) of the '854 Patent, and, as exemplified above, I had personal knowledge of the technologies involved in the '854 Patent.

69. I also understand that various factors are considered in determining the level of ordinary skill in the art. I understand that the factors include types of problems encountered in the art, prior solutions to those problems, rapidity with which innovations are made, sophistication of technology at the time of the invention, and educational levels and experience of persons working in the field and capable of understanding the applicable scientific and engineering principles. I understand that in determining the level of ordinary skill in the art, not all factors may be present, or one or more factors may predominate.

70. I was informed that in the parallel ITC proceeding, a POSA at the time of the purported inventions of the '854 Patent would have had at least a bachelor's degree in electrical or computer engineering, or a related field, and two to three years of experience with the design or implementation of wireless communication systems, control circuits, or power electronics, and that a higher

² To the extent a different priority data is adopted, the analysis herein remains the same.

level of education or skill can make up for less experience, and vice versa. I have applied this level of skill herein.

71. At least as of the date of the Priority Date of the alleged invention, I satisfied and exceeded all of the above requirements for a POSA.

IX. CLAIM CONSTRUCTION

72. I understand that in the related ITC proceeding, four terms were construed:

Claim Term	Construction
<i>“a radio frequency interface configured to receive”³</i>	“a radio frequency interface that is configured to receive”
<i>“a WiFi interface configured to communicate”</i>	“a WiFi interface that is configured to communicate”
<i>“first frequency”</i>	“first frequency”
<i>“second frequency”</i>	“second frequency different from said first frequency,”

(EX1005).

73. I have applied the constructions adopted in the ITC proceeding. EX1005.

X. DETAILED EXPLANATION OF GROUNDS FOR INVALIDITY

74. The sections below demonstrate in detail how claims 1-4 and 8-10 of the '854 Patent are unpatentable over prior art.

³ Italics used to indicate claim language.

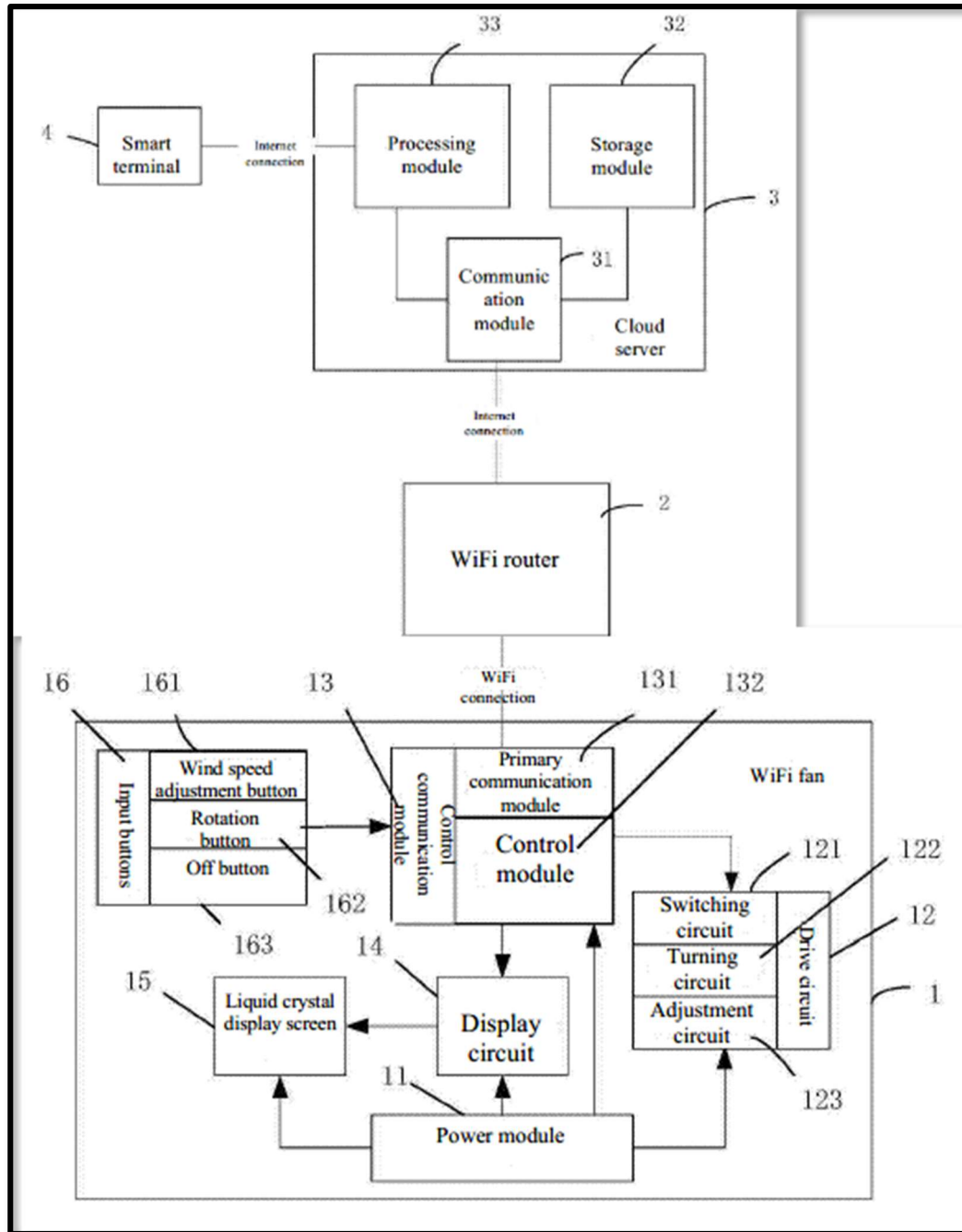
A. Ground 1: Claims 1-4 and 8-10 are obvious over Yun and McPherson

75. The analysis below is based on the combination of Yun and McPherson, wherein McPherson discloses the “*radio frequency interface configured to receive, at a first frequency, a signal,*” not expressly disclosed by Yun. Therefore, the remote-control functionality of McPherson is implemented within the smart fan system of Yun. In particular, receiver 115 (including its associated control signals) of McPherson is combined with input module 16 of Yun such that user commands received by received 115 are used to command the fan in a similar way as input module 16. Moreover, where the two patents disclose analogous functionality, such as a fan motor or fan controller, a POSA would prioritize efficiency and common sense in implementing the individual, nonredundant features into the combined system in order to obtain the benefits of both. I understand that, when there is a reason to solve a problem and there are a finite number of identified, predictable solutions, a POSA has good reason to pursue the known options within his or her technical grasp. Therefore, the analogous functionality and components of both Yun and McPherson further evidence the likelihood of success in combining the two prior art references. For the reasons explained below, combining Yun and McPherson would have been obvious to a POSA, and a POSA would have been motivated to do so.

1. Overview of Yun

76. Yun is Chinese Patent No. 204783774, published on November 18, 2015, and is directed towards a WiFi fan system controlled remotely by both WiFi and local controllers. EX1007, [0027], [0030] (“The smart fan of the present utility model uses WiFi smart control combined with local control.”). For instance, in one embodiment users manually press input buttons to control fan operations. EX1007, [0010]. Wherein, the WiFi fan can be controlled locally by manually pressing the input buttons. EX1007, [0010]. In another embodiment a smart terminal (i.e., smartphone) is connected to a control communications module in the fan via a cloud server and a WiFi router, enabling a user to carry out remote smart control of the WiFi fan through app software on the smart terminal. EX1007, [0010], [0027].

77. A schematic diagram of the system in Yun is shown below:



(EX1007 Fig. 3 & 4 combined)

78. With reference to the figure above, Yun discloses a WiFi fan 1, smart terminal 4, and cloud server 3. EX1007, [0004], [0021]. The WiFi fan 1 includes a power supply module 11, a drive circuit 12 for driving operation of the fan 1, and

a control communications module 13 for controlling operation of the drive circuit 12 and realizing the WiFi connection. EX1007, [0021]. A WiFi router 2 establishes communication between the WiFi fan 1 and the cloud server 3. EX1007, [0005], [0022]. Wherein, the WiFi fan 1: is connected to the Internet through the WiFi router 2, communicates with the cloud server 3, and interacts with the smart terminal 4 through cloud server 3. EX1007, [0023].

79. In one embodiment, the smart terminal 4 has App software that sends control signals to the WiFi fan 1 and receives feedback signals. EX1007, [0025]. Through the App software, the WiFi fan 1 can be remotely operated and configured (off/on, adjust wind speed, and adjust rotation). EX1007, [0025]. Regardless of a user controlling the fan remotely or locally, the WiFi fan sends the status data to the cloud server 3 and simultaneously displays the current state on the liquid crystal display 15. EX1007, [0041].

80. Yun further discloses a cloud-based architecture that enables two-way wireless communication between the smart terminal and WiFi fan. EX1007, [0024]. The cloud server 3 comprises a communications module 31 for communicating with the WiFi router 2, a storage module 32 for storing data obtained from both the WiFi fan 1 and the smart terminal 4, and a processing module 33 for receiving and processing user requests. EX1007, [0006], [0024].

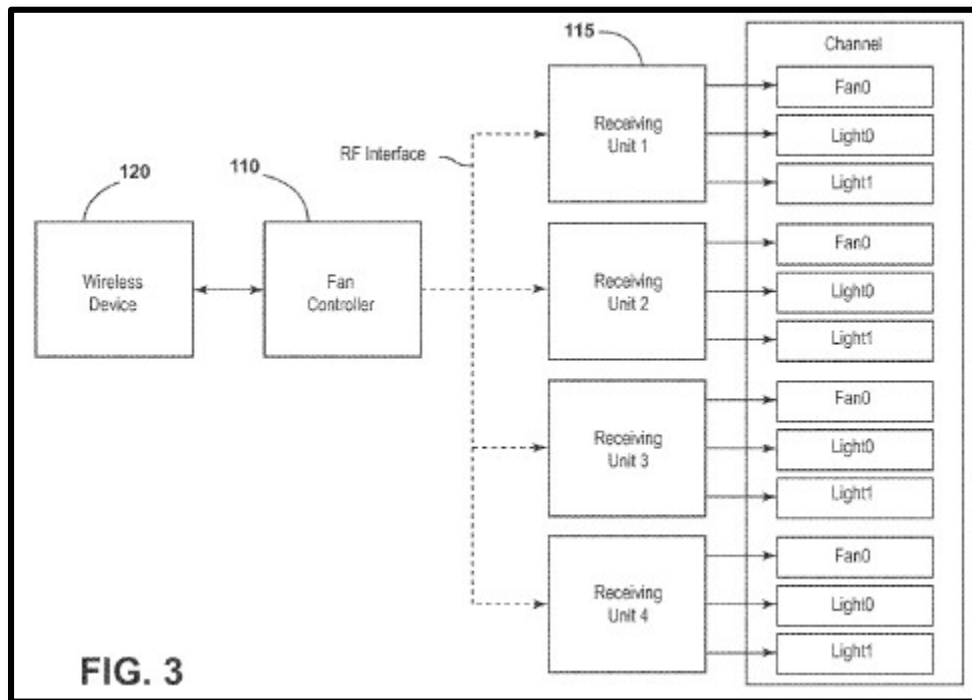
2. Overview of McPherson

81. McPherson is U.S. Patent Publication No. 2015/0325112, published November 12, 2015 and relates to a system and method for controlling ceiling fans. EX1008, [0002], [0009] (“A ceiling fan control system and method used to control and manipulate basic as well as enhanced functional features of a one or more ceiling fans.”). McPherson discloses a ceiling fan controller in communication with one or more wireless devices (i.e., smartphone) over a first radio frequency (e.g., WiFi). The fan controller further communicates with one or more fan devices over a second frequency (e.g., RF). EX1008, [0025], [0028-32] (for example at “ISM band at a frequency between 433.050 MHZ and 434.790 MHZ”). The fan controller includes at least two radio transmitter/receiver (“transceiver”) units. EX1008, [0025]. To that end, each fan has a “radio frequency receiving unit operating at the second frequency.” EX1008, [0011], [claim 12]. As was known in the art, McPherson teaches that transceiver units are generally housed within the ceiling fan canopy to allow users easier control of fan and lighting functions (i.e., not pull chains). EX1008, [0006], [0007].

82. The fan controller contains a processor coupled to both signaling units (i.e., transceivers), which enables the sending and receiving of data messages to and from wireless devices and/or ceiling fans. EX1008, [0033]. The data messages relate to any command and response, including control of the ceiling fan

operations (“cooling and lighting functions of the ceiling fans 130 on and off, changing the fan speeds and lighting output, creating a security function event.”). EX1008, [0033].

83. Figure 3 below depicts a block diagram of the communication and data flow process of the ceiling fan control system. EX1008, [0043]. (“The fan controller 110 receives data messages from wireless control device 120 and then transmits data messages to the fan receiving unit of one or more ceiling fans on a second frequency which is different from the first frequency. Fan controller 110 may be operable to transmit data via radio signals to one or more ceiling fans each having receiving unit 115 which in turn manipulate the cooling and lighting features of the corresponding ceiling fan.”).



(EX1008 Fig. 3)

3. Motivation to Combine

84. In my opinion, a POSA would have been motivated to combine Yun and McPherson such that they would have had a reasonably high expectation of success in incorporating the teachings of either reference. The combination of Yun and McPherson would have been obvious for several reasons.

85. Yun, McPherson, and '854 Patent are analogous art, directed to the same field of endeavor (i.e., the remote control of smart fans). EX1007, [0004]; EX1008, [0010]; EX1001, 1:14-17. Yun and McPherson both relate to the wireless control of fan systems. Yun describes the control of a smart fan system comprising a WiFi fan, a smart terminal, and a cloud server. EX1007, [0004]. McPherson describes a fan control system to realize remote control of multiple ceiling fan, comprising one or more fans, a fan controller, and one or more wireless devices. EX1008, [0010]. Further, Yun and McPherson are reasonably pertinent to the problem addressed by the '854 Patent (e.g., an “improved method of controlling a fan”). EX1008, [0010]; see also EX1001, 1:59-60. Therefore, Yun with McPherson are analogous art to the '854 Patent.

86. It would have been obvious to combine Yun and McPherson because to do so would have been [1] the arrangement of conventional elements (i.e., the remote-control functionality of McPherson, and the fan system of Yun) [2] with

each performing the same function it had been known to perform (i.e., remote control communication with a smart fan) and [3] yielding a predictable system (i.e., a fan system capable of both internet and RF remote control). EX1025, [0025]-[0026].

87. A POSA would have found it obvious to use the remote-control functionality of McPherson in the system of Yun, because a remote control is a convenient and efficient way to facilitate for the user to control the fan. EX1008, [0003]-[0009]. Moreover, remote controls overcame known drawbacks associated with pull chains and other forms of local control (such a switch on the fan body). EX1008, [0003]-[0009], [0006]-[0007] (“Although a simple switch to operate, the reverse switch is difficult for the consumer to reach and therefore operate due to the elevated location of the ceiling fan.”). For instance, McPherson explains that “consumers often get confused and frustrated when manipulating the pull chains to achieve the desired fan speed resulting in multiple consecutive unnecessary actuations of the pull chains.” EX1008, [0005]. Therefore, a POSA would have been motivated to implement remote control in order to improve the customer’s experience.

88. Likewise, a POSA would have been motivated to include the remote-control functionality of McPherson in the system of Yun because as Yun explains “when there is no network connection or when the user does not need to operate

[the fan] remotely” having local control is beneficial. EX1007, [0040]. Therefore, a POSA would have been motivated to include remote-control functionality of McPherson in order to allow the user to control the smart fan during WiFi network outages, or when local control would be more convenient.

89. A POSA would have been additionally motivated to include the RF remote-control functionality of McPherson in the Yun system because RF communications overcame known problems with infrared based remote controls. For example, “only near-range remote control can be achieved” with infrared remote controls. EX1007, [0002]. In contrast, an RF remote control “has the advantages of arbitrary directionality, is not obstructed by objects, is less susceptible to interference, and greater stability.” EX1006, [0030]. A POSA would have understood that traditional TV remotes used infrared (or IR) to communicate. EX1012, 2.

90. Moreover, Yun explains benefits associated with integrating remote control over the internet. For example, Yun explains that, for example:

- “The smart terminal can realize functions such as smart timing, remote restart and shutdown, smart shifting, intelligent display, and smart display through the communication connection between the cloud server and the control communication module, enabling the combination of the smart terminal and the smart fan so that the smart fan can form a home network with smart appliances.”

(EX1007, [0014])

91. Likewise, McPherson teaches how users may configure fan functionality via an application on a wireless device. EX1008, [0040-42]. For instance, the user can implement remote control of the fan, enable “timer features” such as smart scheduling, or activate remote viewing on a display screen. EX1008, [0040-42]. McPherson describes additional features such as load monitoring to mitigate power consumption. EX1008, [0042].

92. Therefore, a POSA would have been motivated to include the benefits of McPherson with Yun in their design. Additionally, a POSA would have known that use known techniques to improve similar devices in the same way and represent a choice among a finite number of identified, predictable solutions.

93. Yun expressly discloses all elements of the challenged claims but for element 1[d], reciting “*a radio frequency interface configured to receive, at a first frequency, a signal.*” Yun discloses a module 16 comprising input buttons for controlling wind speed 161, rotation 162, power 163, and which a POSA would have understood to be either a wireless remote control or a wall-mounted panel. EX1007, [0030]. In my opinion a POSA would have known to locate the input buttons in a user-friendly location to allow for local control (*i.e.*, not on the ceiling fan). EX1007, [0003] (“The present utility model is designed to solve the technical problem that existing fans require direct human touching of buttons or knobs for operation.”); EX1008 [0005] (“Operating and/or controlling the cooling and

lighting features of a ceiling fan by pull chains has its disadvantages.”). Local fan control is largely achieved by either a wireless controller or a wall-mounted panel, both of which are disclosed in McPherson. In either embodiment, wireless communication would likely be over an RF frequency given its broad directionality and increased control range. EX1008, [0032]. This is evidenced by Yun and McPherson explicitly addressing the advantages of remote fan control. EX1007, [0003] (“The present utility model is designed to solve the technical problem that existing fans[] use infrared remote control that can only achieve near-range remote control”); EX1008 [0030] (“By implementing a frequency division strategy, the radio frequency ceiling fan control system 100 enables communication between the control device 120 and the fan controller 110 without interfering with communication between the fan controller 110 and the one or more fan receiving units 115 as well as limiting interference with other wireless devices within the same area.”). EX1008, [0030].

94. Furthermore, McPherson explicitly teaches the claimed radio frequency interface. Yun discloses a smart fan using WiFi smart remote control combined with local control. EX1007, [0027]. Wherein the local operation of the fan is achieved by use of input buttons 16 containing a wind speed adjustment button 161, a rotation button 162, and an off button 163. EX1007, [0030], Figure 3. McPherson discloses a remote fan controller comprising multiple transceiver

units for communicating with fan devices and wireless control devices. EX1008, [0025]. A POSA would have been motivated to connect the control panel of Yun via an RF interface like the “radio frequency receiving unit” taught by McPherson because it would permit operation by a remote controller such as the wall controller 110 shown in Figure 10 of McPherson. EX1008, [0032]. That wall control 110 interacts with the fan using an RF interface in the controller 114 and receiving unit 115 in the fan canopy. EX1008, [0025]. The POSA would have a reasonable expectation of success in utilizing the McPherson wall controller and fan RF interface within the Yun system because doing so involves applying a straightforward solution of RF signal remote control with no undue level of unpredictability.

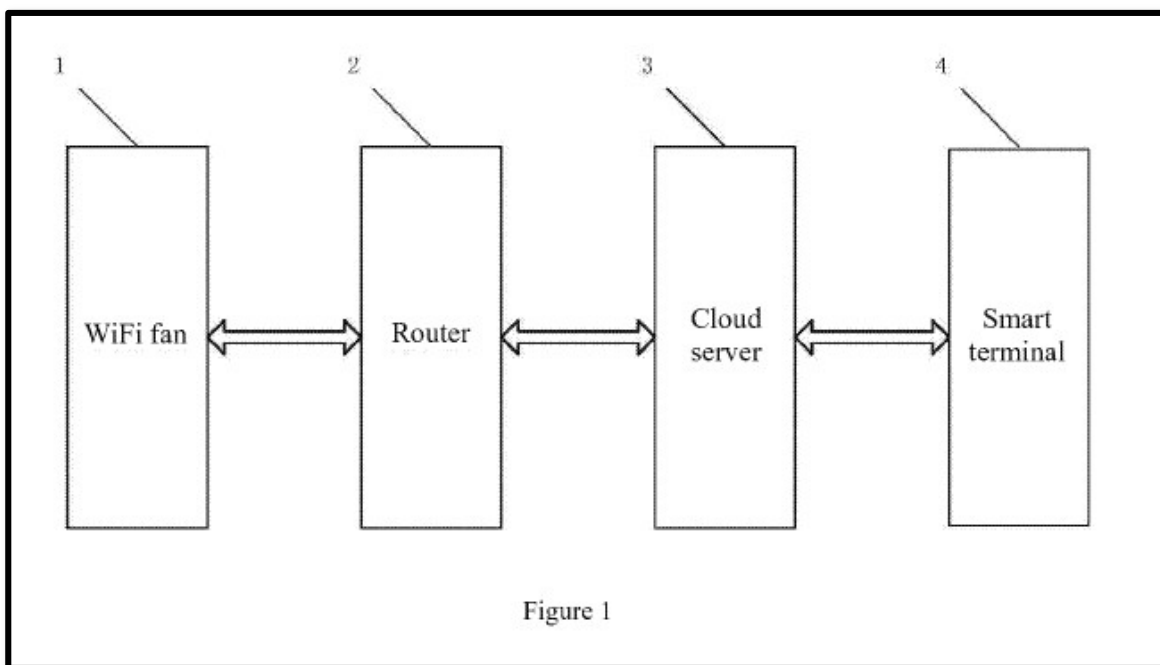
95. A POSA would have a reasonable expectation of success in combining Yun with McPherson because the combination would provide a predictable result – a smart fan system configured to (1) receive control commands from a remote server or user controller over both RF and WiFi, (2) transmit fan state data back to the remote server and the user controller and (3) store fan state information in the remote server. Likewise, as explained above, using both WiFi and RF remote control in a ceiling fan was known in the prior art. *Supra* §VII. Moreover, both Yun and McPherson explain that their disclosures are not limited to any one physical configuration. EX1007, [0020]; EX1008, [0063].

4. Claims 1-4, 8-10

a. Element 1[pre]: “A system comprising:”

96. I understand that the preamble may not be limiting. Regardless, in my opinion, Yun discloses and renders obvious the preamble of claim 1.

97. Yun discloses the claimed “system” as a “smart fan system” comprising an internet-enabled smart fan and cloud server. EX1007, [0024], [0004]. Specifically, the disclosed “smart fan comprises a WiFi fan, a smart terminal, [] a cloud server,” and a WiFi router for establishing a communication connection between the fan and cloud server. EX1007, cl 1, [0005]; Figure 1 (a schematic diagram of the main structure of the smart fan system).



(EX1007, Fig. 1)

98. Thus, to the extent the preamble of claim 1 is limiting, it is my opinion that Yun discloses and renders it obvious.

b. Element 1[a]: “a fan motor;”

99. In my opinion, Yun discloses and renders obvious element 1[a].

100. Yun discloses a “fan motor.” Yun explains that their invention “is designed to solve the technical problem [with] **existing fans**.”⁴ EX1007, [0003]. Yun also states that the WiFi fan is an improvement over a “traditional fan” by additionally including “a remote-control function.” EX1007, [0002]. In my opinion, a POSA would have understood that a “traditional fan” or “existing fan” includes a “fan motor.” Fan motors within ceiling fans were well known in the prior art. EX1024, 2-3 (“A typical electric fan is made up of blades, hub, **motor**, switch, guard, mount and a power cord...[wherein] current is supplied to the DC motor by the battery, which in turn energizes the fan blade”); EX1025, Abstract (“a ceiling fan body, composed of a housing cover, a ceiling fan DC brushless motor, a rotor, a blade, and a light disk.”). Additionally, Yun explains that their invention is “realized” by “[a] smart fan ... comprising: **A WiFi fan**, a smart terminal, and a cloud server.” EX1007, [0004] (“the WiFi fan includes a power supply module for powering, a drive circuit for driving the operation of the WiFi fan, and a control communication module for controlling the operation of the drive circuit and realizing the WiFi connection.”); EX1024, 2-3; EX1025, Abstract. Yun explains that “the WiFi fan 1 includes a power supply module 11

⁴ All emphasis is added unless noted otherwise.

for powering, a drive circuit 12 for **driving the operation of the WiFi fan 1**, and a control communication module 13 for controlling the operation of the drive circuit 12 and realizing the WiFi connection.” EX1007, [0027], [0031]; *see also* [0030] (“When the control communication module 13 is used to control the WiFi fan 1, for example, when the wind speed adjustment button 161 is pressed, the fan starts to work. Each time the wind speed adjustment button is pressed, it will speed up until reaching the third level, after which the fan will return to the first level when pressing the button again and the cycle repeats; when the user presses the rotation button 162, the fan starts rotating left and right.”) Therefore, Yun teaches that drive circuit 12 can cause the fan to “starts to work” (i.e., move). A POSA would have known that to move the blades of the fan Yun must have included a fan motor.

101. I also note that McPherson discloses the claimed “*fan motor*.” For example, McPherson teaches the structure of conventional ceiling fans. EX1008, [0004]; [0006] (“Ceiling fans also typically include a reverse switch which controls the rotary direction of **the motor** and thus the direction of the air flow.”); *see* EX1024, 2-3 (“A typical electric fan is made up of blades, hub, **motor**,”); EX1025, Abstract (“a ceiling fan body, composed of a housing cover, a ceiling fan DC brushless motor.”). McPherson discloses fans comprising a switch housing containing all fan mechanical hardware, including “**the motor of the fan**.”

EX1008, [0004]. The mechanical hardware (i.e., motor) “provide[s] the operation to the functional features of the ceiling fan,” including cooling and lighting functions (i.e., fan rotary direction). EX1008, [0002], [0004]. Therefore, in the combination of Yun and McPherson, both patents teach a “*fan motor*.”

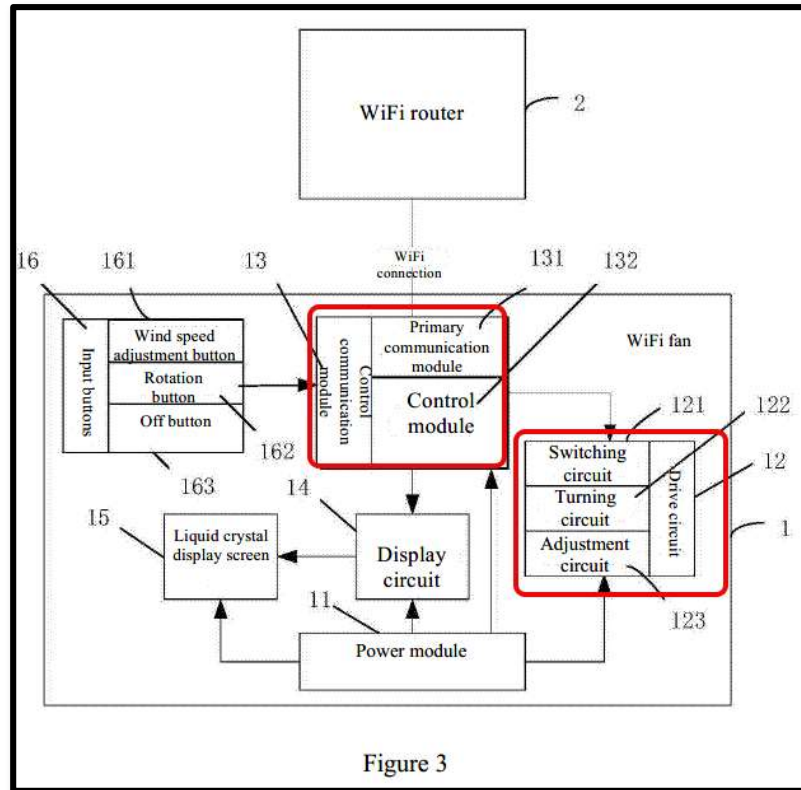
c. Element 1[b]: “*a fan motor control circuit*;”

102. In my opinion, Yun discloses and renders obvious element 1[b].

103. Yun discloses a “*fan motor control circuit*.” Yun explains “the WiFi fan includes...**a drive circuit** for driving the WiFi fan to operate.” EX1007, [Abstract], [0021]; *see* Figure 3 (below). EX1007, [0029]. Additionally, Yun explains that “the WiFi fan 1 includes a power supply module 11 for powering, **a drive circuit 12 for driving the operation of the WiFi fan 1**, and a control communication module 13 for controlling the **operation of the drive circuit 12** and realizing the WiFi connection.” EX1007, [0027], [0031]; *see also* [0030] (“When the control communication module 13 is used to control the WiFi fan 1, for example, when the wind speed adjustment button 161 is pressed, the fan starts to work. Each time the wind speed adjustment button is pressed, it will speed up until reaching the third level, after which the fan will return to the first level when pressing the button again and the cycle repeats; when the user presses the rotation button 162, the fan starts rotating left and right.”) Therefore, Yun teaches that drive circuit 12 causes the fan to “starts to work” (i.e., move) and “driv[es] the

operation of the WiFi fan.” EX1007. [0027]. As described in element 1[a], a POSA would have known that to move the blades of the fan Yun must have included a fan motor. A POSA would have also known that most, if not all, of the commercially available ceiling fans can turn their blades at different speeds and directions. In order to provide such flexibility, certain mechanism for controlling fan motor must be implemented in the fan system, a fact well known to a POSA. Therefore, a POSA would have known the ceiling fan of Yun includes a “*fan motor control circuit*” for controlling the “*fan motor*.”

104. Additionally, drive circuit 12 comprises three sub-control circuits, each corresponding to a different control operation of the WiFi fan. For instance, “the drive circuit 12 includes a switching circuit 121 for turning off the WiFi fan 1, a turning circuit 122 for turning the fan left and right, and an adjustment circuit 123 for adjusting the wind speed,” as shown in the figure below. EX1007, [0027]. Therefore, a POSA would have understood that drive circuit 12 is the “*fan motor control circuit*” because it include sub-circuits for controlling the operation of the fan.



(EX1007, Fig. 3) (annotated)

105. Moreover, Yun expressly states that “[t]he circuit structure of the drive circuit 12 may be realized by the prior art and is not described here.” In my opinion, a POSA would have understood that drive circuits were well known in the art. EX1024, 2; EX1008 (“in one embodiment, the power to the control circuit of fan controller 110 may be provided.”). A POSA would have understood that DC brushless fan motor control circuits were widely utilized in commercial electric fans. EX1025, [0003] (Explaining “Background Art” - “**an electric fan** controllable via a mobile phone speaker, including a fan blade, a motor for driving the fan blade, and **a control circuit for controlling the electric fan.**”); §VII. A

POSA would have known that most, if not all, of the commercially available ceiling fans can turn their blades at different speeds and directions. In order to provide such flexibility, certain mechanism for controlling fan motor must be implemented in the fan system, a fact well known to a POSA. Therefore, a POSA would have known the ceiling fan of Yun includes a fan motor control circuit.

d. Element 1[c]: “a processor in electrical communication with the fan motor control circuit;”

106. In my opinion, Yun discloses and renders obvious element 1[c].

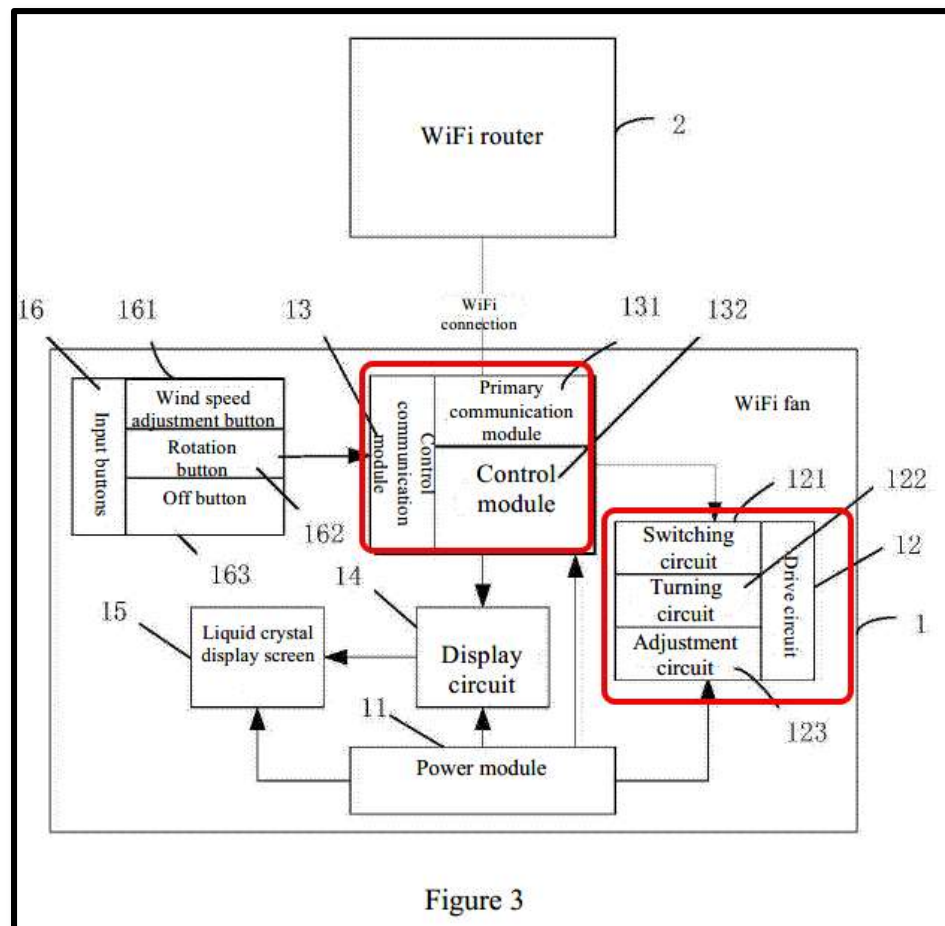
107. Yun discloses a “processor in electrical communication with the fan motor control circuit.” Yun explains that “control module 131,” “adopt[s] the circuit structure of a microcontroller, **microprocessor**.” EX1007, [0029]. In particular, control module 131 is “a control module for receiving and **processing** the control signals of the smart terminal and controlling the operation of the drive circuit.” EX1007, [claim 10], [0029], [0021]. For example:

- “The main communication module 132 is connected to the control module 131, the control module 131 is connected to the drive circuit 12 and the display circuit 14, and the main communication module 132 is connected to the WiFi router 2.” EX1007, [0029].
- “The control communication module 13 is independently developed by the inventor and integrates the **functions of a microcontroller** and a WiFi communication module.” EX1007, [0029].
- “It can enable communication with the smart terminal 4 through the WiFi router 2 and cloud server 3, receive and process the signals of the smart terminal 4, and control external circuits and devices, such as: Controlling the display circuit 14 and drive circuit.” EX1007, [0029].

108. Furthermore, a POSA would have known that the control communication module is a processor based on the disclosed functionality (i.e., establishing WiFi connection, receiving control inputs from the input module 16, processing signal requests and controlling the display 14 and driver circuits 12). EX1007. These functions are most efficiently implemented by a processor-based system. A POSA would recognize that smart devices, including fans, require at least one processor. EX1019, [0071] (“generalized computer architecture that represents an example of the type of computing machinery that may be included in an intelligent controller, server computer, and other **processor-based intelligent devices and systems.**”); EX1022. Therefore, Yun expressly discloses this claim element in describing a smart fan system. EX1007, [0031].

109. Moreover, Yun discloses that control module 131 (i.e., the “processor”) is “*in electrical communication with the fan motor control circuit.*” In particular, **control module 131 is “connected to the drive circuit 12”** (i.e., the fan motor control circuit), as depicted below. EX1007, [0029] (describing Figure 3); Figure 3. Additionally, Yun explains that “the WiFi fan 1 includes a “power supply module [] connected to the control communication module and the drive circuit and the control communication module is connected to the drive circuit.” EX1007, [0004]; Yun explains that “connections” may be communication connections, **electrical connections**, or mechanical connections. EX1007, [0020].

Moreover, the control module 131 controls “the operation of the drive circuit 12.” EX1007, [0021]. A POSA would have understood that being “connected to” and “controlling” the operations of drive circuit 12 means control module 131 is in “*electrical communication with the fan motor control circuit.*” This is further evidenced by the power supply module being connected and providing DC power to “the entire WiFi fan”, namely the control module and drive circuit. EX1007, [0004], [0033].



(EX1007 Fig. 3) (annotated)

e. Element 1[d]: “a radio frequency interface configured to receive, at a first frequency, a signal;”

110. In my opinion, Yun renders obvious element 1[d] in combination with McPherson.

111. Yun explains that the WiFi fan 1 includes an input module 16, that includes buttons for controlling wind speed 161, rotation 162, power 163. EX1007, [0030]. While Yun does not expressly disclose that the input module 16 having a radio frequency interface, Yun does teach that the “WiFi fan 1 can be operated and configured locally through the input buttons 16, whose principle is known to those skilled in the art and is not described here.” Local fan control is largely achieved by either a wireless controller, pull-chain, or a wall-mounted panel, all of which are disclosed in McPherson. EX1008, [0003], [0023] (explaining ceiling fans are “usually operated by one or more pull chains and/or by a remote control” or an “embodiment of the fan controller to be mounted to a wall.”). Therefore, using a remote control to control fan operations would have been obvious to a POSA, since this is how a fan is “usually operated.” EX1007, [0003] (“The present utility model is designed to solve the technical problem that existing fans require direct human touching of buttons or knobs for operation.”); EX1008 [0005] (“Operating and/or controlling the cooling and lighting features of a ceiling fan by pull chains has its disadvantages.”).

112. Moreover, a POSA would have found it obvious to use an RF remote controller in Yun because it was one of a finite number of commercially viable solutions for controlling a ceiling fan, making it obvious to try. EX1008, [0003]. As explained above, wireless RF fan controllers have been known in the art for decades. §VII; EX1008; EX1030; EX1025; EX1014. In either a wall controller or remote controller, wireless communication would likely be over an RF frequency given its broad directionality and increased control range. EX1006, [0030] (“Compared with a traditional TV remote control, [RF] has the advantages of arbitrary directionality, is not obstructed by objects, is less susceptible to interference, and greater stability.”). This is further evidenced by Yun explicitly addressing the advantages of remote fan control. EX1007, [0003] (“The present utility model is designed to solve the technical problem that existing fans[] use infrared remote control that can only achieve near-range remote control”). Therefore, a POSA would have recognized the benefit and ease of implementing an RF controller in the Yun fan system.

113. In the combination, McPherson discloses “*a radio frequency interface configured to receive, at a first frequency, a signal.*” McPherson explains a fan device having a “**radio frequency receiving unit** operating at the second frequency.” EX1008, [0011], [0025], [claim 12]. The disclosed receiving units are housed within the canopy of each fan. EX1008, Figs. 1A and 1B; *see also*

[0007] (“a receiving units housed within the canopy of the ceiling fan”). “The fan controller 110 may be operable to communicate data messages via wireless signals such as radio frequency signals 106 to one or more receiving units 115 via a second direct wireless communication link separate from the direct wireless communication link between the wireless control device 120 and the fan controller 110.” EX1008, [0029]. The data message comprises “commands and responses [] to control the ceiling fans 130,” including “turning the cooling and lighting functions of the ceiling fans 130 on and off, changing the fan speeds and lighting output.” EX1008, [0033]. Therefore, the “data messages” include the same types as commands as input module 16. A POSA would have recognized given their similarities it would have been a manner of routine substitution to combine the input buttons of Yun with the receiver 115 of McPherson.

114. McPherson explains that the receiving unit can be configured to “communicate in the ISM band at a frequency between 433.050 MHz and 434.790 MHz.” EX1008, [0032]. A POSA would have understood that 433.050 – 434.790 MHz is within “*radio frequency*”. EX1027, 10; *see also* EX1001, 11:32-34 (“RF interfaces use a sub-GHz frequency band, e.g., 315 MHz or 433 MHz, and the WiFi interfaces use a 2.4 GHz frequency band.”).

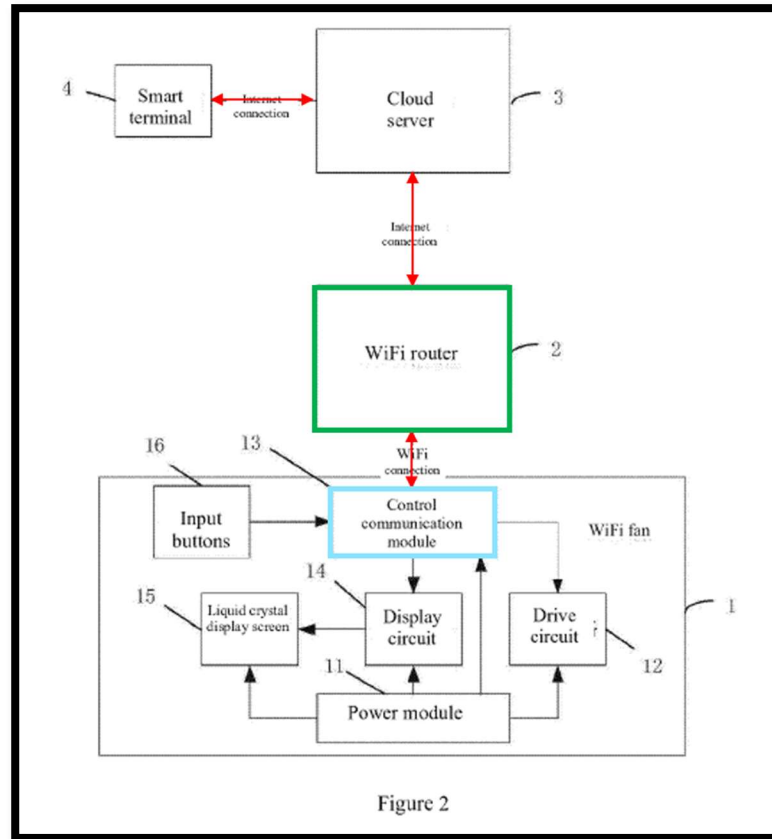
115. Moreover, as explained in §X.A.3, a POSA would have been motivated to implement Yun in view of McPherson. A POSA would have found it

obvious to use the remote-control functionality of McPherson in the system of Yun, as a remote control is a convenient and efficient way to facilitate for the user to control the fan. EX1007, [0027]. Therefore, in the combination of Yun and McPherson, discloses the claimed “*radio frequency interface configured to receive, at a first frequency, a signal.*”

f. Element 1[e]: “*a WiFi interface configured to communicate at a second frequency that is different from the first frequency;*”

116. In my opinion, Yun discloses and renders obvious element 1[e].

117. Yun discloses the “*WiFi interface configured to communicate at a second frequency that is different from the first frequency.*” If the processor and WiFi interface can be part of the same structure, Yun discloses it. Yun explains that the control communication module 13 (**blue**), includes a WiFi communication module (i.e., main communication module 132) and “can realize WiFi communication and control functions” and communicates (**red**) with a WiFi router (**green**) over WiFi. EX1007, [0014], [0029] (“The control communication module 13 is independently developed by the inventor and integrates the functions of a microcontroller and a WiFi communication module. It can enable communication with the smart terminal 4 through the WiFi router 2 and cloud server 3, receive and process the signals of the smart terminal 4, and control external circuits”).



(EX1007, Fig. 2) (annotated)

118. In particular, the “main communication module 132 [is] for communicating with the WiFi router” and can “enable **communication** with the smart terminal 4 through the WiFi router 2 and cloud server 3.” EX1007, [0002]. Therefore, a POSA would have understood that the main communication module 132 is a “*WiFi interface configured to communicate.*”

119. To the extent the claim requires the WiFi communication module and processor to be in sperate sub-components, Yun renders that configuration obvious. In particular, Yun explains that “[v]arious changes, modifications, substitutions, and variations can be made to these examples without departing from

the principles and objectives of” Yun. Therefore, a POSA would have understood that Yun allows for main communication module 132 and control module 131 to be separate components. Using separate components for the main communication module 132 and control module 131 was well-known and well understood, and would have been a matter of simple substitution. For example, see the Qirong ground below which expressly includes a separate WiFi chip.

120. Yun further discloses “*a second frequency that is different from the first frequency.*” A POSA would have understood that WiFi is standardized and comprise a narrower set of frequency bands than RF communications. EX1028, 4; *see* EX1001, 11:34 (“the WiFi interfaces use a 2.4 GHz frequency band.”); EX1007, [0014]. RF remote control of electronic devices generally occurs at 433 MHz whereas WiFi control of home devices occurs between 2.4-2.5 GHz. EX1007; *see* EX1027, 10. McPherson for instance shows that the RF receiving unit 115 operates at a different frequency, namely a band between 433.050 and 434.790 MHz. EX1008, [0032]. A POSA would have known that “WiFi” is a “wireless Ethernet link operating in the 2.4 GHz band and conforming to IEEE 802.11b.” and that the 433 MHz frequency is not used in any WiFi standard. EX1028, 4; *see* EX1001, 11:34 (“the WiFi interfaces use a 2.4 GHz frequency band.”). Yun expressly discloses this standard. EX1007, [0020] (“The ‘WiFi’ referred to in this application, Wireless Fidelity, is a wireless LAN based on the

IEEE 802.11b standard.”). As stated in element 1[d], Yun with McPherson discloses or renders obvious an RF interface communicating at 433 MHz. Therefore, 2.4 GHz (i.e., the “*second frequency*”) differs from 433 MHz (i.e., “*the first frequency*”). EX1007, Figure 2. Therefore, a POSA would have understood that the WiFi communications module in Yun communicates at a frequency different than a conventional RF receiver such as the RF transceiver unit of McPherson.

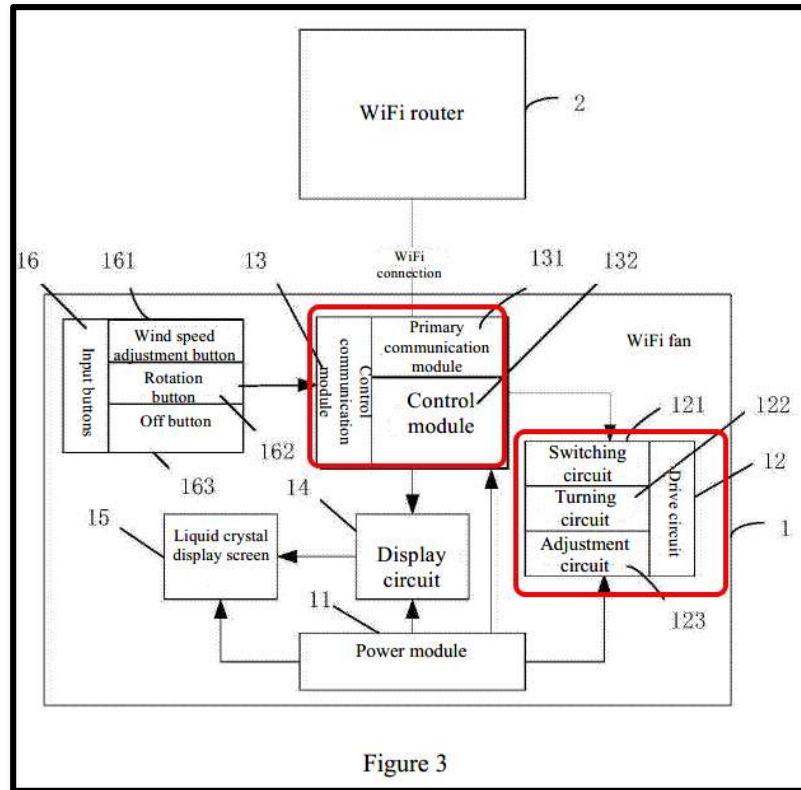
g. Element 1[f]: “*the fan motor control circuit is configured to cause the fan motor to perform an operation in response to the signal; and;*”

121. In my opinion, Yun discloses and renders obvious element 1[f].

122. Yun discloses that “*the fan motor control circuit is configured to cause the fan motor to perform an operation in response to the signal.*” As explained in element 1[b], Yun discloses a “*fan motor control circuit.*” See §X.A.4.c. Yun further explains that the “*fan motor control circuit is configured to cause the fan motor to perform an operation in response to the signal.*” I note that the claimed “*the signal*” in this claim refers to “*a radio frequency interface configured to receive, at a first frequency, a signal,*” in claim element 1[d]. See §X.A.4.e.

123. Specifically, Yun discloses that “input buttons 16” are used to issue commands to the fan. And, Yun’s WiFi smart fan comprises “a drive circuit for

driving the WiFi fan to operate.” EX1007, Claim 1. Yun explains that the “drive circuit 12” is used to drive “the operation of the WiFi fan 1.” EX1007, [0021]. Moreover, “input buttons 16 are arranged corresponding to the drive circuit 12” wherein the “wind speed adjustment button 161” for instance, can adjust the speed of the fan. EX1007, [0030]. Yun explains that “[e]ach time the wind speed adjustment button 161 is pressed, it will speed up.” EX1007, [0040]. A POSA would have understood that a command to “speed up” the fan is an “*operation*” of the fan. EX1003, ¶106; *see* EX1001, 13:63-67 (“operations, e.g., [] **increase fan speed of fan 1**, decrease fan speed of fan 1, change fan direction of fan 1.”) Therefore, a POSA would have understood that the drive circuit 12 is “*configured to cause the fan motor to perform an operation in response*” to input module 16.



(EX1007 Fig. 3)

124. In the combination, McPherson discloses “the fan motor control circuit [] configured to cause the fan motor to perform an operation in response to the signal.” In the combination of Yun and McPherson, the remote-control functionality of McPherson is combined with the system of Yun. McPherson describes how RF “data messages” received by receiving unit 115 include the “commands and responses [] to control the ceiling fans 130,” such as “turning the cooling and lighting functions of the ceiling fans 130 on and off, changing the fan speeds and lighting output.” EX1008, [0033]. In the combination, the “data messages” received by receiving unit 115 of McPherson would be used with the

drive circuit 12 of Yun along with input module 16. The drive circuit 12 would cause the fan motor to perform an operation in response to a RF signal received by receiving unit 115 of McPherson. Therefore, in the combination, drive circuit 12 is “*configured to cause the fan motor to perform an operation in response to [an RF] signal.*” As explained in §X.A.4.c, a POSA would have a reasonable expectation of success in utilizing the McPherson fan system RF interface within the Yun system because doing so involves applying a straightforward solution of RF signal remote control with no undue level of unpredictability or signal interference.

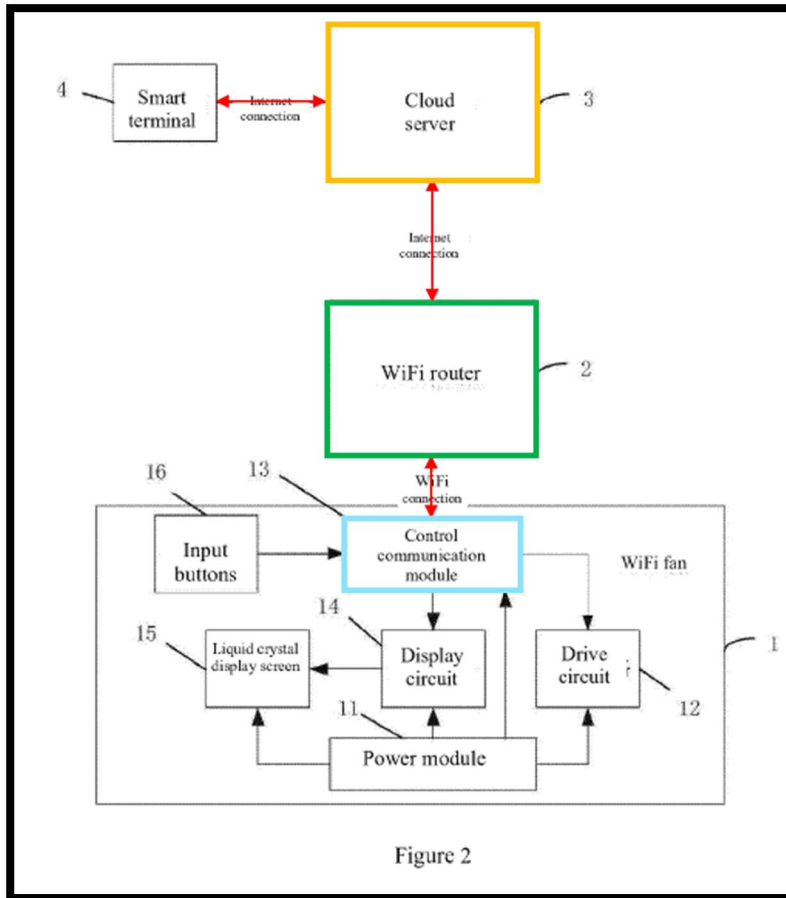
h. Element 1[g]: “*the processor is configured to transmit, via the WiFi interface, to a server, an indication corresponding to the operation.*”

125. In my opinion, Yun discloses and renders obvious element 1[g].

126. Yun discloses that “*the processor is configured to transmit, via the WiFi interface, to a server, an indication corresponding to the operation.*” As explained above (§X.A.4.d), Yun discloses control communication module 13 comprising a “control module 131” (i.e., processor) and main communication module 132. In particular, control module 131 “adopt[s] the circuit structure of a microcontroller, microprocessor” and enables the “receiving and processing [of] control signals of the smart terminals.” EX1007, [0029]; see §X.A.4.d. Yun also discloses that “the smart fan comprises [a] cloud server” (i.e., server). EX1007, [Claim 1].

127. I have been informed that in the parallel ITC investigation both parties proposed competing constructions for the term “*an indication corresponding to the operation.*” In particular, Patent Owner argued that this term should mean “an indication that corresponds to the operation.” EX1036, 31. While Petitioner argued that this term should mean “a message indicating the operation has been performed.” EX1037, 27. As explained below, the prior art discloses this limitation under either construction.

128. Yun explains that the communication module 13 (which includes “*processor*” “control module 131”) can communicate with a “cloud server” over the internet. EX1007, [0041], [0029]. In addition to “control module 131,” communication module 13 comprises a main communication module 132 for “for communicating with the WiFi router 2.” EX1007, [0029]. In particular, “main communication module 132 is a WiFi communication module for realizing communication with the WiFi router 2,” as shown below. EX1007, [0029], [0024]. Therefore, a POSA would have understood that there is a “communication connection” between the “*processor*” (housed inside control communication module 13) and cloud server 3/4 (“*a server*”). Moreover, as described above, Figure 2 shows the “communication connection” occurs “*via the WiFi interface.*” See §X.A.4.f.



(EX1007, Fig. 2) (annotated)

129. As explained above X.A.4.g, to the extent the claim requires the WiFi communication module and processor to be in sperate sub-components, Yun renders that configuration obvious. In any configuration, the “[t]he main communication module 132” would be used by the processor to communicate with the server because it “is a WiFi communication module for realizing communication with the WiFi router 2.” EX1007, [0029], [0024].

130. Yun also discloses that the “*processor [is] configured to transmit ... to a server, an indication corresponding to the operation.*” As explained in

§X.A.4.g, the drive circuit 12 causes the fan motor to perform an operation (i.e., on/off or change speed) in response to a RF signal received by receiving unit 115 of McPherson. As also explained in §X.A.4.e and §X.A.4.g, receiving unit 115 of McPherson is used along with input module 16, and sends the same types of commands (“*operations*”) as input module 16. Yun explains that:

In addition, when there is no network connection or when the user does not need to operate remotely, the input buttons 16 of the WiFi fan 1 can be used to operate the WiFi fan 1. Specifically, the local default state is off after the WiFi fan 1 is powered on. When the user presses the wind speed adjustment button 161, the WiFi fan 1 starts to work. Each time the wind speed adjustment button 161 is pressed, it will speed up until reaching the third level, after which the WiFi fan 1 will return to the first level when pressing the wind speed adjustment button 161 again and the cycle repeats; when the user presses the rotation button 162, the WiFi fan 1 starts rotating left and right. When the rotation button 162 is pressed again, the rotation will stop. When the user presses the off button 163, the fan will stop working. **When the user changes the operating state of the WiFi fan 1, the WiFi fan 1 sends the current state to the cloud server 3 and simultaneously displays the current state on the liquid crystal display 15.**

(EX1007, [0040]).

131. Therefore, when Yun receives an “*operation*” (via input module 16) the “[t]he WiFi fan 1 will then handle the corresponding processing according to the received instructions.” EX1007, [0039]. In the combination, when a command is received by receiving unit 115 of McPherson the processor of Yun would perform the command (in the same manner as if it has been received by input module 16). EX1007, [0039]; EX1008, [0032]; Then the “WiFi fan 1 sends the

current state to the cloud server 3.” EX1007, [0040]. Therefore, in the combined system of Yun with McPherson would upload “the operating state of the WiFi fan” to the cloud server 3 after receiving and processing a control signal received via the “receiving unit.” In particular, the “operating state of the WiFi fan 1” is updated on the server in response to performing a fan “*operation*”—such as “speed up.” A POSA would have understood “the operating state of the WiFi fan” or fan “status information” to be “*an indication corresponding to the operation*” because they are messages that indicate that an operation has been performed by the fan. EX1007, [0028], [0040]; EX1001, 12:8-13:4, 3:42-47, 10:42-46, 10:58-60. In particular, as explained above, as each operation is performed a new message indicating a change in status will be sent to the server. Therefore, each status update is an indication corresponding to an operation, because they change when an operation is performed. The combined system of Yun with McPherson would upload “the current state” of the fan to the cloud server 3 after receiving and processing a control signal received via the “receiving unit.” A POSA would have understood that this command comes from the “*processor*” because, as explained above (§X.A.4.g), (1) drive circuit 12 controls the operations of the “*fan motor*,” (2) the “*processor*” controls “the operation of the drive circuit 12,” and (3) as explained above, there is a “communication connection” between the “*processor*” and the “*server*”. *Supra*, §X.A.4.g. Therefore, changes in the operations of the

fan would be executed by drive circuit 12 under the control of the “*processor*.” EX1007, [0028], [0040]. And the processor would then transmit the updated fan status to the cloud server. Therefore, the “*processor*” transmits “*an indication corresponding to the operation*” to the server after receiving a signal via receiving unit 115 of McPherson.

i. **Element 2[a]: “*The system of claim 1 further comprising, when the signal is a first signal, the operation is a first operation, and the indication is a first indication:*”**

132. In my opinion, Yun discloses and renders obvious element 2[a].

133. As explained in §X.A.4.h, Yun discloses “*the processor is configured to transmit, via the WiFi interface, to a server, **an indication** corresponding to the operation.*” In §X.A.4.e, Yun discloses “*a radio frequency interface configured to receive, at a first frequency, **a signal**.*” And in §X.A.4.g, Yun discloses “*the fan motor control circuit is configured to cause the fan motor to perform **an operation** in response to the signal.*”

134. The “*a signal*,” “*an indication*,” and “*an operation*” described in §§X.A.4.g, X.A.4.e, and X.A.4.h are the claimed “*a first signal, the operation is a first operation, and the indication is a first indication*” required by this claim element. Therefore, Yun discloses this claim element.

j. Element 2[b]: “a light; and”

135. In my opinion, the combination of Yun and McPherson discloses and renders obvious element 2[b].

136. In particular, McPherson explains that “[c]eiling fans have been widely used to provide a cooling function as well as a **lighting function**.” EX1008, [0003]. McPherson teaches that receiving unit 115 can be used to “subsequently manipulate several features of the lighting feature of the ceiling fan 130.” EX1008, [0038]. Moreover, a POSA would have understood that including a light would not change or alter the operation of Yun’s smart fan system. EX1021, 19 (“The [] light accessory operates independently from the fan”). For example, in paragraph [0033] of McPherson they explain that:

The processor **118** converts data messages transmitted from the wireless control device **120** and to the one or more fan receiving units **115**. Similarly, the processor **118** converts data messages transmitted from the one or more fan receiving units **115** to the wireless control device **120**. The data messages describe the commands and responses that to control the ceiling fans **130** from their wireless control device **120**. The data messages can relate to any commands and responses including for control of such features as turning the cooling and **lighting functions of the ceiling fans 130 on and off, changing the fan speeds and lighting output**, creating a security function event to randomly turn on and off the lights at a certain times of day to simulate the premises being occupied, indicating the signal strength of the communication link, etc.

137. Therefore, McPherson expressly discloses a “*light*” by describing the “lighting functions of the ceiling fans 130.”

- k. **Element 2[c]: “a light control circuit configured to cause the light to perform a second operation in response to a second signal received by the radio frequency interface.”**

138. In my opinion, the combination of Yun and McPherson discloses and renders obvious element 2[c].

139. As explained in §X.A.4.g, McPherson describes how RF “data messages” received by receiving unit 115 include the “commands and responses [] to control the ceiling fans 130.” EX1008, [0033]. McPherson goes on to explain that the “data messages can relate to any commands and responses including for control of such features as turning the cooling and **lighting functions of the ceiling fans 130 on and off, changing the fan speeds and lighting output.**” EX1008, [0033]. A POSA would have understood that receiver 115 in McPherson is receiving a “data message” which indicates it should change the lighting output, for example. The system in McPherson “manipulate[s] several features of the lighting feature of the ceiling fan 130,” based on a command received a receiving unit 115 (i.e., executing a command). EX1008, [0038]. Therefore, a POSA would have understood that McPherson discloses a “a light control circuit” because it is able to control the light based on a received command.

140. McPherson also renders this claim element obvious. In particular, “light control circuit[s]” were well-known in the prior art. EX1006, [0005] (“a brushless ceiling fan light based on [] an LED light control circuit”); EX1014,

6:54-55 (“a light level control circuit 68 that controls the illumination level of the ceiling fan light”). A POSA would have understood how to implement a “*light control circuit*” because they were (1) predictable and (2) well-known.

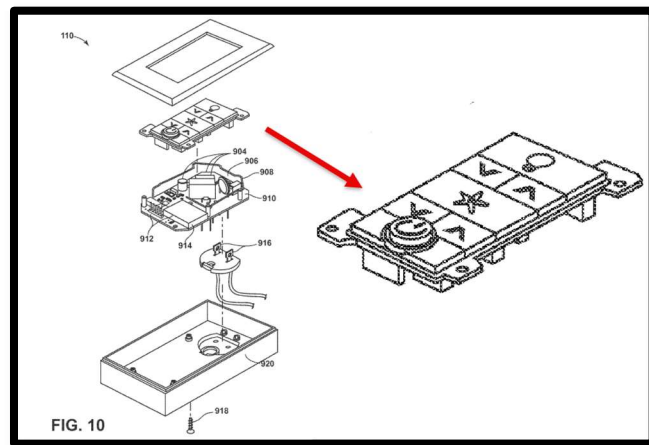
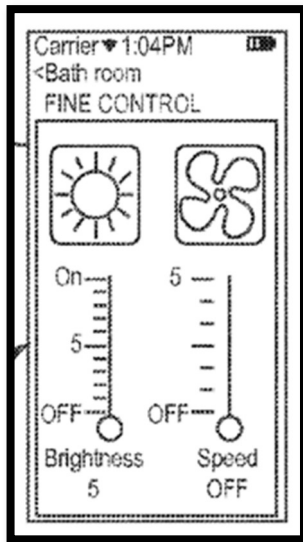
141. McPherson discloses “*a second signal*.” In particular, as explained in §X.A.4.e, the RF receiver 115 of McPherson receives a “*first signal*.” The “first signal” included “data messages” with control signals. Therefore, based on the same reasoning the RF receiver 115 of McPherson also receives a “*second signal*.” Likewise, the “*second signal*” would be “*received by the radio frequency interface*” for the same reasons.

142. McPherson also describes a “*second operation*.” In particular, McPherson explains that “widely used” prior art fan designs included a “lighting feature of the fan [that] typically includes the options: on/off/incremental dimming.” EX1008, [0003]. As explained in [0033] of McPherson “lighting functions of the ceiling fans 130 on and off, changing the fan speeds and lighting output.” EX1008, [0033]; EX1001, 4:4-5. Therefore, a POSA would have understood that McPherson describes a “*second operation*” in the form of operational commands to turn the fan on, off, or for incremental dimming (i.e., lighting output).

143. McPherson also describes controlling the fan light over the internet. For example, McPherson describes an interface “one or more fine control features

of the cooling and lighting functions such as the brightness of the light fixture.”

EX1008, [0040]; Fig. 2A (below). Additionally, McPherson describes a modified fan controller 110 in Figure 10 which includes up and down buttons for incremental dimming. EX1008, Fig. 10.



(EX1008, Fig. 2A and 10) (annotated)

144. Therefore, a POSA would have understood that McPherson discloses using the RF remote control to send on, off, and “lighting output” control signals. The system of McPherson then executes the lighting commands. EX1008, [0038], [0007]. In other words, the commands are “*a second operation in response to a second signal.*” A POSA would have understood that “lighting output” is the brightness of the light. It would also have been obvious to control the brightness of the light using the “data messages” of McPherson as McPherson already discloses using both a wireless device and fan controller to control the brightness of the light. Moreover, incremental dimming had been commonplace for decades

and a POSA would have known how to implement incremental dimming in the combination. EX1008, [0003]; EX1014, 1:65-67 (“She may then adjust the illumination level by depressing and holding the light button.”); EX1015, 1:20-21 (“control the speed of the fan and the intensity of the light.”)

I. Element 2[d]: “*wherein the processor is further configured to transmit to the server, via the WiFi interface, a second indication corresponding to the second operation.*”

145. In my opinion, Yun and McPherson disclose and render obvious element 2[d].

146. As explained in §X.A.4.h, Yun’s “*processor is configured to transmit, via the WiFi interface, to a server, an indication corresponding to the operation.*”

147. In particular, the “operating state of the WiFi fan 1” is updated on the server in response to performing a fan “*operation*”—such as “speed up” or “light on.” EX1007, [0039], [0040]. To ensure the most up to date “operating state of the WiFi fan 1” is in the server, a POSA would have understood that Yun would also transmit a “*a second indication corresponding to the second operation.*” Therefore, Yun discloses this claim element for the same reasons.

- m. **Element 3[a]: “*The system of claim 2 wherein: the first indication corresponds to an operation selected from the group consisting of: fan on, fan off, fan power state change, fan speed-up, fan speed-down, and fan direction-change; and*”**

148. In my opinion, Yun and McPherson disclose and render obvious element 3[a].

149. I have been informed that when a claim recites “*an operation selected from the group consisting of:*” (such as this claim limitation) the prior art need only discloses one of the listed “*operations*” to disclose the entire group.

150. In this case, Yun and McPherson discloses many of the listed operations. For example, Yun explains that:

The WiFi fan 1 is further provided with input buttons 16 for operating and configuring the WiFi fan 1. In this example, the input buttons 16 include at least a wind speed adjustment button 161, a rotation button 162, and an off button 163. The input buttons 16 are arranged corresponding to the drive circuit 12 and connected to the control communication module 13. When the control communication module 13 is used to control the WiFi fan 1, for example, when the wind speed adjustment button 161 is pressed, the fan starts to work. **Each time the wind speed adjustment button is pressed, it will speed up** until reaching the third level, after which the fan will return to the first level when pressing the button again and the cycle repeats; **when the user presses the rotation button 162, the fan starts rotating left and right**. When the rotation button 162 is pressed again, the rotation will turn off. **When the user presses the off button 163, the fan will stop working.**

(EX1007, [0030])

151. Therefore, a POSA would have understood that wind speed adjustment button 161 controls the “*fan speed-up, fan speed-down*” operations

because it can increase and decrease the speed of the fan. Rotation button 162 controls the “*fan direction-change*” operation because it makes the fan turn “left and right.” EX1007, [0030]. And, off button 163 along with wind speed adjustment button 161 controls the “*fan on, fan off, fan power state change*” operations because they turn the fan on and off and change the fan’s power state. EX1007, [0030].

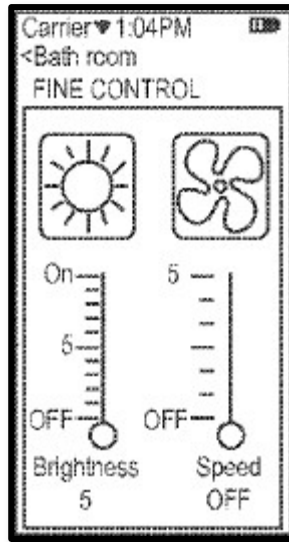
152. Likewise, McPherson explains that “[t]he data messages can relate to any commands and responses including for control of such features as turning the cooling and lighting functions of the ceiling fans 130 on and off, changing the fan speeds and lighting output.” EX1008, [0033]; *see* [0006] (“Ceiling fans also typically include a reverse switch which controls the rotary direction of the motor and thus the direction of the air flow.”) Therefore, McPherson also discloses at least the “*fan on, fan off, fan power state change, fan speed-up, fan speed-down*” operations.

- n. **Element 3[b]: “*the second indication corresponds to an operation selected from the group consisting of: light on, light off, light power state change, light increase, and light decrease.*”**

153. In my opinion, Yun and McPherson disclose and render obvious element 3[b].

154. I have been informed that when a claim recites “*an operation selected from the group consisting of:*” (such as this claim limitation) the prior art need only discloses one of the listed “*operations*” to disclose the entire group.

155. As explained in §X.A.4.k, McPherson discloses using the RF remote control to send on, off, and “lighting output” (i.e., incremental dimming) control signals. EX1008, [0033]. A POSA would have understood that on and off signals are the “*light on, light off, [and] light power state change*” operations. A POSA would have understood that incremental dimming includes the “*light increase, and light decrease*” operations. Moreover, McPherson teaches that the user may “manipulate and control [] the brightness of the light fixture” which a POSA would understand to include the “*light increase, and light decrease*” operations. EX1008, [0040], Fig. 2A (showing a brightness adjustment feature); EX1014, 1:65-67 (“She may then adjust the illumination level by depressing and holding the light button.”).



(EX1008, Fig. 2A) (annotated)

- o. Claim 4: “The system of claim 1 further comprising a housing; wherein the fan motor, the fan motor control circuit, the processor, the radio frequency interface, and the WiFi interface are disposed in the housing.**

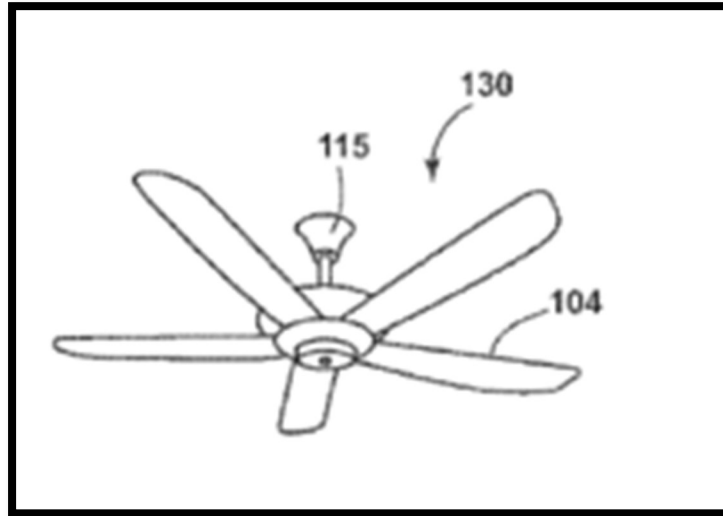
156. In my opinion, Yun and McPherson disclose and render obvious claim 4.

157. As explained in §§X.A.4.b, X.A.4.c, X.A.4.d, X.A.4.e, and X.A.4.f, the combination of Yun and McPherson discloses “*the fan motor, the fan motor control circuit, the processor, the radio frequency interface, and the WiFi interface.*”

158. Yun also renders this claim element obvious. Yun explains that their invention is an improvement over “traditional fan” or “existing fans” but additionally includes “a remote-control function.” EX1007, [0024], [0003], [0004]. “[T]raditional fan” or “existing fans” included a “*housing.*” In particular, a POSA would have known the general construction and configuration of a ceiling

fan, including that they include a housing in which their mechanical and electrical components are “*disposed*.” For example, using a fan housing in this manner was well-known and commonplace. *See e.g.*, EX1008, [0005] (“Existing ceiling fans comprise switch housings that contain the mechanical hardware which provide the operation to the functional features of the ceiling fan.”); EX1024, 2 (“Schulyer Wheeler was however adjudged to have invented the first electric fan produced from two unshielded blades, powered by an electric motor and housed in a protective cage using the principle of home cooling.”); EX1025, [0008] (“the housing cover is installed above the rotor, and the top of the housing cover has an opening where a downrod is fixed, with a yoke at the lower end thereof, and the ceiling fan DC brushless motor is disposed on the upper surface of the rotor; additionally, a canopy is installed at the upper end of the downrod, a mounting bracket is fixedly set on the canopy, and the mounting bracket is equipped with a receiver for controlling the DC brushless ceiling fan motor.”)

159. Additionally, McPherson discloses that receiving unit 115 is included within the fan of 130 (shown below). EX1008, [0025]; Fig. 1B.



(EX1008, Fig. 1B) (annotated)

160. Based on the figures and related description a POSA would have understood that fan 130 includes a housing, that receiving unit 115 is “*disposed in.*” Moreover, it would have been obvious to include the components of Yun’s system in the fan housing to (1) protect them, (2) protect the user, and (3) because such an implementation was well-known and commonplace.

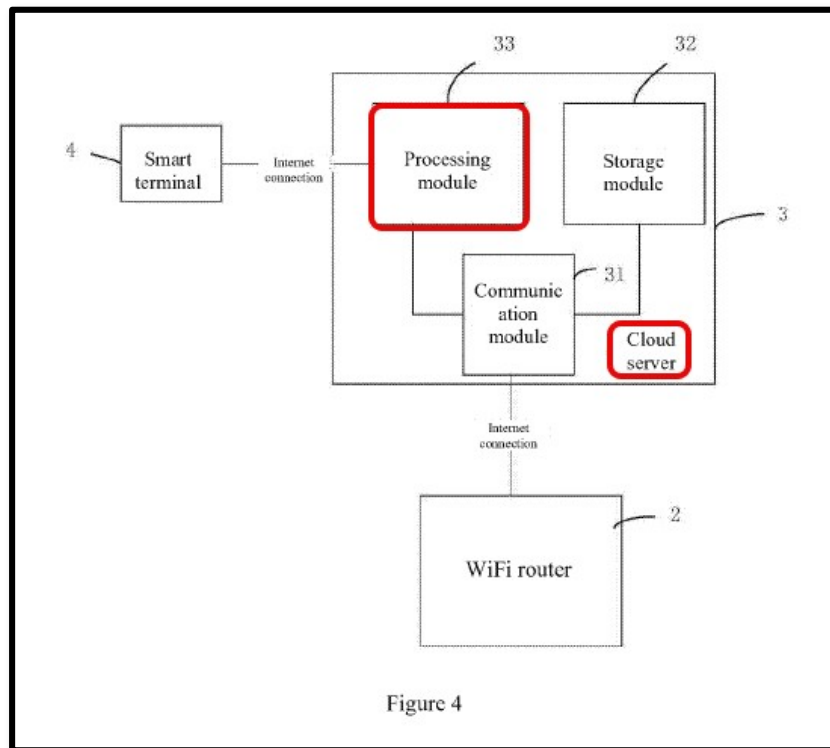
- p. **Element 8[a]: “*The system of claim 1 further comprising, when the processor is a first processor, the server; wherein the server includes a second processor configured to cause the server to*”**

161. In my opinion, Yun discloses and renders obvious element 8[a].

162. Yun discloses “*the server; wherein the server includes a second processor configured to cause the server*” to perform function recited later in claim

8. As explained in §X.A.4.h, Yun includes a “cloud server 3” in communication with the WiFi fan. EX1007, [0004], [0024]. Yun also explains that the cloud server 3 comprises “**a processing module 33 for receiving and processing user**

requests.” EX1007, [0006], [0024]. The processing module handles user requests and enables the cloud server to realize both WiFi communication with and control functions over the WiFi fan. EX1007, [0006], [0024]. “Referring to Figure 4, the cloud server 3 comprises a communication module 31 for communicating with the WiFi router 2, a storage module 32 for storing data obtained from the WiFi fan 1 and the smart terminal 4, and a processing module 33 for receiving and processing user requests. The storage module 32 and the processing module 33 are connected to the communication module 31. The processing module 33 is connected to the smart terminal 4 and is used to receive and process user requests made through the smart terminal.” EX1007, [0024]. A POSA would know based on these disclosures that the processing module of the cloud server comprises at least one processor.



(EX1007, Figure 4) (annotated).

163. Moreover, a POSA would have understood that a server is a type of computer that provides various services to another device such as data storage, web contents, or messaging. EX1027, 11; *see* EX1019 [0072] (“generalized computer architecture that represents an example of the type of computing machinery that may be included in an intelligent controller, **server computer, and other processor-based intelligent devices and systems.**”). By its conventional definition and based on Yun’s specifications, a POSA would know the “*the server*” in Yun comprises a processor. Therefore, a POSA would have known the cloud server of Yun to include a “*second processor.*”

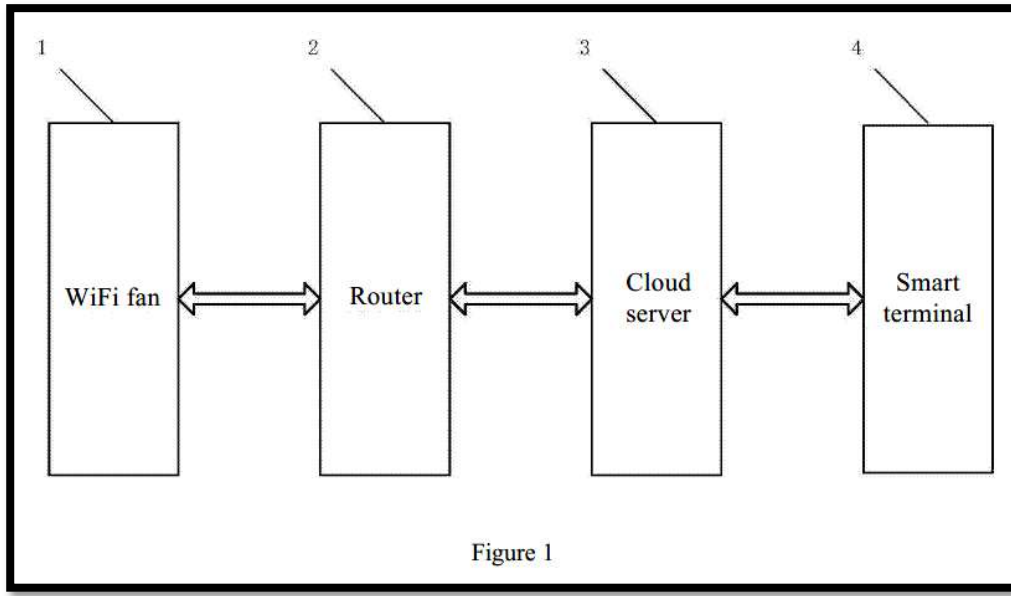
q. Element 8[b]: “*receive a command directed to the first processor; and*”

164. In my opinion, Yun discloses and renders obvious element 8[b].

165. Yun discloses a second processor configured to cause the server to “*receive a command directed to the first processor.*” Yun explains that “the cloud server 3 comprises a communication module 31 for communicating with the WiFi router 2, a storage module 32 for storing data obtained from the WiFi fan 1 and the smart terminal 4, and a processing module 33 for receiving and **processing user requests mase through the smart terminal.**” EX1007, [0024], [0006]. For example, a “cell phone is installed with an app software program that sends **control signals** to the WiFi fan 1 and receives feedback signals.” EX1007, [0025].

The app software can be used by the user to “[a]djust the wind speed, set rotational state, set timed on/off, timed shifting, etc.” (i.e., “*a command*”). EX1007, [0038]. The app software the “sends the user’s required state to the cloud server 3 and the cloud server 3 sends the information to the WiFi fan 1.” EX1007 [0039]. Once WiFi fan 1 receives the “user’s required state” the “control communication module 13 of the WiFi fan 1 will take the corresponding actions according to the received information.” EX1007, [0038-39]. As explained above (§X.A.4.d), the control communication module 13 includes “control module 131” (i.e., “*the first processor*”). EX1007, [0029]. Therefore, a POSA would know the “user’s required state” is a “*command directed to the first processor*” of the WiFi fan.

166. Moreover, “[t]he communication module 31 is connected to the WiFi router 2 for communicating with the WiFi router 2 to acquire information from the WiFi fan 1 and transmit it to the smart terminal 4 or to **send the requests processed by the processing module 33 to the control communication module 13 of the WiFi fan 1** through the WiFi router 2 so that the WiFi fan 1 performs the corresponding operations.” EX1007, [0024]. Figure 1 further shows the cloud server receiving the “user requests” sent from a smart terminal and sending the processed control signals to the corresponding WiFi fan. EX1007, [0029]. Therefore, the processing module (i.e., “*second processor*”) of the cloud server receives user requests meant for the WiFi fan.



(EX1007 Fig. 1)

r. Element 8[c]: “*communicate the command via the Internet and a WiFi router to the first processor.*”

167. In my opinion, Yun discloses and renders obvious element 8[c].

168. Yun discloses a second processor configured to cause the server to “*communicate the command via the Internet and a WiFi router to the first processor.*”

169. As explained in §X.A.4.q, Yun discloses a “*WiFi router*” communicating with the second processor of the server. Yun explains that “the WiFi fan 1 is connected to the cloud server 3. The cloud server 3 is connected to the smart terminal 4, thereby enabling the smart terminal 4 to remotely control the WiFi fan 1 through the cloud server 3.” Yun also discloses a “WiFi router 2 [whose] purpose is to establish a connection between the WiFi fan 1 and the cloud

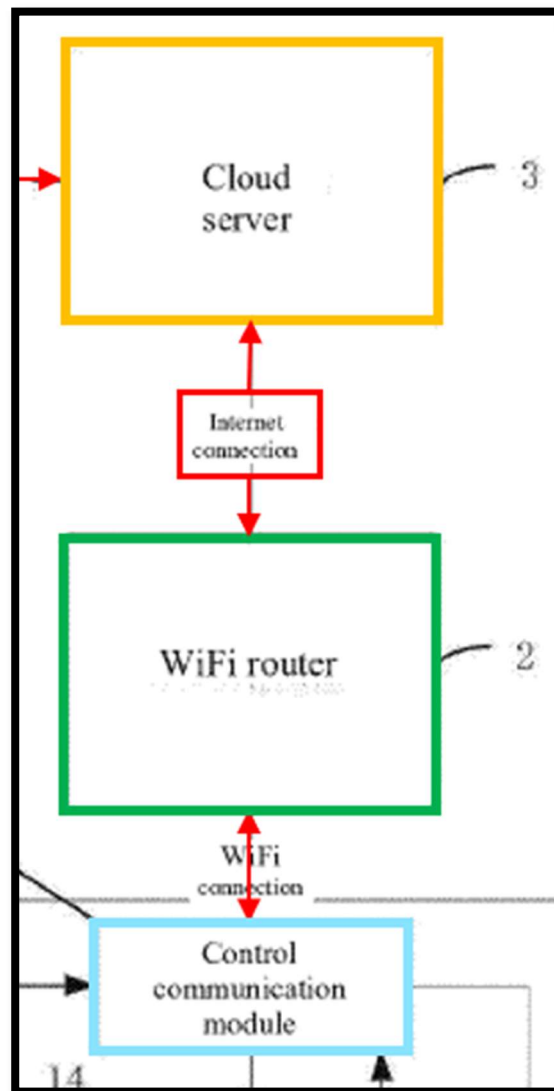
server 3. The WiFi fan 1 is connected to the Internet through the WiFi router 2, communicates with the cloud server 3, and then implements interaction with the smart terminal 4 through the cloud server 3.” EX1007, [0023], [0041]. “The communication module 31 is connected to the WiFi router 2 [which] **send[s] the requests processed by the processing module 33 to the control communication module 13 of the WiFi fan 1** through the WiFi router 2 so that the WiFi fan 1 performs the corresponding operations.” EX1007, [0024]. As explained in element 8[b], a POSA would have understood the “requests” to be “*commands*.”

170. Furthermore, Yun describes the smart terminal as an operations terminal connected to the Internet, thereby achieving remote control of the smart fan. EX1007, [0025]. Thus, when the app software receives a command it “sends the user's required state to the cloud server 3 and the cloud server 3 sends the information to the WiFi fan 1.” EX1007, [0039]. Once the WiFi fan 1 receives the “user's required state”, the control module 131 (i.e., the first processor) “will take the corresponding actions according to the received information.” EX1007, [0039]. Therefore, a POSA would have understood that the second processor “*communicate[s] the command ... to the first processor*,” because the first processor “*take[s] the corresponding actions*.”

171. Yun discloses that the server “*communicate[s] the command via the Internet and a WiFi router*.” Yun explains that the “WiFi fan 1 is connected to the

Internet through the WiFi router 2” and “communicates with the cloud server 3.”

EX1007, [0023], [0005]. This is further evidenced by Figures 2 and 4 showing an “Internet Connection” linking the WiFi router 2 and cloud server 3. EX1007, Figs. 2 & 4. Therefore, a POSA would have understood that the command is sent via the Internet and a WiFi router to the first processor.



(EX1007 Fig 2) (annotated)

- s. **Claim 9: “*The system of claim 8 wherein the second processor is further configured to cause the server to update information about a state of a device that is in a wireless local network based on the command.*”**

172. In my opinion, Yun discloses and renders obvious claim 9.

173. Yun discloses that the second processor is configured to cause the server “*to update information about a state of a device that is in a wireless local network based on the command.*”

174. First, as explained in §X.A.4.i, Yun discloses a “*second processor.*” Yun explains that the cloud server 3 comprises “**a processing module 33 for receiving and processing user requests.**” EX1007, [0006], [0024]. A POSA would know that the processing module comprises “*a second processor.*”

175. Second, Yun discloses that the second processor is configured to cause the server “*to update information about a state of a device...based on the command.*” As explained in §X.A.4.q, when the app software receives a command it “sends the user’s required state to the cloud server 3 and the cloud server 3 sends the information to the WiFi fan 1.” EX1007, [0039]. Once the WiFi fan 1 receives the “user’s required state,” the control module 131 (i.e., the first processor) “will take the corresponding actions according to the received information.” EX1007, [0039]; see [0029]. Yun further explains that after the WiFi fan implements the requested action, “the current state of the WiFi fan 1 will be sent to the cloud server 3 and the cloud server 3 will then forward it to the user's smart terminal 4.”

EX1007, [0039]. Additionally, “[o]n the smart terminal 4, the **user can see the latest state of the smart fan at any time.**” EX1007, [0039]. A POSA would have understood that because the “latest state of the smart fan” is visible at all times and because “the current state of the WiFi fan 1 will be sent to the cloud server 3” after each command the server must “*update information about a state of a device.*” Specifically, the “latest state” means that when the fan executes a user command (causing its state to change), the current state of the fan must be updated to a new “latest state.” EX1007, [0039]. Therefore, the “*second processor*” (e.g., processing module 33 in cloud server 3) is “*configured to cause the server to update information*” by forwarding the current state of the fan to the user's smart terminal 4.

176. Third, Yun discloses that the fan device “*is in a wireless local network.*” As explained in §X.A.4.h, connection between the WiFi fan 1 and cloud server 3 is enabled over WiFi, via the WiFi router 2. EX1007, [0014], [0022]. Yun also explains that “the smart fan can form a smart home network with smart appliances.” EX1007, Abstract. A POSA would have understood the WiFi fan 1 and WiFi router 2 to comprise a “*wireless local network.*” Moreover, Yun describes how to configure the WiFi fan within the “current range” of the WiFi router, so that “the smart fan can form a **home network with smart appliances.**” EX1007, [0014], [0036] (“First, connect the smart terminal 4 to a currently

available WiFi. Click Add Device on the app software program of the smart terminal 4 and the smart terminal 4 will automatically search for an available WiFi fan 1 in the **current range**.”). A POSA would have recognized that Yun is describing setting up “*a wireless home network*.” Therefore, the fan status sent by the WiFi module to the server is the “*state of a device that is in a wireless local network*.” EX1007, Abstract, [0014], [0036].

177. Moreover, Yun explains that “[o]n the smart terminal 4, the user can see the latest state of the smart fan at any time.” EX1007, [0039], [0024] (“a storage module 32 for storing data obtained from the WiFi fan 1 and the smart terminal 4”). A POSA would have understood the ability to “see the latest state of the smart fan at any time” indicates that the “latest state” of the fan is stored in the cloud server 3 storage module 32. Furthermore, a POSA would have understood that storing the current fan state in the server would be a common-sense way to configure the system, as the server already includes a memory. EX1007, [0039], [0024]; EX1019 [0072] (“server computer, and other processor-based intelligent devices and systems...includes one or multiple central processing units (“CPUs” 602-605, one or more electronic memories.”) A POSA would have understood that “[i]t is a collective function of the central cloud-based management server [] to ensure that the group-state-information object in each [device] is maintained with fresh information.” EX1019 [0226]. Moreover, a POSA would have understood

based on the disclosed cloud server functionality, that Yun discloses that a server which “*update[s] information about a state of a device that is in a wireless local network based on the command.*” Yun’s cloud server 3 possesses intelligent functionality such as “smart timing, remote restart and shutdown, smart shifting, intelligent display, and smart display.” EX1007, [0041]. Disclosed functions such as smart timing, smart shifting, and intelligent displays are autonomous features that a POSA would have understood requires the server to be able to update information regarding fan status and convey that data to a user device.

- t. **Claim 10: “*The system of claim 9 wherein the second processor is further configured to cause the server to update the information in response to transmitting the command from the server.*”**

178. In my opinion, Yun discloses and renders obvious claim 10.

179. Yun discloses that “*the second processor is further configured to cause the server to update the information in response to transmitting the command from the server.*” As explained in §X.A.4.s, when the WiFi fan 1 receives a “user’s required state” it “will take the corresponding actions according to the received information.” EX1007, [0039], [0029]. After the WiFi fan takes the user requested actions, “the current state of the WiFi fan 1 will be sent to the cloud server 3 and the cloud server 3 will then forward it to the user’s smart terminal 4.” EX1007, [0039]. Once the cloud server 3 forwards the current state of the WiFi fan 1, “the user can see the latest state of the smart fan at any time”

(i.e., the server updates the current state of WiFi fan 1 after it sends the command).

EX1007, [0039]. Therefore, the cloud server 3 updates the information “*in response to transmitting the command from the server.*”

180. In my opinion, Yun expressly discloses this limitation, but to the extent Patent Owner argues otherwise, Yun additionally renders this claim limitation obvious. As explained in §X.A.4.s, when the app software receives a user command it “sends the user's required state to the cloud server 3 and the cloud server 3 sends the information to the WiFi fan 1.” EX1007, [0039]. Yun also explains that “the user can see the latest state of the smart fan at any time.” EX1007, [0039]. A POSA would have understood updating the server in response to transmitting a command is a common-sense way to configure the system since the server includes a memory for updating information in response to any substantial event. EX1019 [0072], [0226] (“server computer, and other processor-based intelligent devices and systems...includes one or multiple central processing units (“CPUs) 602-605, one or more electronic memories....[wherein] [i]t is a collective function of the central cloud-based management server [] to ensure that the group-state-information object in each [device] is maintained with fresh information.”). Therefore, it would have been obvious to a POSA “*to update the information in response to transmitting the command from the server*” in order to show the current state of the fan. A POSA would also understand that to “*update*

the information” after transmission from the server would be a simple optimization of existing components within the system of Yun. Therefore, Yun renders obvious this claim limitation.

B. Ground 2: Claims 1-4 and 8-10 are obvious over Qirong alone

1. Overview of Qirong

181. Qirong (EX1006) is Chinese Patent No. 206738206, published on December 12, 2017, and discloses a smart fan controllable by a control terminal (e.g., smartphone) and a traditional remote control. EX1006, [0019], [0025], Title (“A Brushless Ceiling Fan Light Based on WiFi Smart Remote Control.”). I understand based on the specification, that Qirong “is a pioneering creation in the ceiling fan light industry, being the first to introduce Internet of Things (IoT) technology to realize remote control of brushless ceiling fan lights.” EX1006, [0020]. The fan device of Qirong comprises two communication interfaces: [1] a WiFi module and [2] a wireless remote control receiver circuit operating at 433 MHz (i.e., RF). EX1006, [0019]-[0021], [0030]; EX1001, 11:32-34 (“the RF interfaces use a sub-GHz frequency band, e.g., 315 MHz or 433 MHz.”).

182. The WiFi module enables a user to view and control fan operations (i.e., speed, on-off, mode adjustments) remotely from a device over the Internet. EX1006, [0021]. Users remotely operate the fan via mobile application. “By installing the mobile APP on the phone, and with the fan control system being

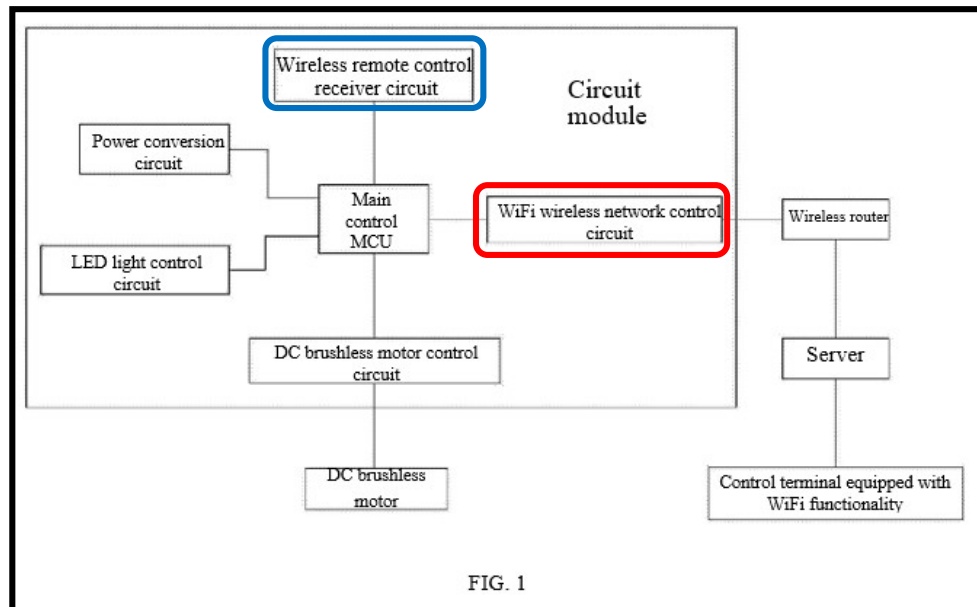
within the available WiFi signal range, it is capable of realizing remote viewing and control through the network.” EX1006, [0028]. The user may perform stepless speed regulation, on and off switching, and mode adjustments for the ceiling fan light remotely over the Internet. Connection between the fan and control terminal equipped with WiFi functionality is established via an intermediate WiFi router and server. EX1006, [19]. "The WiFi module of a ceiling fan light is connected to a wireless router device in STA mode through the TCP/IP protocol. The wireless router is connected to the Internet, and a connection to the server is established therethrough. The WiFi module of the ceiling fan light is connected to a motor driver through the UART serial port, thereby enabling data communication. The status is then uploaded to the server through the WiFi module and synchronized for push notifications to the WiFi control terminal.” EX1006, [0023-25]. The WiFi wireless network control circuit (“WiFi Module”) is connected to a wireless router outside of the circuit module. EX1006, [0019]. The wireless router is further connected to a server, which enables wireless communication in between a control terminal equipped with WiFi functionality and the fan device. EX1006, [0019]. Data communication related to fan status and command inputs occurs between the WiFi module and a control terminal via an intermediate server. EX1006, [0019]. A POSA would have known that “WiFi” is a “wireless Ethernet link operating in

the 2.4 GHz band and conforming to IEEE 802.11b.” EX1028, 4; *see* EX1001, 11:34 (“the WiFi interfaces use a 2.4 GHz frequency band.”).

183. Qirong also teaches a wireless remote control receiver circuit for receiving RF commands from a remote control. “The wireless remote control receiver circuit adopts a wireless communication with a frequency of 433 MHz. Compared with a traditional TV remote control, it has the advantages of arbitrary directionality, is not obstructed by objects, is less susceptible to interference, and greater stability.” EX1006, [0030]. Like the WiFi module, the receiver circuit is “connected to the main control MCU,” enabling the sending of control messages to the motor driver. EX1006, [0024], [0027]. By adding the WiFi wireless network control interface, Qirong acknowledges that the system structure provides for an additional interface beyond the wireless remote interface operating at 433 MHz. EX1006, [0019], [0025], [0030], Figure 1. Specifically, Qirong states, “brushless ceiling fans are no longer restricted to remote control, wall control, and chain methods, thereby enhancing the usability thereof.” EX1006, [0022]. Based on Figure 1 and further disclosures in Qirong’s specification, I understand that the architecture promotes two separate receivers for both WiFi and RF control.

184. Figure 1, which I reproduced below, provides “a schematic diagram illustrating the principle of the ceiling fan and light system.” EX1006, [0012]. Qirong permits for reception of commands at either or both the WiFi wireless

network control circuit (**red**) or the RF wireless remote control receiver circuit (**blue**). EX1006, [0006-0007] (“In one or more examples of the present utility model, the control terminal with WiFi functionality refers to a mobile phone, which is equipped with an **APP software for controlling** the LED light control circuit and the DC brushless motor control circuit. In one or more examples of the present utility model, a **wireless remote control receiver circuit** connected to the main control MCU is further included.”).



(EX1006, Fig. 1)

185. Qirong further discloses a conventional DC brushless fan comprising a DC brushless motor, motor control circuit, and centralized main control MCU for processing and implementing command inputs. EX1006, [0019]. The fan also includes a power conversion circuit to supply power to the other fan components,

an LED light and light control circuit, a wireless remote control receiver circuit which enables RF communication, and a WiFi wireless network control circuit which enables WiFi communications. EX1006, [0019], [0030]. As stated earlier, “[a] typical electric fan is made up of blades, hub, motor, switch, guard, mount and a power cord”. EX1024, 2. Wherein the current supplied to the fan motor energizes the fan blades and enables rotation. EX1024, 2. A fan control circuit enables the performed operation of the fan motor and corresponding fan blades. EX1012, 2. Qirong teaches these conventional fan elements with additional “remote control” functionality.

186. Qirong further discloses a main control MCU which is responsible for controlling fan circuitry such as the disclosed DC brushless motor control circuit and the LED light control circuit. EX1006, [0019]. “The main control MCU part adopts imported chips designed in the United States. Highly optimized for the power supply and control requirements of the new generation of smart home appliances and intelligent devices, the chip integrates a 50 MHz ARM Cortex-M0 32-bit microcontroller core with a multi-mode power management module, configurable analog front end, and special application power drives. These components form a highly integrated microcontroller-based universal controller, particularly suitable for motor control applications.” EX1006, [0032]. Control

signals received by the receiver unit cause the MCU to control the operation of the corresponding fan circuit. EX1006, [0019].

2. Claims 1-4, 8-10

a. Element 1[pre]: “*A system comprising:*”

187. I understand that the preamble may not be limiting. Regardless, in my opinion, Qirong renders obvious the preamble of claim 1.

188. Qirong discloses “*a system.*” Specifically, Qirong teaches a “fan control system [] capable of realizing remote viewing and control through the network.” EX1006, [0005], [0028]. The specification further describes a “motor driver system” within the fan which controls the fan blade status. EX1006, [0027]; see Figure 1 (a schematic diagram of the main structure of the fan control system).

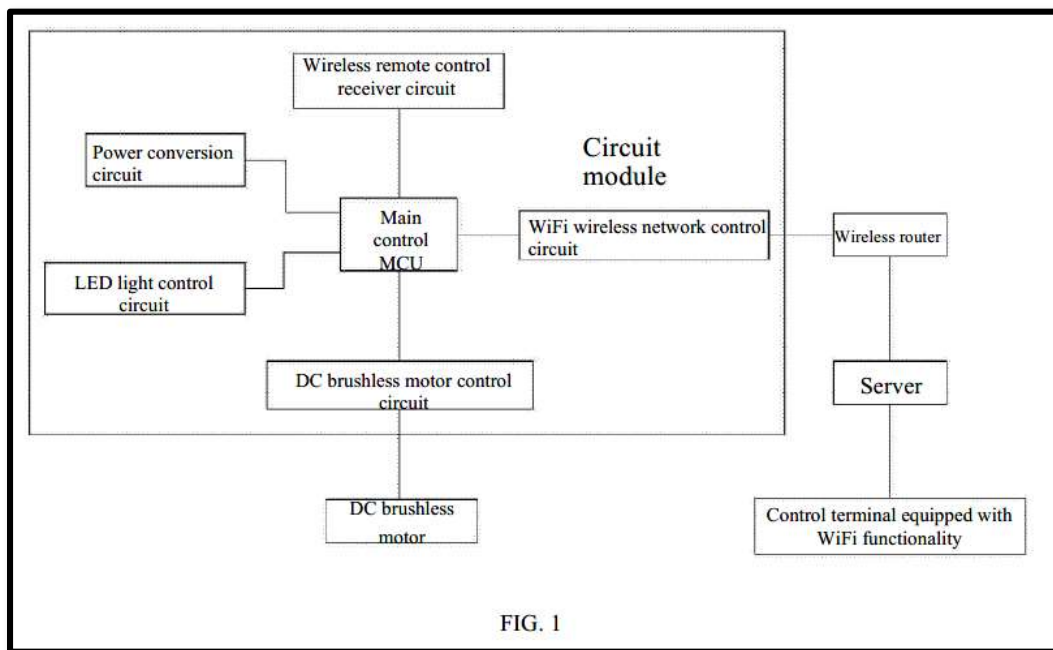


FIG. 1

(EX1006, Fig. 1)

189. Thus, to the extent the preamble of claim 1 of the '854 Patent is limiting, it is my opinion that Qirong discloses and renders obvious the preamble of claim 1.

b. Element 1[a]: “*a fan motor*,”

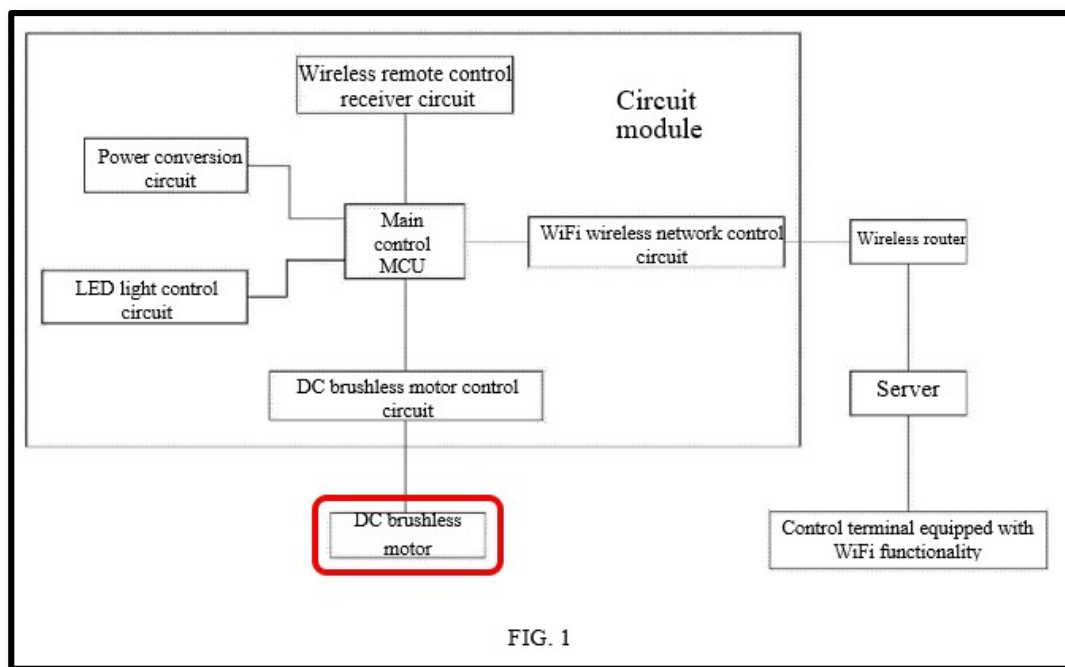
190. In my opinion, Qirong discloses and renders obvious element 1[a].

191. Qirong discloses “*a fan motor*.” Qirong explains the structure of a conventional “**brushless ceiling fan** light...including a DC brushless **motor**.” EX1006, Abstract, [0019] (“With reference to FIG. 1, a brushless ceiling fan light based on WiFi smart remote control is provided in the present example, including a DC brushless motor”). The disclosed fan motor is operated by the **DC brushless motor** control circuit, which “adopts an FOC sensorless sine wave drive hardware and its algorithm [] [for] **improving motor efficiency**.” EX1006, [0033]; *see* [0027] (“motor driver system”). The “main control MCU [] components for a highly integrated microcontroller based universal controller, particularly suitable for **motor control application**.”

192. Moreover, Qirong expressly teaches the structure of conventional ceiling fans in the “prior art.” EX1006, [0003]. In my opinion, a POSA would have understood that a “ceiling fan includes a “*fan motor*.” In particular, fan motors within ceiling fans were well known in the prior art. EX1024, 2-3 (“A typical electric fan is made up of blades, hub, **motor**, switch, guard, mount and a power

cord...[wherein] current is supplied to the DC motor by the battery, which in turn energizes the fan blade”); EX1025, Abstract (“a ceiling fan body, composed of a housing cover, a ceiling fan DC brushless motor, a rotor, a blade, and a light disk.”). Therefore, a POSA would have known the ceiling fan of Qirong includes a fan motor.

193. Figure 1 shows the DC brushless fan motor connected to the DC brushless motor control circuit of the circuit module.



(EX1006 Fig. 1) (annotated)

194. I understand that a DC fan motor is one of the disclosed embodying fan motors of the '854 Patent. EX1001, 8:27-29 (“In various embodiments fan motor 304 is a Brushless DC (BLDC) motor”). Qirong expressly discloses a “DC

brushless motor” in the fan design. EX1006, [0019]. Therefore, Qirong expressly discloses this claim element.

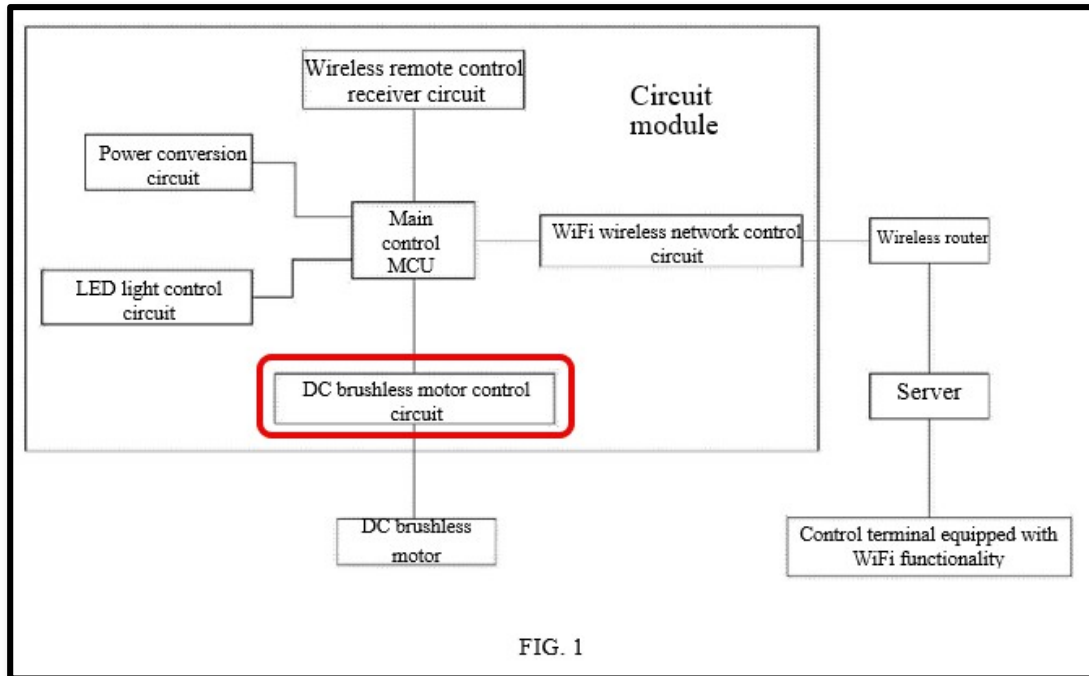
c. Element 1[b]: “a fan motor control circuit;”

195. In my opinion, Qirong discloses and renders obvious element 1[b].

196. Qirong discloses “a fan motor control circuit.” Qirong explains the structure of a conventional “**brushless ceiling fan** light [] which comprises [] a DC brushless motor control circuit.” EX1006, [0019]. The “DC brushless fan motor control circuit” connects the main control microcontroller unit (“MCU”) to the fan motor. EX1006, [0019]. “The DC brushless motor control circuit adopts an FOC sensorless sine wave drive hardware and its algorithm, enabling sensorless FOC **operation of the motor.**” EX1006, [0033]. A POSA would have understood that the “DC brushless **fan motor control circuit**” is the claimed “*fan motor control circuit*,” and controls the operation of the fan motor. This is evidenced by the disclosed functionality of the MCU, which is “particularly suitable for motor control applications.” EX1006, [0032]. Moreover, Qirong teaches that a user may remotely control the fan device from app software on a mobile device, where the “APP software [is] for controlling the LED light control circuit and the DC brushless motor control circuit.” EX1006, [0025], [0029]. A POSA would know that control of the motor control circuit results “stepless speed regulation, on and off switching, and mode adjustments for the ceiling fan.” EX1006, [0025].

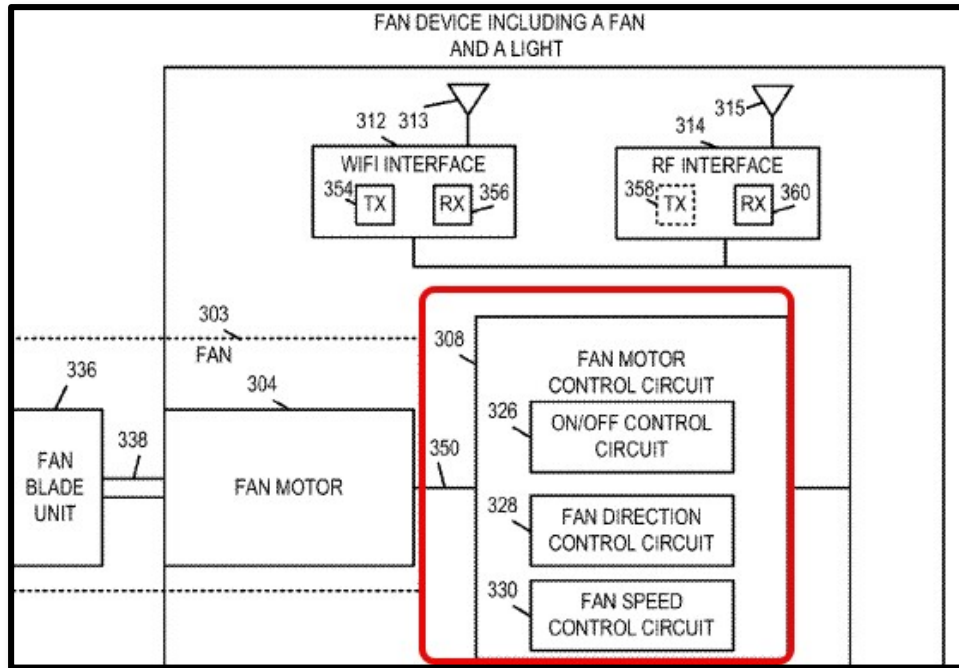
Moreover, a POSA would have understood that DC brushless fan motor control circuits were widely utilized in commercial electric fans due to their increased energy efficiency and durability. EX1006, [0033] (Explaining field oriented control in the “DC brushless motor control circuit [] enables the three-phase operating current of the motor to approach a sine wave, thereby **reducing torque ripple, minimizing rotational noise, and improving motor efficiency.**”); see EX1025, [0003] (“an electric fan controllable via a mobile phone speaker, including a fan blade, a motor for driving the fan blade, and a control circuit for controlling the electric fan.”). Therefore, a POSA would have known the ceiling fan of Qirong includes a fan motor control circuit.

197. Figure 1 shows the DC brushless fan motor control circuit connected to the DC brushless motor and main control MCU of the circuit module.



(EX1006 Fig. 1) (annotated)

198. I understand that a DC fan motor control circuit is one of the disclosed embodying fan motors of the '854 Patent. EX1001, 8:27-29 (“In various embodiments fan motor 304 is a Brushless DC (BLDC) motor...[with] a fan motor control circuit 308”); Figure 3 (showing a schematic diagram of a fan device, including the fan motor control circuit). Qirong expressly discloses a “DC brushless motor control circuit” in the fan design. EX1006, [0019]. A POSA would have known that most, if not all, of the commercially available ceiling fans can turn their blades at different speeds and directions. In order to provide such flexibility, certain mechanism for controlling fan motor must be implemented in the fan system, a fact well known to a POSA. Therefore, Qirong expressly discloses this claim element.



(EX1001 Fig. 3) (annotated)

d. Element 1[c]: “a processor in electrical communication with the fan motor control circuit;”

199. In my opinion, Qirong discloses and renders obvious element 1[c].

200. Qirong discloses “a processor in electrical communication with the fan motor control circuit.” Qirong discloses a microcontroller unit (“MCU”) that “integrates a 50 MHz ARM Cortex-M0 32-bit microcontroller core.” EX1006, [0019], [0032]. A POSA would know ARM Cortex-M are a group of widely utilized processing cores optimized for the energy efficient operation of electronic devices (i.e., fans). EX1033, 12 (“The Cortex-M4 processor is a low-power processor that features low gate count, low interrupt latency, and low-cost debug.”), 22. These chips enable digital signal control of a device in signal rich

environment such as a home appliance network. The disclosed ARM microprocessor “features up to 32 KB of embedded flash memory and 8 KB of SRAM, a 10-bit μ s high-speed analog-to-digital converter (ADC) with two automatic sampling sequences, 5V/3.3V configurable I/Os, a flexible clock source, a timer, a versatile 14-channel PWM engine, and multiple serial interfaces.”). EX1006, [0032]. Here, the ARM microprocessor processes signals received by the Wireless remote control receiver circuit and the WiFi wireless network control circuit to implement the corresponding fan and light operation. EX1006, [0019], [0029], [0032]. The ARM microprocessor likewise processes information received by the various fan circuits (i.e., power conversion, motor control, light control) to send to the server and control terminals via the WiFi wireless network control circuit. EX1006, [0019], [0028].

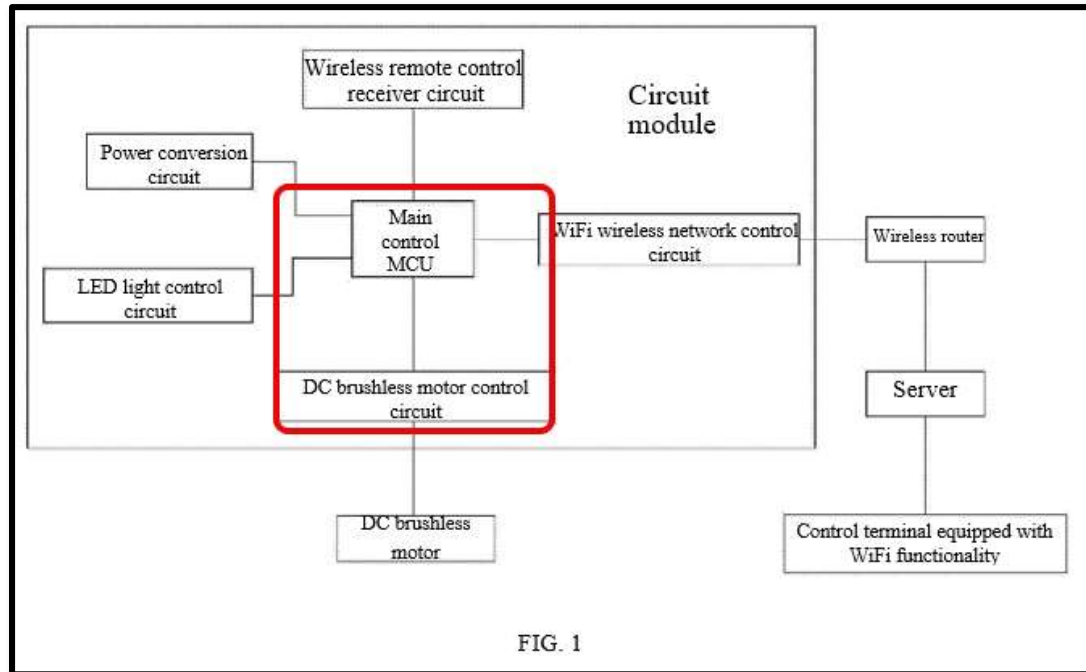
201. Moreover, a POSA would have known that the MCU is a processor based on the disclosed functionality (i.e., establishing WiFi connection, stepless speed regulation, receiving control inputs, processing signal requests and smart remote control). EX1006. The MCU directly controls both the LED light control circuit and DC brushless motor control circuit in response to a command signal. EX1006, [0019], [0029] (“the control terminal with WiFi functionality refers to a mobile phone, which is equipped with an APP software for controlling the LED light control circuit and the DC brushless motor control circuit.”). The MCU

“component form a highly integrated microcontroller based universal controller particularly suitable for motor control application.” EX1006, [0032]. These functions are most efficiently implemented by a processor. A POSA would recognize that smart devices, including fans, require at least one processor. EX1019, [0071] (“generalized computer architecture that represents an example of the type of computing machinery that may be included in an intelligent controller, server computer, and other **processor-based intelligent devices and systems.**”); EX1022. Therefore, Yun discloses this claim element. EX1006, [0021], [0032].

202. Moreover, Qirong discloses that processor (i.e., MCU) is “*in electrical communication with the fan motor control circuit.*” In particular, “[t]he main control MCU is connected to the DC brushless motor through the DC brushless motor control circuit,” as depicted below. EX1006 [0030]; *see* [0019] (“**The main control MCU is respectively connected to** the power conversion circuit, the LED light control circuit, **the DC brushless motor control circuit**, and the WiFi wireless network control circuit, of which, the power conversion circuit converts mains electricity into high- and low-voltage DC to supply power to various circuit components.”); Fig. 1 (reproduced below) (depicting the MCU in direct electrical connection with the DC brushless fan motor control circuit), [0016] (noting that “connection...should be broadly interpreted.”).

203. Furthermore, Qirong teaches that a user may remotely control the fan device from app software on a mobile device, where the “**APP software [is] for controlling** the LED light control circuit and **the DC brushless motor control circuit.**” EX1006, [0025], [0029]. Wherein, “[t]he **main control MCU is connected to []** the WiFi wireless network control circuit [which] is connected to a router, which is connected to a server, which establishes a wireless communication connection with a control terminal equipped with WiFi functionality and **a mobile phone APP.**” EX1006, [0005]. The control signals sent from a mobile phone are received by the fan’s WiFi wireless network control circuit, which causes the MCU to control the DC brushless motor control circuit. EX1006, [0005], [0025]. This is further evidenced by the “motor control applications” of the MCU. EX1006, [0032]. (“components form a highly integrated microcontroller based universal controller particularly suitable for **motor control application.**”) EX1006, [0032]. A POSA would have understood that the MCU (i.e., processor) would need to be in electrical communication with the motor control circuit to implement the requested functions (i.e., “stepless speed regulation, on and off switching”) by issuing certain control signals. EX1006, [0025].

204. Figure 1 further discloses the MCU in direct contact with the DC brushless fan motor control circuit.



(EX1006 Fig. 1) (annotated)

205. Additionally, Qirong describes electrical and data connections between the MCU and the DC brushless motor control circuit. EX1006, [0024] (the “WiFi module” has a “data communication” channel with the “motor driver through the UART serial port”). Moreover, the power conversion circuit enables power supply to the main control MCU and the motor driver system. EX1006, [0027]. The power version circuit converts AC220V to high-voltage DC required for the motor driver system and low-voltage DC required for the main control MCU. EX1006, [0027]. EX1006, [0024]. A POSA would have understood based on this statement and Figure 1, that data communication from the fan motor driver

to the WiFi module requires an electrical connection from the fan motor control circuit and MCU processor.

e. **Element 1[d]: “a radio frequency interface configured to receive, at a first frequency, a signal;”**

206. In my opinion, Qirong discloses and renders obvious element 1[d].

207. Qirong discloses “a radio frequency interface configured to receive, at a first frequency, a signal.” Qirong explains that the fan device includes a “wireless remote control receiver circuit.” EX1006, [0019]; [0030]. The “wireless remote control receiver circuit” is connected to the MCU and uses a “frequency of 433 MHz” (i.e., a “first frequency”). EX1006, [0030]. In particular, Qirong states:

Preferably, a wireless remote control receiver circuit connected to the main control MCU is also included. The wireless remote control receiver circuit adopts a wireless communication with a frequency of 433 MHz Compared with a traditional TV remote control, it has the advantages of arbitrary directionality, is not obstructed by objects, is less susceptible to interference, and greater stability.

208. A POSA would have understood that 433 MHz is within “radio frequency,” and therefore, the “wireless remote control receiver circuit” is a “**radio frequency** wireless interface configured to receive, at a first frequency.” EX1001, 11:33-34 (“RF interfaces use a sub-GHz frequency band, e.g., 315 MHz or 433 MHz, and the WiFi interfaces use a 2.4 GHz frequency band.”). The Microsoft Computer Dictionary defines Radio Frequency as “the portion of the

electromagnetic spectrum with frequencies between 3 kilohertz and 300 gigahertz.” EX1027, 10. Therefore, Qirong discloses a “*radio frequency*.”

209. Moreover, the “*wireless remote control receiver circuit*” receives “*a signal*.” A POSA would have understood “wireless communication” to mean the receiving and/or transmitting of signals. In particular, a POSA would have understood that the “**wireless remote control receiver circuit**” is used to wirelessly communicate with a “remote control.” EX1006, [0030]. Therefore, the disclosed receiver circuit receives a first signal. For example, Qirong explains that the wireless remote control receiver circuit uses a “frequency of 433 MHz” (i.e., a “*first frequency*”) for “wireless communication.” EX1006, [0030], [Claim 3], [0007]. This is further evidence by the comparison of the control of the wireless remote control receiver circuit to that of a conventional TV remote. Qirong explains that “[c]ompared with a traditional TV remote control,” the “wireless remote control receiver circuit” has the advantages of “arbitrary directionality, is not obstructed by objects, is less susceptible to interference, and greater stability.” EX1006, [0030]. A POSA would have understood that the “wireless remote control receiver circuit” receives a signal in order to enable it to perform the types of functionalities associated with a “traditional TV remote control.”

210. As stated earlier, local fan control is largely achieved by remote controllers or pull-chains. EX1008, [0003], [0023] (explaining ceiling fans are

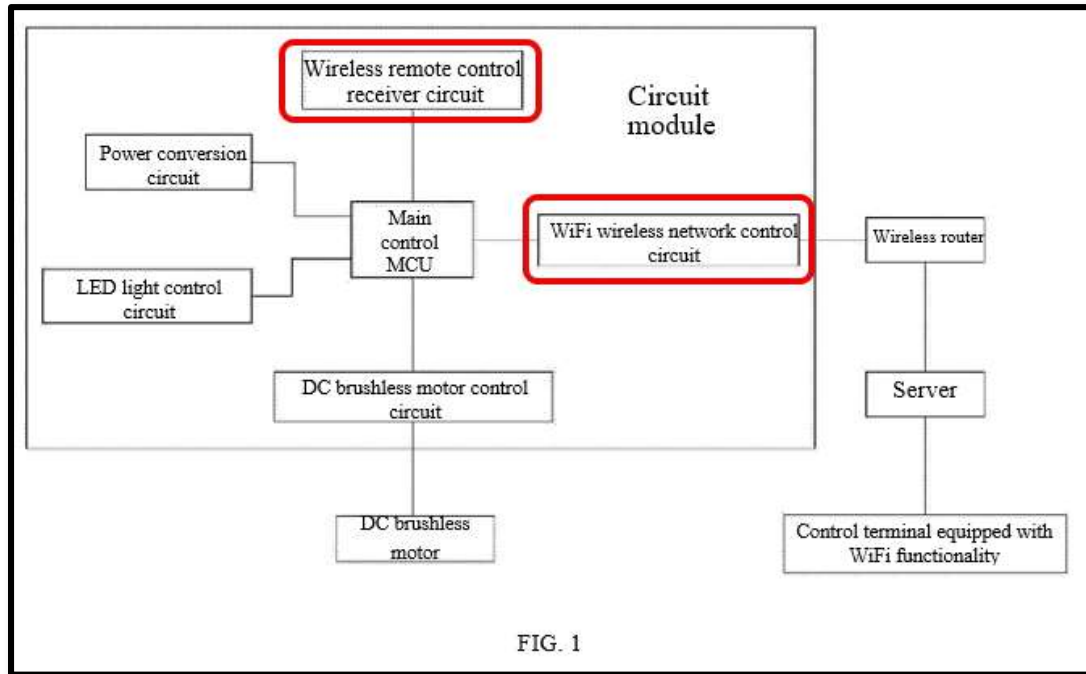
“usually operated by one or more pull chains and/or by a remote control” or an “embodiment of the fan controller to be mounted to a wall.”). Therefore, using an RF remote control to control fan operations would have been obvious to a POSA, since this is how a fan is “usually operated.” Moreover, an RF remote controller was one of a finite number of commercially viable solutions for controlling a ceiling fan, making it obvious to try. EX1008, [0003]. Namely, wireless RF fan controllers have been known in the art for decades and provide several advantages to other control methods such as broad directionality and increased control range. EX1006, [0030]; EX1008; EX1030; EX1012; EX1014.

211. Therefore, Qirong discloses this limitation.

f. Element 1[e]: “a *WiFi interface configured to communicate at a second frequency that is different from the first frequency*;”

212. In my opinion, Qirong discloses and renders obvious element 1[e].

213. Qirong discloses the “*WiFi interface configured to communicate at a second frequency that is different from the first frequency*.” Qirong explains that the fan device contains a “WiFi wireless network control circuit” (i.e., “WiFi module”). EX1006, [0019], [0023]. In particular, in Figure 1, Qirong depicts the two communication modules: (1) an RF interface (“remote control receiver unit”) and (2) a WiFi interface (“WiFi wireless network control circuit”).



(EX1006 Fig. 1) (annotated)

214. Qirong describes how the WiFi module established two-way communication with the server and corresponding control terminal, wherein the WiFi module may receive command inputs from the control terminal, as well as send fan status data to the server. EX1006, [0025], [0023]. Qirong explains that the WiFi module within the fan is “connected to a wireless router” and uses “the TCP/IP protocol.” EX1006, [0023]. A POSA would have understood that “TCP/IP” is a “transmission control protocol” over Internet Protocol, widely used to communicate over the internet. Likewise, the WiFi module enables **data communication** to the server via a UART serial port enabling the motor driver to convey fan status to the WiFi module. EX1006, [0024], [0025]. The WiFi module

enables data communication to the server via a UART serial port enabling the motor driver to convey fan status to the WiFi module. EX1006, [0024]. “The status is then uploaded to the server through the WiFi module.” Ex1006, [0025]. Therefore, a POSA would have understood that the WiFi module is a “*WiFi interface configured to communicate.*”

215. Qirong further discloses “*a second frequency that is different from the first frequency.*” A POSA would have understood that WiFi communications comprise a narrower set of frequency bands than RF communications. EX1028, 4; *see* EX1001, 11:34 (“the WiFi interfaces use a 2.4 GHz frequency band.”). RF remote control of electronic devices generally occurs at the disclosed 433 MHz whereas WiFi control of home devices occurs between 2.4-2.5 GHz. EX1006, [0030]; *see* EX1027, 10. Qirong shows that wireless remote control receiving unit operates at a different frequency, namely 433 MHz. EX1006, [0030]. A POSA would have known that “WiFi” is a “wireless Ethernet link operating in the 2.4 GHz band and conforming to IEEE 802.11b.” and that the 433 MHz frequency is not used in any WiFi standard. EX1028, 4; *see* EX1001, 11:34 (“the WiFi interfaces use a 2.4 GHz frequency band.”). As stated in element 1[d], Qirong discloses an RF interface communicating at 433 MHz. Therefore, the 2.4 GHz WiFi frequency (i.e., the “*second frequency*”) differs from the 433 MHz RF signal (i.e., “*the first frequency*”) received by the wireless remote control receiver unit.

EX1006, [0030]. Therefore, a POSA would have understood that the WiFi module in Qirong communicates at a frequency different than the disclosed RF wireless remote control receiver circuit.

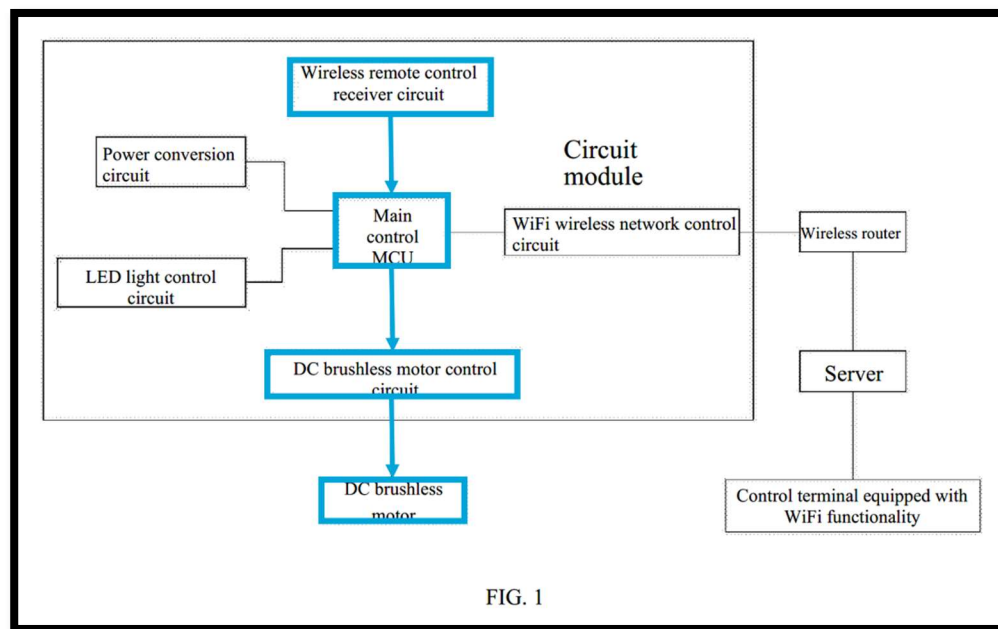
g. Element 1[f]: “*the fan motor control circuit is configured to cause the fan motor to perform an operation in response to the signal; and;*”

216. In my opinion, Qirong discloses and renders obvious element 1[f].

217. Qirong discloses that “*the fan motor control circuit is configured to cause the fan motor to perform an operation in response to the signal.*” As explained in element 1[b], Yun discloses a fan motor control circuit. EX1006, [[0019] (“DC brushless motor control circuit”); See §X.B.2.c.

218. Qirong further explains that the “*fan motor control circuit is configured to cause the fan motor to perform an operation in response to the signal.*” Specifically, the “DC brushless fan motor control circuit” uses “drive hardware and its algorithm... [in the] operation of the motor.” EX1006, [0033]. And, as explained in §X.B.2.d, the MCU provides control signals to the DC brushless motor control circuit to control the DC brushless motor. EX1006, [0032] (“The **main control MCU**... [is] particularly suitable **for motor control.**”). Qirong additionally explains that the “wireless remote control receiver circuit [is] connected to the main control MCU” and “wireless[ly] communicat[es]” with the WiFi fan. EX1006, [0030]. A POSA would have understood that when a user

command is received by the “wireless remote control receiver circuit,” the MCU processes the request and relays the command to the DC brushless fan motor control circuit to use “[in the] operation of the motor.” EX1006, [0033]. A POSA would have known that most, if not all, of the commercially available ceiling fans can turn their blades at different speeds and directions. In order to provide such flexibility, certain mechanism for controlling fan motor must be implemented in the fan system, a fact well known to a POSA. Therefore, the DC brushless fan motor control circuit controls the motor in response to commands received by the MCU and wireless remote control receiver circuit, as illustrated below:



(EX1006 Fig. 1) (annotated)

219. Additionally, the DC brushless fan motor control circuit “*cause[s] the fan motor to perform an operation in response to the signal.*” As explained above,

the DC brushless fan motor control circuit controls the motor in response to commands received by wireless remote control receiver circuit. A POSA would have understood that the “wireless remote control receiver circuit” receives a signal in order to enable it to perform the types of functionalities associated with a “traditional TV remote control.” EX1006, [0030]. For example, Qirong explains that “remote controls” (such as the one used with the “wireless remote control receiver circuit”) “possesses practical functions such as remote timing switch, **stepless speed regulation**, light control adjustment, and fault alarm.” EX1006, [0011]. A POSA would have understood that at least “stepless speed regulation, [and] light control adjustment” are “operations” because each regulate the speed (i.e., speed up or down) or adjust the light (more or less bright). Therefore, a POSA would have understood that the fan motor control circuit causes the fan motor to perform an operation (i.e., changing speed) in response to a signal from the RF remote control.

220. In my opinion, Qirong expressly discloses this claim limitation. However, Qirong also renders this claim obvious. Specifically, Qirong explains that “[c]ompared with a traditional TV **remote control**,” the wireless remote control receiver circuit receiving the signal via the RF interface, has “advantages of directionality, is not obstructed by objects, is less susceptible to interference, and [has] greater stability.” EX1006, [0030]. Qirong further explains that “remote

controls” (i.e., RF controllers) “possesses practical functions such as remote timing switch, stepless **speed regulation**, light control adjustment, and fault alarm.” EX1006, [0011]. Moreover, Qirong discloses that “ceiling fan lights are no longer restricted to remote control”. EX1006, [0022]. As stated earlier, local fan control is largely achieved by remote controllers or pull-chains. EX1008, [0003], [0023] (explaining ceiling fans are “usually operated by one or more pull chains and/or by a remote control” or an “embodiment of the fan controller to be mounted to a wall.”). Therefore, using an RF remote control to control fan operations would have been obvious to a POSA, since this is how a fan is “usually operated.” Moreover, an RF remote controller was one of a finite number of commercially viable solutions for controlling a ceiling fan, making it obvious to try. EX1008, [0003]. Namely, wireless RF fan controllers have been known in the art for decades and provide several advantageous to other control methods such as broad directionality and increased control range. EX1006, [0030]; EX1008; EX1012; EX1014; EX1030. Therefore, a POSA reading the disclosures in Qirong would have been motivated to use the RF remote control disclosed in Qirong to control the operation of the fan because of the benefits associated with RF remote controls, and using a remote control to operate the fan would have been cheap, each and obvious to try.

221. Additionally, Qirong teaches that a user may remotely control the fan device from app software on a mobile device, where the “APP software [is] for controlling the LED light control circuit and the DC brushless motor control circuit.” EX1006, [0025], [0029]. A POSA would have understood that the DC brushless motor control circuit operates the same regardless of whether the signal is received from the remote control or the APP software. EX1006, [0025]. Therefore, Qirong renders this claim limitation obvious.

h. Element 1[g]: “*the processor is configured to transmit, via the WiFi interface, to a server, an indication corresponding to the operation.*”

222. In my opinion, Qirong discloses and renders obvious element 1[g].

223. Qirong discloses that “*the processor is configured to transmit, via the WiFi interface, to a server, an indication corresponding to the operation.*”

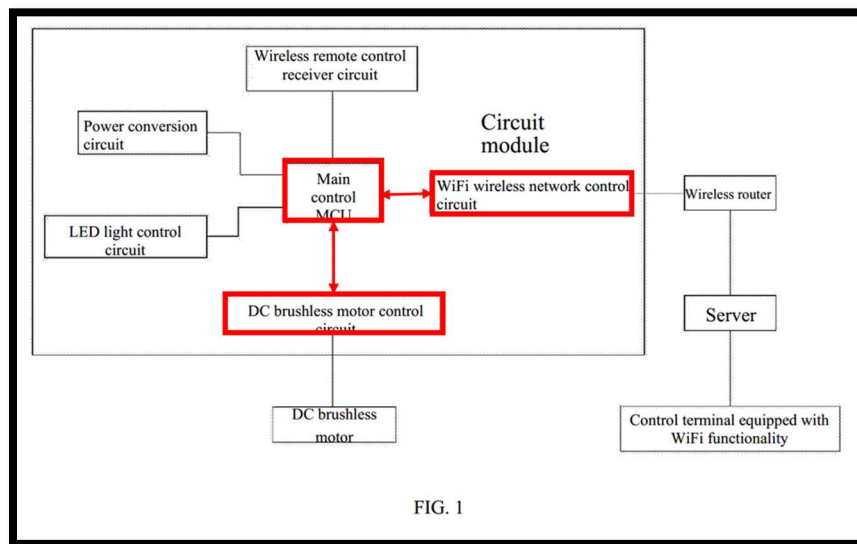
224. As explained above, I have been informed that in the parallel ITC investigation both parties proposed competing constructions for the term “*an indication corresponding to the operation.*” In particular, Patent Owner argued that this term should mean “an indication that corresponds to the operation.” EX1036, 32. While Petitioner argued that this term should mean “a message indicating the operation has been performed.” EX1037, 27. As explained below, the prior art discloses this limitation under either construction.

225. First, as explained above (§X.B.2.d), Qirong discloses the claimed processor as the “main control MCU integrating a “50 MHz ARM Cortex-M0 32-bit microcontroller core.” EX1006, [0032]; *see* §X.B.2.d.

226. Second, Qirong discloses “*a server*.” Qirong explains that “[t]he main control MCU is connected to the DC brushless motor through the DC brushless motor control circuit, the WiFi wireless network control circuit is connected to a router, which is **connected to a server**.” EX1006, [0019]. In particular, “[t]he WiFi module of a ceiling fan light is connected to a wireless router device in STA mode through the TCP/IP protocol. The wireless router is connected to the Internet, and a **connection to the server** is established therethrough.” EX1006, [0019]. Therefore, the WiFi module facilitates communication with the server over the internet.

227. Third, Qirong discloses that “*the processor is configured to transmit, via the WiFi interface, to a server*.” The MCU (i.e., processor) in Qirong is connected to the WiFi module. EX1006, [0019] (“The main control MCU is respectively connected to ... the WiFi wireless network control circuit.”); Fig. 1. The MCU and the WiFi module are in communication with each other. EX1006, [0024]. Qirong explains that “WiFi module of the ceiling fan light is connected to a motor driver through the UART serial port, thereby enabling **data communication**.” EX1006, [0024]. A POSA would have understood that the

“motor driver” system is the DC brushless fan motor control circuit, as that circuit drives the “operation of the motor.” Moreover, as explained above in §X.B.2.g, the “motor driver” controls the motor in response to commands received by the MCU. Therefore, a POSA would have understood that the “data communication” between the WiFi module and the DC brushless fan motor control circuit is enabled via the MCU, as depicted in **red** in the figure below:



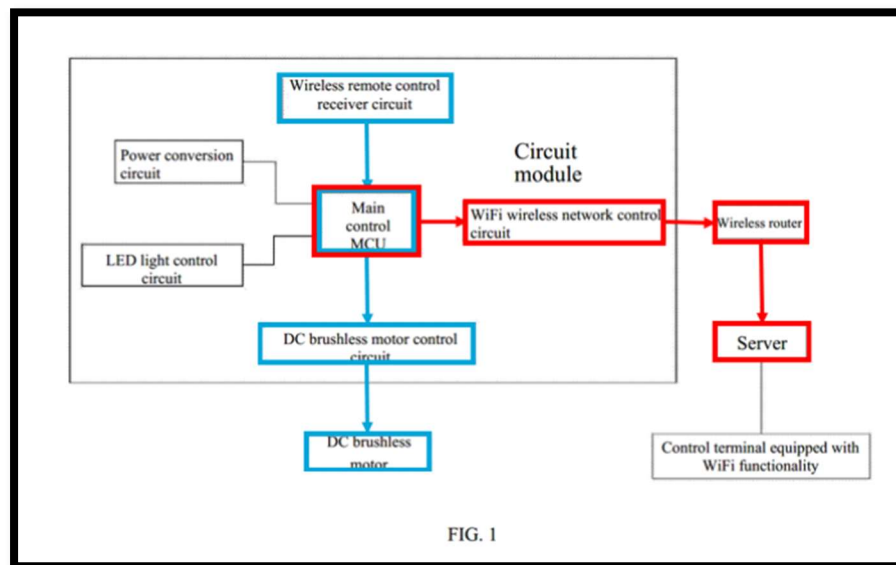
(EX1006, Figure 1) (annotated)

228. Additionally, Qirong explains that a user may remotely control fan operations over the internet (i.e., “stepless speed regulation, on and off switching, and mode adjustments”). EX1006, [0025]. Specifically, user requests are sent from the user’s phone through the server, router, and WiFi module until it reaches the MCU. EX1006, [0019]. The MCU then performs the user’s request. See §X.B.2.g. The fan “status is then uploaded to the server through the WiFi module

and synchronized for push notifications to” the user’s phone. EX1006, [0025]. Based on these disclosures, a POSA would have understood that the MCU of Qirong is configured to transmit the status of the fan, via the WiFi module, to the server and the user’s phone. A POSA would have understood that the fan “status” is “*an indication corresponding to the operation,*” because it is a message that indicates that an operation has been performed by the fan. EX1001, 12:8-13:4, 3:42-47, 10:42-46, 10:58-60. In particular, as explained above, as each operation is performed, a new message indicating a change in status will be sent and synchronized to the server. Therefore, each status update is an indication corresponding to an operation because the status changes when the operation is performed.

229. Fourth, Qirong discloses that the MCU (i.e., processor) is “*configured to transmit, via the WiFi interface, to a server, an indication corresponding to the operation.*” Qirong explains that the WiFi module “upload[s] to the server” the “synchronized” fan status over the internet. EX1006, [0025]. As explained above, the MCU is configured to transmit the status of the fan, via the WiFi module, to the server. A POSA would have understood that “synchronized” means “[t]o cause (data or files) to remain identical in more than one location, changes made to a copy in one location being propagated to the others.” EX1029, 4. In this instance, the POSA would have understood that to keep the fan status on the server

“synchronized” at all times, when an operation (e.g., speed regulation or on/off switching) is performed using the RF remote control, the MCU would transmit a new fan status to the server. Therefore, the MCU (i.e., processor) is responsible for transmitting the operation of the DC brushless fan motor (i.e., a change in fan status as indicated in blue), via the WiFi interface (i.e., the WiFi module) to a server, as illustrated below (in red).



(EX1006 Fig. 1) (annotated)

230. In my opinion Qirong expressly discloses that “*the processor is configured to transmit, via the WiFi interface, to a server, an indication corresponding to the operation.*” However, Qirong also renders this limitation obvious. A POSA would have found it obvious to transmit operational changes made by the RF remote to the server. For example, a POSA would have understood that the MCU tracks the operational state of the fan and transmits status

data to the sever. This is further evidenced by the disclosed real-time remote viewing and control functionality of Qirong. EX1006, [0028]. Therefore, it would have been obvious to transmit the most up-to-date and accurate operational status, regardless of which interface was used to control the fan. In particular, as explained in §X.B.2.f, Qirong discloses that a user may perform fan adjustments (such as on/off switching and speed regulation) remotely over the Internet via a control terminal. EX1006, [0021], [0023], [0025]. Qirong also explains that after the user issues a “*command*” for fan adjustment (and the command is executed) the fan “status is then uploaded to the server through the WiFi module and synchronized.” EX1006, [0025]. Therefore, it would have been obvious to upload an “*indication corresponding to the operation*” in response to an operation request from the RF remote control, because the fan is already updating its status with the server after each operation performed by the user’s control terminal. Additionally, since the fan of Qirong includes a WiFi module in communication with a remote server, transmitting status changes in response to received RF control signals would be cheap and easy to implement.

- i. **Element 2[a]: “*The system of claim 1 further comprising, when the signal is a first signal, the operation is a first operation, and the indication is a first indication:*”**

231. In my opinion, Qirong discloses and renders obvious element 2[a].

232. As explained in §X.B.2.h, Qirong discloses “*the processor is configured to transmit, via the WiFi interface, to a server, **an indication** corresponding to the operation.*” In §X.B.2.e, Qirong discloses “*a radio frequency interface configured to receive, at a first frequency, **a signal**.*” And in §X.B.2.g, Qirong discloses “*the fan motor control circuit is configured to cause the fan motor to perform **an operation** in response to the signal.*”

233. The “*a signal*,” “*an indication*,” and “*an operation*” described in §§X.B.2.h, X.B.2.e, and X.B.2.g are the claimed “*a first signal, the operation is a first operation, and the indication is a first indication*” required by this claim element. Therefore, Qirong discloses this claim element.

j. Element 2[b]: “*a light; and*”

234. In my opinion, Qirong discloses and renders obvious element 2[b].

235. In particular, Qirong discloses “*a light.*” Qirong explains that their invention “relates to a ceiling fan **light**,” and includes “both the decorative function of a light and the practicality of a fan.” EX1006, [0001], [0002]; claim 4 (comprising a “LED cold light source connected to the LED light control circuit.”); [0008].

k. Element 2[c]: “*a light control circuit configured to cause the light to perform a second operation in response to a second signal received by the radio frequency interface.*”

236. In my opinion, Qirong discloses and renders obvious element 2[c].

237. Qirong discloses “an LED light control circuit” that connects to the MCU. EX1006, [0019]. Qirong explains that the LED light control circuit also connects to a “LED cold light source,” which provides “high efficiency, and uniform brightness.” EX1006, [0031], [0036]. A user can use the APP software to control the LED light control circuit. EX1006, [0029]. First, a POSA would have understood that the “LED **light control circuit**” is a “*light control circuit*.” Second, a POSA would have understood the “LED **light control circuit**” is a “*light control circuit*,” because it controls the operation of “*light*.”

238. As explained in §X.B.2.g, Qirong explains that “remote controls” “possesses practical functions such as remote timing switch, stepless speed regulation, **light control adjustment**, and fault alarm.” EX1006, [0011]. In particular, a POSA would have understood that when a user command for is received by the “wireless remote control receiver circuit,” the MCU processes the request and relays the command to the DC brushless fan motor control circuit to use “[in the] operation of the motor.” EX1006, [0033]. Likewise, when the user command is received by the “wireless remote control receiver circuit,” the MCU processes the request and relays the command to the “LED light control circuit” for use in controlling the “*light*.”

239. Therefore, for the same reasons as discussed in §X.B.2.g a POSA would have understood that the “*radio frequency interface*” receives “*a second*

signal” from the RF remote control for “light control adjustment”—i.e., “cause the light to perform a second operation.”

240. Qirong also explains that “the control terminal with WiFi functionality refers to a mobile phone, which is equipped with an APP software for controlling the LED light control circuit and the DC brushless motor.” EX1006, [0029]. Therefore, a POSA would have understood that the “LED light control circuit” performs “*a second operation in response to a second signal*” because, as explained in §X.B.2.r, the DC brushless motor is controlled in the same way. Moreover, a POSA would have found it obvious to control the LED light control circuit using the RF remote control because the LED light control is already controlled by the APP software.

I. Element 2[d]: “*wherein the processor is further configured to transmit to the server, via the WiFi interface, a second indication corresponding to the second operation.*”

241. In my opinion, Qirong discloses and renders obvious element 2[d].

242. As explained in §X.B.2.h, Qirong’s “*processor is configured to transmit, via the WiFi interface, to a server, an indication corresponding to the operation.*”

243. In particular, Qirong explains that the WiFi module “upload[s] to the server” the “synchronized” fan status over the internet. EX1006, [0025]. As explained above, the MCU is configured to transmit the status of the fan, via the

WiFi module, to the server. A POSA would have understood that “synchronized” means “[t]o cause (data or files) to remain identical in more than one location, changes made to a copy in one location being propagated to the others.” EX1029, 4. In this instance, the POSA would have understood that to keep the fan status on the server “synchronized” at all times, when an operation (e.g., lighting adjustment) is performed using the RF remote control, the MCU would transmit a new fan status to the server. Therefore, Qirong discloses this claim element for the same reasons.

- m. **Element 3[a]: “*The system of claim 2 wherein: the first indication corresponds to an operation selected from the group consisting of: fan on, fan off, fan power state change, fan speed-up, fan speed-down, and fan direction-change; and*”**

244. In my opinion, Qirong discloses and renders obvious element 3[a].

245. I have been informed that when a claim recites “*an operation selected from the group consisting of:*” (such as this claim limitation) the prior art need only discloses one of the listed “*operations*” to disclose the entire group.

246. As explained in §X.B.2.k, Qirong explains that “remote controls” “possesses practical functions such as remote timing switch, **stepless speed regulation**, light control adjustment, and fault alarm.” EX1006, [0011]. A POSA would have understood that “stepless speed regulation” includes at least commands to change the speed of the fan (“*fan speed-up, fan speed-down.*”)

- n. **Element 3[b]: “*the second indication corresponds to an operation selected from the group consisting of: light on, light off, light power state change, light increase, and light decrease.*”**

247. In my opinion, Qirong discloses and render obvious element 3[b].

248. I have been informed that when a claim recites “*an operation selected from the group consisting of:*” (such as this claim limitation) the prior art need only discloses one of the listed “*operations*” to disclose the entire group.

249. As explained in §X.B.2.k, Qirong explains that “remote controls” “possesses practical functions such as remote timing switch, stepless speed regulation, **light control adjustment**, and fault alarm.” EX1006, [0011]. A POSA would have understood that “light control adjustment” includes at least commands to adjust the light (“*light on, light off, light power state change, light increase, and light decrease.*”)

- o. **Claim 4: “The system of claim 1 further comprising a housing; wherein the fan motor, the fan motor control circuit, the processor, the radio frequency interface, and the WiFi interface are disposed in the housing.**

250. In my opinion, Qirong disclose and render obvious claim 4.

251. As explained in §§X.B.2.b, X.B.2.c, X.B.2.d, X.B.2.e, and X.B.2.f, Qirong discloses “*the fan motor, the fan motor control circuit, the processor, the radio frequency interface, and the WiFi interface.*”

252. Qirong also renders this claim element obvious. Qirong explains it is an improvement over prior art “ceiling fans.” These ceiling fans serve a “decorative function” and “perfectly embodies the fusion of classical and modern styles, making it the preferred choice for indoor decoration.” EX1006, [0002].

253. “[D]ecorative” prior art fan included a “*housing*.” In particular, a POSA would have known the general construction and configuration of a ceiling fan, including that they include a housing in which their mechanical and electrical components are “*disposed*.” For example, using a fan housing in this manner was well-known and commonplace. *See e.g.*, EX1008, [0005] (“Existing ceiling fans comprise switch housings that contain the mechanical hardware which provide the operation to the functional features of the ceiling fan.”); EX1024, 2 (“Schulyer Wheeler was however adjudged to have invented the first electric fan produced from two unshielded blades, powered by an electric motor and housed in a protective cage using the principle of home cooling.”); EX1025, [0008] (“the housing cover is installed above the rotor, and the top of the housing cover has an opening where a downrod is fixed, with a yoke at the lower end thereof, and the ceiling fan DC brushless motor is disposed on the upper surface of the rotor; additionally, a canopy is installed at the upper end of the downrod, a mounting bracket is fixedly set on the canopy, and the mounting bracket is equipped with a receiver for controlling the DC brushless ceiling fan motor.”)

254. Moreover, it would have been obvious to include the components of Qirong's system in the fan housing to (1) protect them, (2) protect the user, and (3) because such an implementation was well-known and commonplace.

p. Element 8[a]: “*The system of claim 1 further comprising, when the processor is a first processor, the server; wherein the server includes a second processor configured to cause the server to*”

255. In my opinion, Qirong discloses and renders obvious element 8[a].

256. Qirong discloses “*the server; wherein the server includes a second processor configured to cause the server*” to perform function recited later in claim 8.

257. First, as explained in §X.B.2.h, Qirong includes a “*server*” in communication with the WiFi fan. EX1006, [0019], [0023], [0025]; see §X.B.2.h.

258. Second, Qirong discloses that “*the server includes a second processor.*” A POSA would have understood that a server is “a computer running administrative software that controls access to the network and its resources, such as printers and disk drives, and provides resources to computers functioning as workstations.” EX1027, 11; see EX1019 [0072] (“generalized computer architecture that represents an example of the type of computing machinery that may be included in an intelligent controller, **server computer, and other processor-based intelligent devices and systems.**”).

259. Moreover, Qirong's architecture dictates that the server includes a processor. For example, the disclosed server communicates with a WiFi wireless network control circuit (using TCP/IP) and with a control terminal equipped with WiFi functionality. EX1006, [0019]. By this structure, a user can send commands to the ceiling fan light over the Internet. EX1006, [0025]. Further, the status of the ceiling fan light is sent to the server "through the WiFi module" and is "uploaded to the server." EX1006, [0025]. Once synchronized, the server pushes notifications of the updated status to the control terminal equipped with WiFi functionality. EX1006, [0025]. Based on this architecture, a POSA would have understood that the server in Qirong includes a processor that can provide at least communication and data storage services. By its conventional definition and based on Qirong's specifications, a POSA would know the "the server" in Qirong comprises a processor. Therefore, a POSA would have known the cloud server of Yun to include a "*second processor*."

260. Furthermore, a POSA would have understood that Qirong's server includes a processor based on the disclosed server functionality. For example, the server in Qirong provides for wireless communication with the ceiling fan light (via wireless router and WiFi wireless network control circuit) and also with the control terminal equipped with WiFi functionality. EX1006, [0019]. Furthermore, Qirong discloses that the fan device sends status updates to the user device, where

“[t]he status is [] uploaded to the server through the WiFi module and synchronized for push notifications to the WiFi control terminal.” EX1006, [0025]. A POSA would have understood the server performs these functions with a processor. Thus, Qirong teaches or renders obvious this limitation.

261. Moreover, the use server-side architecture was one of a finite number of commercially viable solutions for wirelessly controlling fans from a distance. EX1006, [0030]. Namely, server-side remote control systems were known in the art and provide several advantageous over local controls. EX1006, [0030]; EX1013, 3; EX1019, [0226] (“It is a collective function of the central cloud-based management server [] to ensure that the group-state-information object in each [device] is maintained with fresh information.”). Therefore, a POSA reading the disclosures in Qirong would have been motivated to use the server disclosed in Qirong to relay user commands because of the benefits associated with server-side architecture and the high likelihood success.

q. Element 8[b]: “*receive a command directed to the first processor; and*”

262. In my opinion, Qirong discloses and renders obvious element 8[b].

263. Qirong discloses a second processor configured to cause the server to “*receive a command directed to the first processor.*” Qirong explains that “[t]he main control MCU is connected to the DC brushless motor through the DC brushless motor control circuit, the WiFi wireless network control circuit is

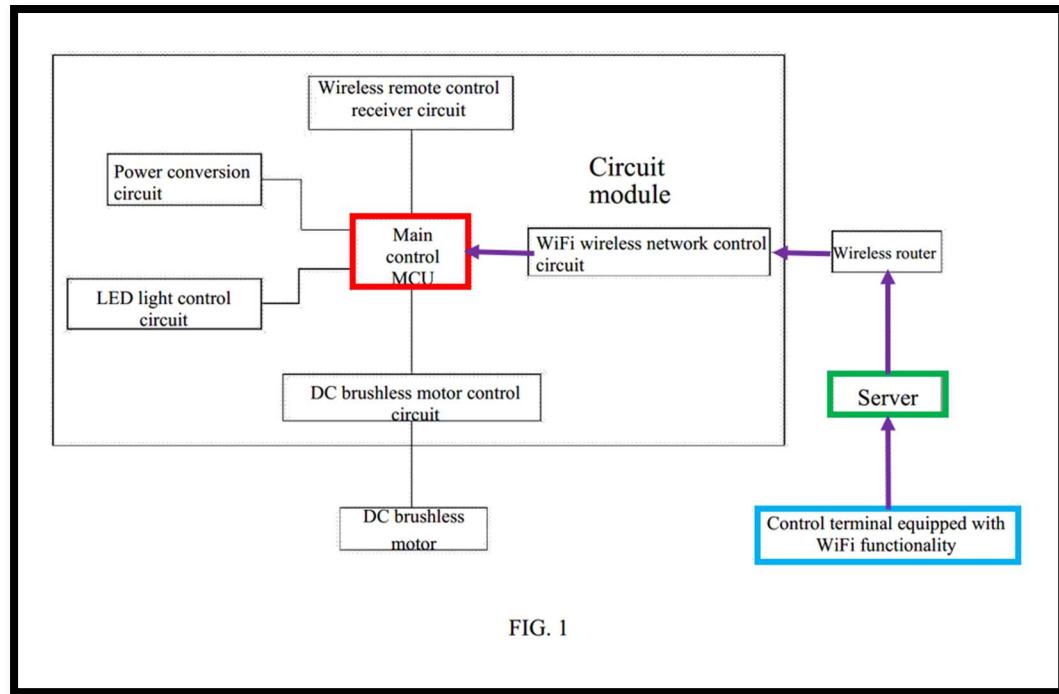
connected to a router, which is **connected to a server.**” EX1006, [0019]. In particular, “[t]he WiFi module of a ceiling fan light is connected to a wireless router device in STA mode through the TCP/IP protocol. The wireless router is connected to the Internet, and a **connection to the server** is established therethrough.” EX1006, [0019]. Therefore, the WiFi module facilitates communication with the server over the internet. Therefore, Qirong describes the server as bridging the wireless communication between a control terminal (e.g., smartphone) and the fan processor (e.g., MCU), where the control terminal sends operation commands to the server to be received by the fan device. EX1006, [0005], [0006], [0023], [0025]. This enables a user to “remote control” the smart fan by using a smart phone “equipped with an app software for controlling the LED light control circuit and the DC brushless motor control circuit.” EX1006, [0028]-[0029]. Using the app the user can issue command to control various operations of the fan remotely over the Internet (i.e., speed regulation, on and off switching, and mode adjustments). EX1006, [0028]. A POSA would have understood that a command to control the operations of the fan is a “*command directed to the first processor*” because the “*first processor*” (i.e., the MCU) is responsible for controlling the fan. *Supra* §X.B.2.g; X.B.2.d.

264. Moreover, forwarding remote control instruction via server-side architecture was one of a finite number of commercially viable solutions for

wirelessly controlling fans from a distance. EX1006, [0030]. Namely, server-side remote control systems were known in the art and provide several advantageous over local controls. EX1006, [0030]; EX1013, 3; EX1019, [0226] (“It is a collective function of the central cloud-based management server [] to ensure that the group-state-information object in each [device] is maintained with fresh information.”). Therefore, a POSA reading the disclosures in Qirong would have been motivated to use the server disclosed in Qirong to relay user commands because of the benefits associated with server-side architecture and the high likelihood success.

265. Moreover, Qirong discloses that this command is received by the “*second processor*.” Qirong explains that the server is used to connect the MCU and WiFi module on the one hand, and the control terminal on the other. EX1006, [0019]; Fig. 1 (depicting the server acting as a rely between the control terminal the fan). Therefore, a POSA would have understood that a command (**purple**) sent from the app (**blue**) is relayed through (as received by) the server (**green**) (i.e., the second processor) before being sent to the first processor (**red**), as depicted below. This is further evidenced in the abstract, where “the WiFi wireless network control circuit is connected to a router, which is connected to a server, which establishes a wireless communication connection with a control terminal equipped with WiFi functionality, thereby enabling remote control of the brushless ceiling fan. A

POSA would have understood that “enabling remote control” uses a connection to the server from a user device.



(EX1006 Fig. 1) (annotated)

r. Element 8[c]: “*communicate the command via the Internet and a WiFi router to the first processor.*”

266. In my opinion, Qirong discloses and renders obvious element 8[c].

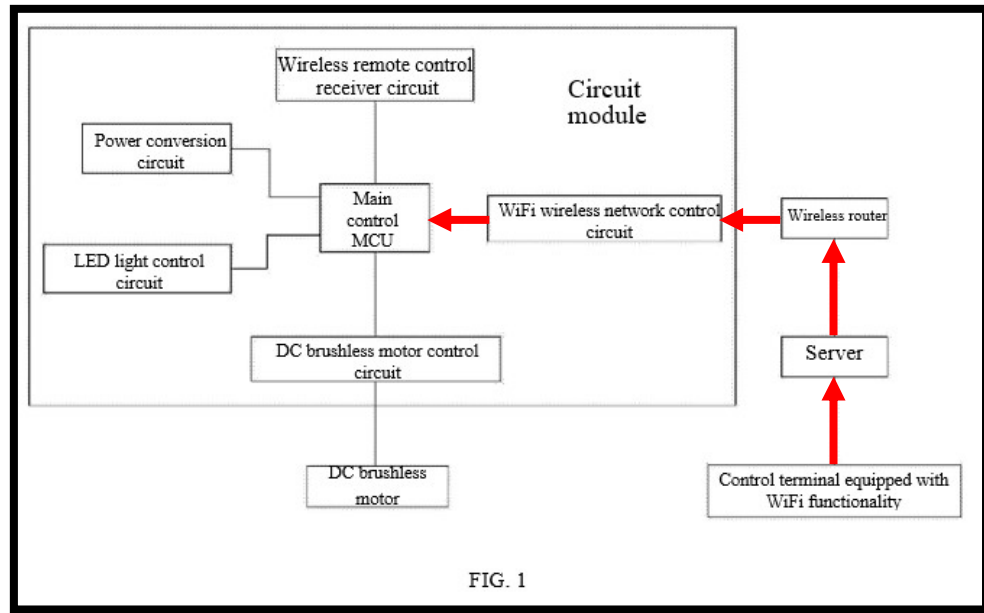
267. Qirong discloses a second processor configured to cause the server to “*communicate the command via the Internet and a WiFi router to the first processor.*”

268. As explained in §X.B.2.q, Qirong discloses a “*WiFi router*” communicating with the second processor of the server. Qirong explains “[t]he user may perform stepless speed regulation, on and off switching, and mode

adjustments for the ceiling fan light remotely over the Internet” via a control terminal. EX1006, [0021], [0023], [0025]. Qirong explains that “[t]he main control MCU is connected to the DC brushless motor through the DC brushless motor control circuit, the WiFi wireless network control circuit is connected to a router, which is **connected to a server.**” EX1006, [0019]. In particular, “[t]he WiFi module of a ceiling fan light is connected to a wireless router device in STA mode through the TCP/IP protocol. The wireless router is connected to the Internet, and a **connection to the server** is established therethrough.” EX1006, [0019]. Therefore, the WiFi module facilitates communication with the server over the internet. Therefore, Qirong describes the server as bridging the wireless communication between a control terminal (e.g., smartphone) and the fan processor (e.g., MCU), where the control terminal sends operation commands to the server to be received by the fan device. EX1006, [0005], [0006], [0023], [0025]. This enables a user to “remote control” the smart fan by using a smart phone “equipped with an app software for controlling the LED light control circuit and the DC brushless motor control circuit.” EX1006, [0028]-[0029]. A POSA would have understood that a command sent from the APP is received by the second processor before being sent to the first processor.

269. Qirong additionally explains that the command is communicated to the MCU (i.e., processor) “*via the Internet and WiFi router.*” For example, as

explained above in §X.B.2.f, the WiFi module within the ceiling fan is “connected to a wireless router” and uses “the TCP/IP protocol” for data communication. EX1006, [0023]; see [0021] (“remote control over the Internet”). The WiFi module also transmits and receives commands for the MCU. *Supra* §X.B.2.f. Qirong additionally explains that the “wireless router is connected to the Internet, and a connection to the server is established therethrough.” EX1006, [0019], [0021], [0023]; Fig 1 (showing the server and router enabling wireless communication between the control terminal and fan device.). Therefore, a connection is established over the internet, which travels from the server, through the router to the WiFi module and is then received by the MCU. A POSA would have understood that the second processor uses this communication channel (i.e., “*via the Internet and WiFi router*”) to communicate commands to the first processor.



(EX1006 Fig. 1)

- s. **Claim 9:** *“The system of claim 8 wherein the second processor is further configured to cause the server to update information about a state of a device that is in a wireless local network based on the command.”*

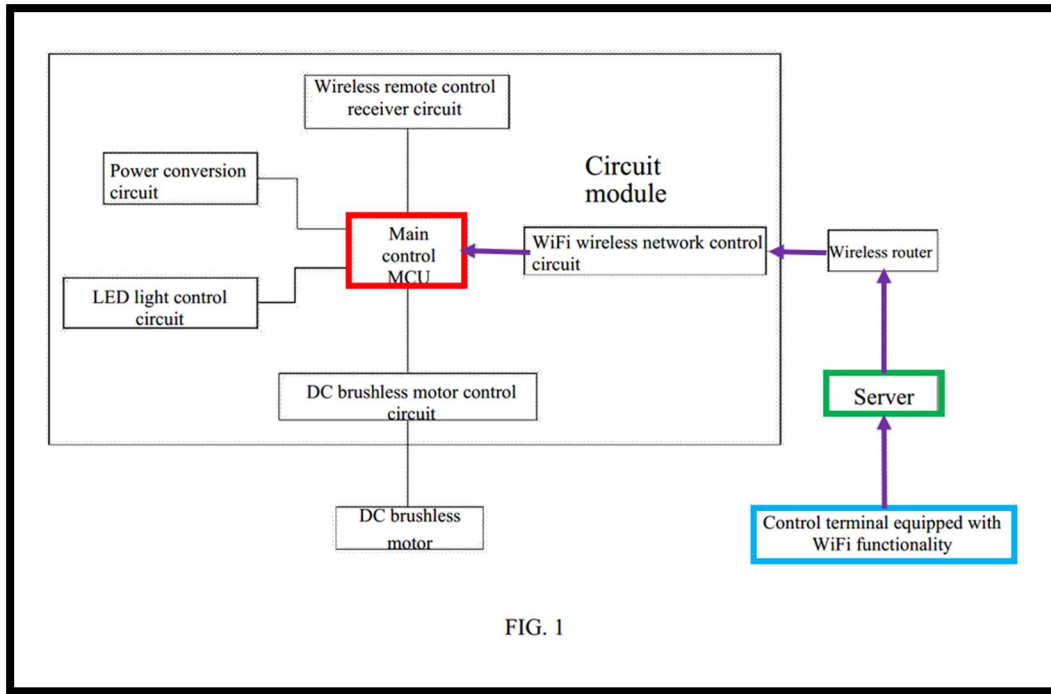
270. In my opinion, Qirong discloses and renders obvious claim 9.

271. Qirong discloses that the second processor is configured to cause the server “to update information about a state of a device that is in a wireless local network based on the command.”

272. First, as explained in §X.B.2.p, Qirong discloses a “second processor.” A POSA would have understood that the disclosed server in Qirong is a “processor-based intelligent devices and systems.” EX1019 [0072].

273. Second, Qirong discloses that the second processor is configured to cause the server “to update information about a state of a device...based on the

command.” As explained in §X.B.2.q, Qirong discloses that a user may perform fan adjustments (such as on/off switching and speed regulation) remotely over the Internet via a control terminal. EX1006, [0021], [0023], [0025]. Qirong explains that the WiFi module “upload[s] to the server” the “synchronized” fan status over the internet. EX1006, [0025]. As explained in §X.B.2.h, the MCU is configured to transmit the status of the fan, via the WiFi module, to the server. A POSA would have understood that “synchronized” means “[t]o cause (data or files) to remain identical in more than one location, changes made to a copy in one location being propagated to the others.” EX1029, 4. In this instance, a POSA would have understood that a command (**purple**) sent from the app (**blue**) is relayed through (and received by) the server (**green**) (i.e., “*the second processor*”) before being sent to the first processor (**red**), as depicted below.



274. Therefore, to keep the fan status on the server “synchronized” at all times, when an operation (e.g., speed regulation, light adjustment, or on/off switching) is performed using the APP, the MCU would transmit a new fan status to the server. Therefore, the MCU (i.e., processor) is responsible for transmitting the operation of the DC brushless fan motor in response to a received command (i.e., a change in fan status as indicated in). A POSA would have understood that the uploading and synchronization of fan status data is commonly performed by a processor (i.e., second processor).

275. Moreover, the fan device of Qirong operates on a “*wireless local network*.” The fan WiFi module is connected to the wireless router through TCP/IP protocol, wherein the router is connected to the external server via the Internet.

EX1006, [0023]. A POSA would have understood that a WiFi network is a type of local area network (LAN). Therefore, the fan status data sent by the WiFi module to the server originates from a “wireless local network.” EX1006, [0025].

276. A POSA would have further deemed it a matter of predictable design choice to configure the server processor to update the device status information in response to the issued command. Qirong describes the benefit of server-side handling, wherein the server provides the connection between the fan and user device and enables real-time remote viewing and control of the fan device from the user device. EX1006, Abstract, [0028]. The use server-side architecture was one of a finite number of commercially viable solutions for wirelessly controlling fans from a distance. EX1006, [0030]. Namely, server-side remote control systems were known in the art and provide several advantageous over local controls. EX1006, [0030]; EX1013, 3; EX1019, [0226] (“It is a collective function of the central cloud-based management server [] to ensure that the group-state-information object in each [device] is maintained with fresh information.”). Therefore, a POSA reading the disclosures in Qirong would have been motivated to use the server disclosed in Qirong to relay user commands because of the benefits associated with server-side architecture and the high likelihood success.

- t. **Claim 10:** *“The system of claim 9 wherein the second processor is further configured to cause the server to update the information in response to transmitting the command from the server.”*

277. In my opinion, Qirong discloses and renders obvious claim 10.

278. Qirong discloses a “second processor is further configured to cause the server to update the information in response to transmitting the command from the server.” As explained in §X.B.2.s, Qirong discloses that the server (i.e., second processor) updates and “synchronizes” information regarding the fan status after the fan executes a command. *Supra* §X.B.2.s; EX1006, [0025]. Therefore, a POSA would have understood (1) that the server is always “synchronized” with the latest operational status of the fan, and (2) that the fan status changes when the fan receives a new command from the server. (discussing how the server relays commands from the control terminal to the MCU). Therefore, after the server transmits a command to the fan, the fan will execute the command, and update its new status with the server. To remain “synchronized” the server will then “*update the information*” in its memory. EX1006, [0025]. Therefore, the second processor “updates the information” (i.e., fan status) in response to transmitting the command from the server to the first processor.

279. In my opinion, Qirong expressly discloses this limitation. However, Qirong additionally renders this limitation obvious. A POSA would have known that the continuous “remote viewing” of fan device status from a user control

terminal would necessarily require the server to update status information in response to transmitting a command to the device or the terminal. EX1006, [0028]. If the status information available on the server was out-of-date, a user could not “remote view” the fan status. A POSA would have deemed it a matter of predictable design choice to configure the server processor to update the information in response to the transmission of the command from the server. Namely, server-side remote control systems were known in the art and provide several advantageous over local controls. EX1006, [0030]; EX1013, 3; EX1019, [0226] (“It is a collective function of the central cloud-based management server [] to ensure that the group-state-information object in each [device] is maintained with fresh information.”). A POSA would have understood updating the server in response to transmitting a command is a common-sense way to configure the system since the server includes a memory for updating information in response to any substantial event. EX1019 [0072], [0226] (“server computer, and other processor-based intelligent devices and systems...includes one or multiple central processing units (“CPUs) 602-605, one or more electronic memories....[wherein] [i]t is a collective function of the central cloud-based management server [] to **ensure that the group-state-information object in each [device] is maintained with fresh information.**”). Qirong further describes the benefit of server-side handling, wherein the server provides the connection between the fan and user

device, enabling real-time remote viewing and control of the fan device. EX1006, Abstract, [0028]. Therefore, it would have been obvious to a POSA “to update the information in response to transmitting the command from the server” in order to show the current state of the fan. A POSA would also understand that to “update the information” after transmission from the server would be a simple optimization of existing components within the system of Qirong. Therefore, Qirong renders obvious this claim limitation.

C. Ground 3: Claims 1-4 and 8-10 are obvious over Qirong and Yun

280. The analysis below is based on the combination of Qirong and Yun. In the combination, the server-side architecture and functionality of Yun is combined with the system of Qirong. Moreover, where the two systems disclose analogous functionality, such as a processor, server, WiFi interface, router, fan motor, fan controller, etc., their techniques are combined, as a POSA would prioritize efficiency and common sense in implementing the individual, nonredundant features into the combined system in order to obtain the benefits of both. For the reasons explained below (§X.C.1), combining Qirong and Yun would have been obvious to a POSA, and POSA would have been motivated to do so.

1. Motivation to Combine

281. In my opinion, a POSA would have been motivated to combine Qirong and Yun such that they would have had a reasonably high expectation of success in incorporating the teachings of either reference. The combination of Qirong and Yun would have been obvious for several reasons. For example, a POSA would have been motivated to combine Qirong and Yun for many of the same reasons they would be motivated to combine McPherson and Yun. §X.A.3.

282. Qirong, Yun, and '854 Patent are analogous art, since each is directed to the same field of endeavor (i.e., the remote control of smart fans). EX1007, [0004]; EX1006, Abstract; EX1001, 1:14-17. Furthermore, Qirong and Yun are reasonably pertinent to the problem addressed by the '854 Patent (e.g., an “improved method of controlling a fan and/or ceiling light”). EX1001, 1:59-60.

283. It would have been obvious to make this combination because to do so would have been [1] the arrangement of old elements (i.e., the server-side architecture and functionality of Yun, and the system of Qirong) [2] with each performing the same function it had been known to perform (a smart fan with multiple interface modalities (Qirong); internet-based remote control of a ceiling fan (Yun)) and [3] yielding no more than what one would expect from such an arrangement (a fan system capable of both internet and RF remote control). EX1025, [0025]-[0026].

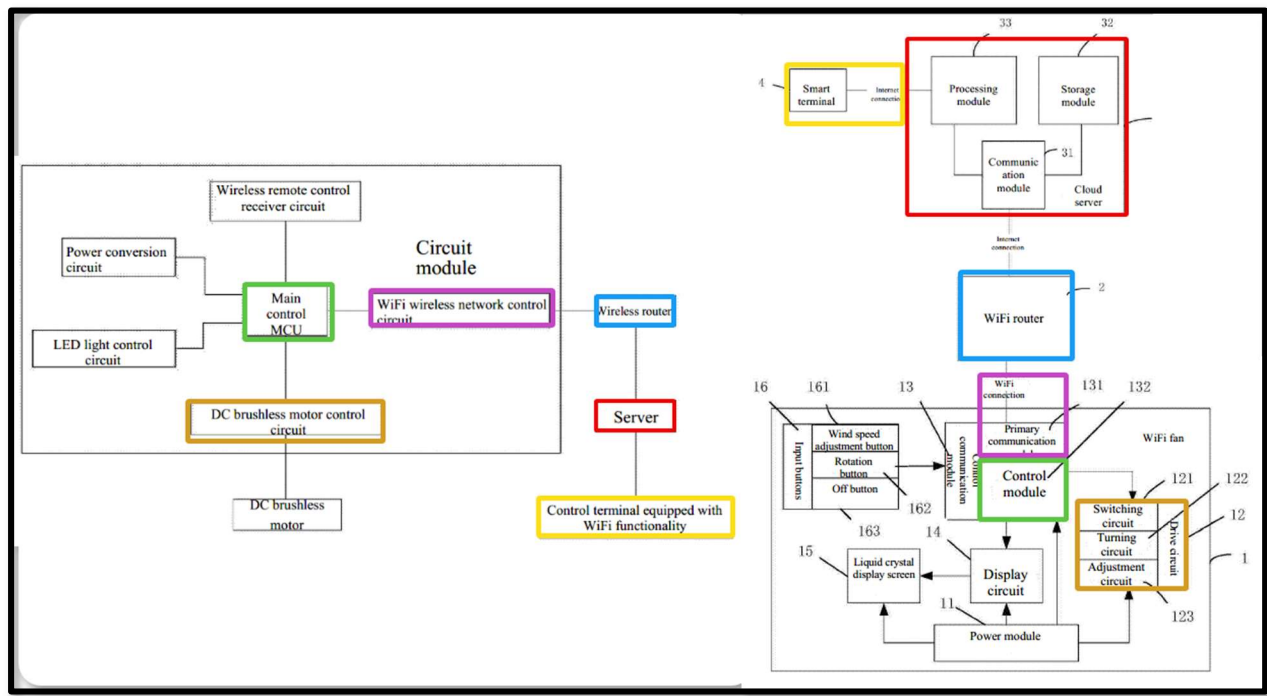
284. Furthermore, the references use known techniques which yield a predictable result (i.e., high likelihood of success) to improve similar devices in the same way. Qirong describes a fan system adopting Internet of Things (“IoT”) technology to realize remote control of fan devices, and wherein the fan WiFi module uploads fan status data to a server. EX1006, [0020], [0025]. Yun discloses a smart fan comprising a WiFi fan, a smart terminal, and a cloud server. EX1007, [0004]. Moreover, as explained above, using both WiFi and RF remote control in a ceiling fan was known in the prior art. *Supra* §VII.D. Moreover, both Yun and Qirong explain that their disclosures are not limited to any one physical configuration. EX1007, [0020]; EX1006, [0014]. A POSA would have a reasonable expectation of success in combining Qirong with Yun because the combination would provide a predictable result– a smart fan system configured to (1) receive control commands from a remote server or user controller, (2) transmit fan state data back to the remote server and the user controller and (3) store fan state information in the remote server. Therefore, a POSA would have a reasonable expectation of success in utilizing the remote-control functionality of Qirong within the Yun system because doing so involves applying the straightforward solution of RF remote control with no undue level of unpredictability.

285. Additionally, Qirong explains the benefits of “remote control of brushless ceiling fan lights” over the internet. EX1006, [0020]. For example, Qirong explains that “ceiling fan lights are no longer restricted to remote control, wall control, and chain control methods, thereby enhancing the usability thereof.” EX1006, [0022]. A POSA, therefore, would have been motivated to include the teachings of Qirong in the combination to enhance the usability of their resulting design. EX1003, ¶142. Likewise, Yun explains other benefits associated with integrating remote control over the internet. For example, Yun explains that, for example:

- “The cloud server is connected to the smart terminal, thereby enabling the smart terminal to remotely control the WiFi fan through the cloud server and also enabling one smart terminal to control multiple smart fans through the cloud server;” (EX1007, [0014].)
- “The smart terminal can realize functions such as smart timing, remote restart and shutdown, smart shifting, intelligent display, and smart display through the communication connection between the cloud server and the control communication module, enabling the combination of the smart terminal and the smart fan so that the smart fan can form a home network with smart appliances.” (EX1007, [0014].)

286. Therefore, a POSA would have been motivated to include the benefits of Qirong with Yun in their design. Additionally, a POSA would have known that use known techniques to improve similar devices in the same way and represent a choice among a finite number of identified, predictable solutions.

287. Moreover, Yun and Qirong share the same fan system architecture as shown in the figures below. This includes an external server (red) in wireless communication with a control terminal (yellow) and a WiFi router (blue), and a fan comprising a WiFi interface (purple), fan processor (green), and fan motor control circuit (orange).



(EX1006 Fig. 1) (annotated) (EX1007 Fig. 3 and 4 combined) (annotated)

288. Because Qirong includes WiFi functionalities configured to transmit information to and receive information from a remote server, a POSA would have been motivated to identify a server-side architecture to communicate with the fan and provide server-side functionalities that can be implemented with the fan. A POSA would recognize the various benefits of implementing server-side communications in a remote system. Servers allow for improved data storage

across network devices, improve processing capabilities with, for instance, autocorrelation algorithms to handle excess device data, and enable complex features such as smart monitoring and control. EX1020, 4; EX1019, [0070], [0226]. (“It is a collective function of the central cloud-based management server and the intelligent [device] to ensure that the group-state-information object in each intelligent thermostat is maintained with fresh information”). Therefore, given Yun’s disclosed server-side architecture (above) is configured to store fan state data and communicate with the fan and its user controller (e.g., a smartphone), a POSA would be motivated to combine its disclosures with Qirong. In particular, Yun discloses a cloud server connected to a WiFi router and corresponding WiFi fan. EX1007, [0041]. The cloud server contains a processing module for receiving and processing user requests, which enables the smart terminal to control the WiFi fan through the cloud server. EX1007, [0024]. The WiFi fan in Yun further contains a first processor for handling and implementing received instructions from the smart terminal. EX1007, [0039]. The processor enables the smart terminal to control the WiFi fan through the cloud server, whereby commands are sent to the fan device via the cloud server communication module. EX1007, [0039].

289. Moreover, Qirong and Yun teaches a WiFi fan comprising a WiFi transceiver (interfaces). In both, the WiFi transceiver communicates with a local

WiFi router such that remotely located users can control the WiFi fan via a control terminal equipped with WiFi functionality for Qirong (EX1006, [0019]) and a smart terminal for Yun. EX1007, [0023]. Furthermore, Qirong and Yun further provide a second fan interface for receiving control commands. *See* annotated figures (“local control input”). The control communication module 13 of Yun is connected to a module that contains a variety of input buttons 16 such as wind speed adjustment button 161, rotation button 162, and off button 163. EX1007, [0030]. Whereas the wireless remote control receiver circuit of Qirong receives control commands from a wireless remote control. EX1006, [0030].

290. A POSA would have known that local fan control is often achieved by a wireless remote control like the one disclosed in Qirong. A POSA would know that RF remote control generally have higher signal stability, broad directionality, efficiency, and increased control range. EX1007, [0003]. This is evidenced by Yun and Qirong explicitly addressing the advantages of remote fan control but warning against the disadvantages of IR remote control. EX1007, [0003]; EX1006, [0030] (“Compared with a traditional TV remote control, [RF] has the advantages of arbitrary directionality, is not obstructed by objects, is less susceptible to interference, and greater stability.”). EX1006, [0030].

2. Claims 1-4, 8-10

291. Qirong teaches and renders obvious claims 1-4 and 8-10. To the extent the Patent Owner argues Qirong does not teach or suggest claims 1[g], or 2-4, or 8-10, each of these limitations is taught and rendered obvious by Yun.

a. Elements 1[pre]-1[f]

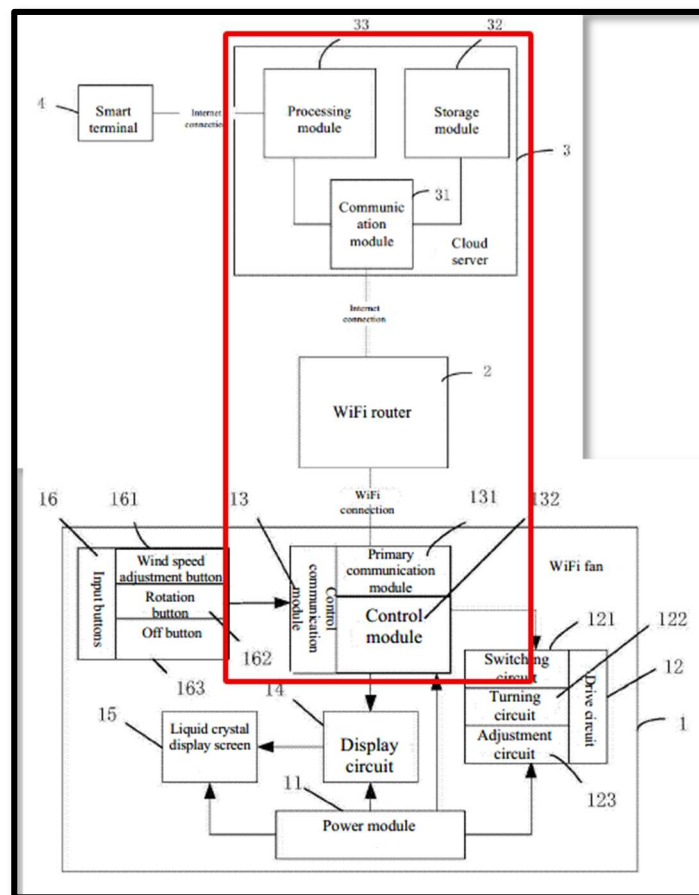
292. As discussed above in §X.B.2 of Ground 2, Qirong teaches or suggests each of these limitations.

b. Element 1[g]: “*the processor is configured to transmit, via the WiFi interface, to a server, an indication corresponding to the operation.*”

293. In my opinion, Qirong discloses and renders obvious element 1[g]. *See Supra* §X.B.2. I also note that for the same reasons discussed in §X.A.4.h, Yun discloses “*the processor is configured to transmit, via the WiFi interface, to a server, an indication corresponding to the operation.*”

294. As explained in §X.C.1, a POSA would have found the combination of Qirong and Yun obvious. In the combination of Qirong and Yun, the processor of Qirong is combined with the server-side architecture and functionality of Yun such that the communications and control signals of Yun are integrated into the system of Qirong. Additionally, both Qirong and Yun disclose a fan “*processor,*” EX1006, [0019] (“main control MCU”); EX1007, [0024] (“control module 131 [which] adopt[s] the circuit structure of a microcontroller, **microprocessor.**”). Similarly, both Qirong and Yun disclose a “WiFi interface” to communicate with

the external server. EX1006, [0025] ("The status is then uploaded to the server through the **WiFi module**."); EX1007, [0029] ("The main communication module 132 is a **WiFi communication module** for realizing communication with the WiFi router 2."). Therefore, a POSA would have been motivated to combine the analogous functionality of each processor and interface to obtain the benefits of both. Moreover, Yun's disclosures related to the cloud server's processing of fan operations signals, namely, the use of internal communication, processing, and storage modules, would be invaluable to a POSA seeking to develop the server-side architecture of Qirong. EX1007, [0029].



(EX1007, Fig. 3 & 4) (annotated)

a. Claims 2-4 and 8-10

295. As discussed above in §X.B.2 of Ground 2, Qirong teaches or suggests each of these limitations. In the combination of Qirong and Yun, the fan device of Qirong is combined with the server-side architecture and functionality of Yun such that the communications and control signals of Yun are integrated into the system of Qirong. A POSA would have found this combination obvious. §X.C.1.

XI. SECONDARY CONSIDERATIONS

296. I understand that certain objective factors, sometimes known as “secondary considerations,” are taken into account in determining whether a claimed invention would have been obvious. In most instances, these secondary considerations of non-obviousness are raised by the patentee. I also understand that these objective indications are only relevant to obviousness if there is a connection, or nexus, between them and the invention covered by the patent claims.

297. I also understand that secondary considerations of non-obviousness are inadequate to overcome a strong showing on the primary considerations of obviousness. For example, where the inventions represented no more than the

predictable use of prior art elements according to their established functions, the secondary considerations are inadequate to establish non-obviousness.

298. I have been informed that Petitioner is unaware of any publicly available secondary considerations evidence bearing any nexus to the purported claimed invention. No secondary considerations were asserted or relied on during prosecution. EX1002. I understand Patent Owner has introduced evidence in the parallel ITC proceeding purportedly related to secondary indicia of non-obviousness. However, that evidence is subject to a protective order, and I am precluded from addressing it in this petition. I reserve the right to address any secondary considerations should Patent Owner raise them.

XII. CONCLUSION

299. In my opinion, the Challenged Claims 1-4, and 8-10 of the '854 Patent are unpatentable.

* * *

300. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: June 13, 2024

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Paul Min", written in dark ink.

Dr. Paul Min