(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
04 July 2019 (04.07.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/129209 A1

(51) International Patent Classification:
H04W 36/30 (2009.01) *H04W 24/00* (2009.01)
H04W 84/12 (2009.01) *F21V 33/00* (2006.01)

(21) International Application Number:
PCT/CN2018/124918

(22) International Filing Date:
28 December 2018 (28.12.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
201711464758.0 28 December 2017 (28.12.2017) CN

(71) Applicant: **SENGLED CO., LTD.** [CN/CN]; Room 201/15, Building #1, No. 498 Guoshoujing Road, Pilot Free Trade Zone, Shanghai 201203 (CN).

(72) Inventors: **SONG, Weiwei**; 10th Floor, Building C, No.1582 Gumei Rd., Xuhui District, Shanghai 200233 (CN). **DENG, Xingming**; 10th Floor, Building C, No.1582 Gumei Rd., Xuhui District, Shanghai 200233 (CN). **SHEN, Jinxiang**; 10th Floor, Building C, No.1582 Gumei Rd., Xuhui District, Shanghai 200233 (CN).

(74) Agent: **LEADER PATENT & TRADEMARK FIRM**; 8F-6, Bldg. A, Winland International Center, No.32 Xizhimen North Street, Haidian District, Beijing 100082 (CN).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,

(54) Title: METHOD AND DEVICE FOR CONTROLLING A WIRELESS ROUTER AND AN LED LIGHTING DEVICE

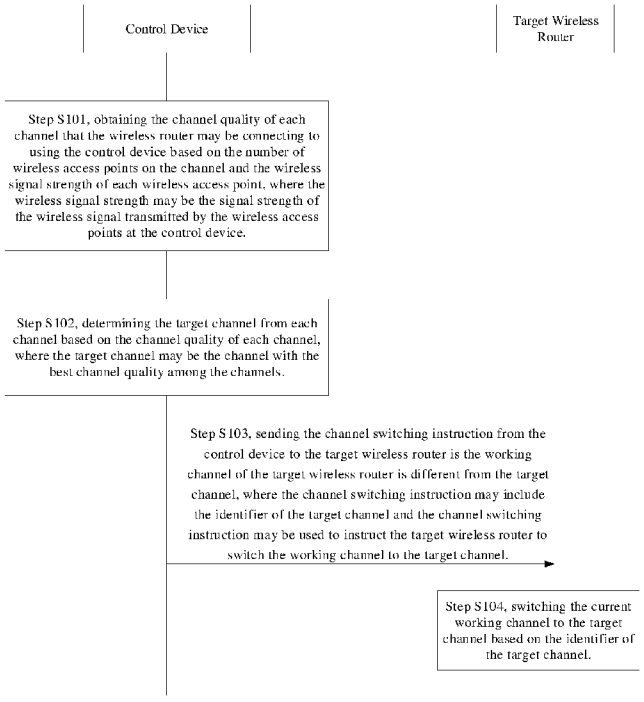

FIG. 2

(57) Abstract: The present disclosure provides a method and apparatus for controlling a wireless router and an LED device. The method includes obtaining a channel quality of each channel of multiple channels that the wireless router can connect to based on a number of wireless access points on each channel and wireless signal strengths of the wireless access points, a wireless signal strength being a signal strength of a wireless signal transmitted by a wireless access point at the control device; determining a target channel having the best channel quality from the multiple channels based on the channel quality of each channel; and sending a channel switching instruction from the control device to a target wireless router if a working channel of the target wireless router is different from the target channel. The channel switching instruction includes an identifier of the target channel.

WO 2019/129209 A1

[Continued on next page]

OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

METHOD AND DEVICE FOR CONTROLLING A WIRELESS ROUTER AND AN LED LIGHTING DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the priority to Chinese Patent Application No. 201711464758.0 entitled "Method and Device for Controlling A Wireless Router and An LED Lighting Device" filed on December 28, 2017, the entire content of which is incorporated herein by reference.

FIELD OF THE TECHNOLOGY

[0002] The present disclosure relates to the field of communication technology. More specifically, the present disclosure relates to a method and device for controlling a wireless router and a light emitting diode (LED) lighting device.

BACKGROUND

[0003] With the development of Internet, wireless WiFi routers have become more and more common in our life as they allow users to access different networks without the cluster of wires. With the wireless WiFi routers, users may freely use their mobile phones and tablets to surf the Internet, and smart devices such as smart TVs and smart TV boxes may connect to the Internet through WiFi, thereby removing the need to a physical cable connection.

[0004] However, either at home or in an office, multiple wireless WiFi routers may exist and they may interfere with each other, hence reducing the quality of the wireless connection of the wireless WiFi router.

SUMMARY

[0005] Embodiments of the present disclosure provide a method and apparatus for controlling a wireless router and an LED lighting device to improve the communication quality of the wireless router.

[0006] One aspect of the present disclosure provides a wireless router control method applied in a control device. The method includes: obtaining a channel quality of each channel of multiple channels that the wireless router can connect to based on a number of wireless

access points on each channel and wireless signal strengths of the wireless access points. A wireless signal strength is a signal strength of a wireless signal transmitted by a wireless access point at the control device. The method also includes: determining a target channel from the multiple channels based on the channel quality of each channel, the target channel being a channel with the best channel quality among the multiple channels; and sending a channel switching instruction from the control device to a target wireless router if a working channel of the target wireless router is different from the target channel. The channel switching instruction may include an identifier of the target channel and the channel switching instruction may be used to instruct the target wireless router to switch the working channel to the target channel.

[0007] In one embodiment, the method may further include: obtaining a channel quality indicator value of each channel based on a sum of the wireless signal strengths of all the wireless access points on the corresponding channel and the number of the wireless access points, where the channel quality indicator value may be used to indicate the channel quality of the corresponding channel; and determining the target channel from the multiple channels based on the channel quality indicator value corresponding to each channel.

[0008] In one embodiment, prior to obtaining the channel quality of each channel, the method may further include: detecting the wireless signal corresponding to each channel to obtain the number of the wireless access points on each channel and the respective wireless signal strengths of the wireless access points on each channel.

[0009] In one embodiment, the method may further include: periodically detecting the wireless signal corresponding to each channel at a predetermined time interval; and obtaining, in each detection period corresponding to the predetermined time interval, the number of the wireless access points on each channel and the wireless signal strengths of the wireless access points on each channel.

[0010] Another aspect of the present disclosure provides a control device including a channel quality acquisition module, a target channel determination module, and a transmission module. The channel quality acquisition module is configured to obtain a channel quality of each channel of multiple channels that the wireless router can connect to, based on a number of wireless access points on each channel and wireless signal strengths of the wireless access points. A wireless signal strength is a signal strength of a wireless signal

transmitted by a wireless access point at the control device. The target channel determination module may be configured to determine the target channel from multiple channels based on the channel quality of each channel, where the target channel may be a channel with the best channel quality among the multiple channels. The transmission module may be configured to send a channel switching instruction to the wireless router if a working channel of the wireless router is different from the target channel, where the channel switching instruction may include an identifier of the target channel, and the channel switching instruction may be used to instruct the wireless router to switch the working channel to the target channel.

[0011] In one embodiment, the channel quality acquisition module may be further configured to obtain the channel quality indicator value of each channel based on the sum of the wireless signal strengths of all the wireless access points on the corresponding channel and the number of the wireless access points, where the channel quality indicator value may be used to indicate the channel quality of the corresponding channel; and the target channel determination module may be further configured to determine the target channel from the multiple channels based on the channel quality indicator value corresponding to each channel.

[0012] In one embodiment, the control device may further include a detection module configured to detect the wireless signal corresponding to each channel to obtain the number of the wireless access points on each channel and the respective wireless signal strengths of the wireless access points on each channel.

[0013] In one embodiment, the detection module may be further configured to periodically detect the wireless signal corresponding to each channel at the predetermined time interval; and obtain, in each detection period corresponding to the predetermined time interval, the number of the wireless access points on each channel and the wireless signal strengths of the wireless access points on each channel.

[0014] Another aspect of the present disclosure provides a computer readable storage medium, comprising: computer program instructions to be executed by a computer to perform the aforementioned wireless router control method.

[0015] Another aspect of the present disclosure provides an electronic device having a processor; a storage; and a communication bus, where the communication bus may be used to connect different computer components, the storage may be used to store computer program instructions, and the processor may be used to read and execute the computer program

instructions stored in the storage to perform the aforementioned wireless router control method.

[0016] Another aspect of the present disclosure provides an LED lighting device including an LED lighting unit; an LED driving power source; and a control device (e.g., the aforementioned control device). The LED lighting unit and the control device may be connected to the LED driving power source. The control device may be configured to obtain a channel quality of each channel of multiple channels that the wireless router can connect to, based on a number of wireless access points on each channel and wireless signal strengths of the wireless access points, a wireless signal strength being a signal strength of a wireless signal transmitted by a wireless access point at the control device; determine a target channel from the multiple channels based on the channel quality of each channel, the target channel being a channel with the best channel quality among the multiple channels; and send a channel switching instruction from the control device to a target wireless router if a working channel of the target wireless router is different from the target channel. The channel switching instruction includes an identifier of the target channel and the channel switching instruction is used to instruct the target wireless router to switch the working channel to the target channel.

[0017] In one embodiment, the LED lighting unit is configured to adjust emitted light based on an instruction received by the control device from the target wireless router through the target channel.

[0018] In one embodiment, the control device may be further configured to: obtain the channel quality indicator value of each channel based on the sum of the wireless signal strengths of all the wireless access points on the corresponding channel and the number of the wireless access points, where the channel quality indicator value may be used to indicate the channel quality of the corresponding channel; and determine the target channel from the multiple channels based on the channel quality indicator value corresponding to each channel.

[0019] In one embodiment, the control device may be further configured to: detect the wireless signal corresponding to each channel to obtain the number of the wireless access points on each channel and the respective wireless signal strengths of the wireless access points on each channel.

[0020] In one embodiment, the control device may be further configured to: periodically

detect the wireless signal corresponding to each channel at the predetermined time interval; and obtain, in each detection period corresponding to the predetermined time interval, the number of the wireless access points on each channel and the wireless signal strengths of the wireless access points on each channel.

[0021] The embodiments of the present disclosure provide a method that allows the wireless router to select the channel with the best quality out of all available channels. If the wireless router's current working channel is not the channel with the best quality, a channel switching instruction may be sent to the wireless router to switch the working channel of the wireless router to the channel with the best quality, thereby improving the communication quality of the wireless router.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] For a more complete understanding of the present disclosure, and the advantages thereof, reference is now made to the following descriptions to be taken in conjunction with the accompanying drawings. The accompanying drawings in the following description show merely some embodiments of the present invention, and a person of ordinary skill in the art may still derive other drawings from these accompanying drawings without creative efforts.

[0023] FIG. 1 is a schematic illustrating a system according to an embodiment of the present disclosure;

[0024] FIG. 2 is a signal flowchart of a method for controlling a wireless router according to an embodiment of the present disclosure;

[0025] FIG. 3 is a schematic of a control device according to an embodiment of the present disclosure;

[0026] FIG. 4 is a schematic of the control device according to another embodiment of the present disclosure;

[0027] FIG. 5 is schematic of an LED lighting device according to an embodiment of the present disclosure; and

[0028] FIG. 6 is a schematic of an electronic device according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0029] Hereinafter, aspects, features, and embodiments of the present disclosure will be described with reference to the accompanying drawings. It should be understood that such description is exemplary only but is not intended to limit the scope of the present disclosure. In addition, it will be understood by those skilled in the art that various modifications in form and details may be made therein without departing from the spirit and scope of the present disclosure.

[0030] Features and aspects of the present disclosure will become apparent with reference to the accompanying drawings and non-limiting examples describing various preferred embodiments of the present disclosure.

[0031] It will also be appreciated that although the present disclosure has been described with reference to some specific examples, equivalents of the present disclosure can be achieved by those skilled in the art. These equivalents having features claimed in the present disclosure should fall within the scope of protection defined hereinafter.

[0032] Hereinafter, embodiments of the present disclosure will be described with reference to the accompanying drawings. It should be understood that such description is exemplary only but is not intended to limit the scope of the present disclosure. In addition, in the following description, descriptions of well-known structures and techniques are omitted to avoid unnecessarily obscuring the concepts of the present disclosure. Therefore, specific structural and functional details disclosed herein are not intended to be limiting, but are merely used as a basis of the claims to teach those skilled in the art to use the present disclosure in various combinations.

[0033] The terms used herein is for the purpose of describing particular embodiments only but is not intended to limit the present disclosure. The words “a”, “an” and “the” as used herein should also cover the meanings of “a plurality of” and “a variety of”, unless the context clearly dictates otherwise. In addition, the terms “comprising”, “including”, “containing” and the like as used herein indicate the presence of the features, steps, operations and/or components, but do not preclude the presence or addition of one or more other features, steps, operations or components.

[0034] The phrases “in an embodiment”, “in another embodiment”, “in another embodiment”, or “in other embodiments” may refer to the same or different embodiments accordingly to the present disclosure.

[0035] FIG. 1 is a schematic illustrating a system according to an embodiment of the present disclosure. Referring to FIG. 1, the system includes a terminal 11, a control device 12, a first wireless router 13, and one or more second wireless routers 14. In particular, through an application installed in the terminal 11, the control device 12 may connect to a wireless network provided by the first wireless router 13 whose communication quality may be improved using the embodiments of the present disclosure.

[0036] In some embodiments, the control device 12 may detect the wireless signal corresponding to each channel that the wireless router may be connected to, subsequently, the control device 12 may obtain the number of wireless access points on each channel and the wireless signal strengths of the wireless access points, where the wireless signal strength may be the signal strength of the wireless signal transmitted by the wireless access points at the control device 12 (e.g., measured/detected by the control device 12), so the channel quality of each channel may be determined. Based on the channel quality of each channel, the control device 12 may determine the channel with the best channel quality as a target channel. If the current working channel of the first wireless router 13 is different from the target channel, an identifier identifying the target channel with the best channel quality may be sent to the first wireless router 13, so the first wireless router 13 may switch the current working channel to the target channel, thereby improving the communication quality of the first wireless router 13.

[0037] The control method of the wireless router will be described in detail below in the following embodiment.

[0038] FIG. 2 is a signal flowchart of a method for controlling a wireless router according to an embodiment of the present disclosure. As shown in FIG. 2, the control method of the present embodiment includes the following steps:

[0039] Step S101, obtaining the channel quality of each channel that the wireless router may be connected to using the control device based on the number of wireless access points on the channel and the wireless signal strength of each wireless access point, where the wireless signal strength may be the signal strength of the wireless signal transmitted by the wireless access points at the control device.

[0040] Step S102, determining the target channel from each channel based on the channel quality of each channel, where the target channel may be the channel with the best channel

quality among the channels.

[0041] Step S103, sending the channel switching instruction from the control device to the target wireless router if the working channel of the target wireless router is different from the target channel, where the channel switching instruction may include the identifier of the target channel and the channel switching instruction may be used to instruct the target wireless router to switch the working channel to the target channel.

[0042] Step S104, switching the current working channel to the target channel based on the identifier of the target channel.

[0043] More specifically, the control device of the present embodiment may be the control device 12 of FIG. 1, and the target wireless router may be the first wireless router 13 of FIG.1.

[0044] Further, the target wireless router in the present embodiment may be a wireless WiFi router. The wireless router may include an access point (AP), which may be used to convert the wired network into a wireless network and transmit wireless signals. At this point, the identifier of the wireless router may also be the identifier of the wireless access point. Furthermore, the wireless access point may also work as an independent node, which may not have any routing function.

[0045] Prior to Step S101, the control device may connect to the wireless network provided by the target wireless router through the application installed in the terminal.

[0046] The specific process in which the control device accesses the wireless network provided by the target wireless router may include: the user provides the target wireless router's management account and password to the terminal; the terminal sends the management account and password of the target wireless router to the control device after receiving the management account and password, so the control device may access the wireless network provided by the target wireless router; and the control device accesses the wireless network provided by the target wireless router based on the IEEE 802.11 b/g/n WiFi protocol. Further, the control device may need to store the management account and password of the target wireless router to control the target wireless router through the Hyper Text Transfer Protocol (HTTP) communication mode.

[0047] Step S101, obtaining the channel quality of each channel that the wireless router may be connected to using the control device based on the number of wireless access points

on the channels and the wireless signal strength of each wireless access point, where the wireless signal strength is the signal strength of the wireless signal transmitted by the wireless access points at the control device.

[0048] More specifically, prior to Step S101, each wireless signal corresponding to each channel may need to be detected to obtain the number of wireless access points on each channel and the wireless signal strength of each wireless access point on each channel, where the wireless signal strength is the signal strength of the wireless signal transmitted by the wireless access point at the control device.

[0049] Further, channels may also be referred to as tunnels and frequency bands, which is the data signal transmission passage using wireless signals as the transmission carrier. Furthermore, a wireless router may correspond to a plurality of channels. For example, a wireless router may correspond to 13 channels, where each channel may correspond to a different center of frequency. For example, the 13 channels corresponding to the wireless router may be 13 channels obtained by dividing the 2.4GHz band into 13 frequency ranges, where Channel 1's center of frequency may be 2412MHz, and the frequency range may be 2401~2423MHz; Channel 2's center of frequency may be 2417MHz, and the frequency range may be 2406~2428MHz; Channel 3's center of frequency may be 2422MHz, and the frequency range may be 2411~2433MHz; Channel 4's center of frequency may be 2427MHz, and the frequency range may be 2416~2438MHz; Channel 5's center of frequency may be 2432MHz, and the frequency range may be 2421~2443MHz; Channel 6's center of frequency may be 2437MHz, and the frequency range may be 2426~2448MHz; Channel 7's center of frequency may be 2442MHz, and the frequency range may be 2431~2453MHz; Channel 8's center of frequency may be 2447MHz, and the frequency range may be 2436~2458MHz; Channel 9's center of frequency may be 2452Hz, and the frequency range may be 2441~2463MHz; Channel 10's center of frequency may be 2457MHz, and the frequency range may be 2446~2468MHz; Channel 11's center of frequency may be 2462MHz, and the frequency range may be 2451~2473MHz; Channel 12's center of frequency may be 2467MHz, and the frequency range may be 2456~2478MHz; and Channel 13's center of frequency may be 2472MHz, and the frequency range may be 2461~2483MHz. As can be seen, there is no frequency overlap between Channel 1, Channel 6, and Channel 13, that is, if wireless router A's working channel is Channel 1, and wireless router B's working channel is

channel 6, then the wireless router A and wireless router B will not interfere each other.

[0050] In particular, if a wireless router's working channel is the abovementioned Channel 1, then the frequency of the wireless signal transmitted by the wireless router will be between 2041~2423MHz. In addition, if the working channel of the wireless router is the other abovementioned channel, then the frequency of the wireless signal transmitted by the wireless router will match the frequency band corresponding to the respective channel.

[0051] Correspondingly, detecting the wireless signal corresponding to each channel may be detecting the wireless signal whose frequency corresponds to a corresponding channel. Further, the information in the wireless signal may include: an identifier identifying the wireless access point that transmitted the wireless signals (if the wireless access point is located in the wireless router, then the identifier of the wireless access point is the identifier of the wireless router); a Media Access Control (MAC) address of the wireless access point that transmitted the wireless signals (if the wireless access point is located in the wireless router, then the MAC address of the wireless access point is the MAC address of the wireless router); and a Received Signal Strength Indication (RSSI), where the RSSI may be used to indicate the wireless signal strength of the wireless access point, that is, the strength when the wireless signal transmitted by the wireless access point reaches the signal receiving device. For example, if the device receiving the signal is the control device, then the RSSI may indicate the wireless signal strength at the control device, in other words, the signal strength of the wireless signal received by the control device.

[0052] For example, when the control device detects a wireless signal corresponding to Channel 1, the control device may detect the wireless signal in the frequency range of 2401~2423MHz, and count the number of identifiers of the wireless access points carries in each wireless signal between 2401~2423MHz and the corresponding RSSI. Further, if the number of identifiers carried by the wireless access points in each wireless signal with the frequency in the range of 2401~2423MHz is two, then Channel 1 may include two wireless access points. Furthermore, if the two wireless access points are both wireless access points of the wireless router, then number of wireless routers whose working channel is Channel 1 equals two, such as wireless router C and wireless router D. In addition, $RSSI_C$ may represent the wireless signal strength transmitted by the wireless router C (or the wireless access point C on wireless router C) at the control device, that is, the strength of the wireless signal

transmitted by the wireless router C received by the control device, in other words, the wireless signal strength of the wireless router C or the wireless signal strength of the wireless access point C. Further, $RSSI_D$ may represent the wireless signal strength transmitted by the wireless router D (or the wireless access point D on wireless router D) at the control device, that is, the strength of the wireless signal transmitted by the wireless router D received by the control device, in other words, the wireless signal strength of the wireless router D or the wireless signal strength of the wireless access point D.

[0053] For example, if the wireless signal with a frequency of 2418MHz is detected and the wireless signal carries the identifier of the wireless router C, then the RSSI carried in the wireless signal may be the wireless signal strength ($RSSI_C$) when the wireless signal transmitted by the wireless router C reaches the control device.

[0054] Through the method mentioned above, the number of wireless access points on Channel 1 and the wireless signal strength of each wireless access point on Channel 1 may be obtained (that is, the signal strength of the wireless signal transmitted by each wireless access point on Channel 1 at the control device may be obtained).

[0055] Those skilled in the art will appreciate that the farther the control device is from the wireless router, the weaker the strength of the wireless signal transmitted by the wireless router and received by the control device will become, and the RSSI will be smaller.

[0056] Using the same method described above, the wireless signals corresponding to other channels may be detected, and the number of wireless access points on other channels and the signal strength of the wireless signals transmitted by the wireless access points on other channels at the control device may be obtained as well. Further, after obtaining the number of wireless access points on each channel and the signal strength of the wireless signals transmitted by the respective wireless access points on each channel at the control device, the channel quality of each channel may be determined.

[0057] More specifically, obtaining the channel quality of each channel that the wireless router may be connected to using the control device based on the number of wireless access points on the channels and the wireless signal strength of each wireless access point, where the wireless signal strength is the signal strength of the wireless signal transmitted by the wireless access points at the control device may include:

[0058] For each channel, the control device may obtain a channel quality indicator value

that may be used to indicate the channel quality of the channel. In particular, the channel quality indicator value of a channel may be obtained based on the sum of the wireless signal strengths of all the wireless access points on the corresponding channel and the number of the wireless access points of the corresponding channel. Further, the channel quality indicator value Q may be obtained using the following equation:

$$Qi=RSSI_1 +\ldots+RSSI_c+ \ldots+ RSSI_C$$

Where Q_i is the channel quality indicator value of the i^{th} channel, $RSSI_c$ is the signal strength of the wireless signal transmitted by the c^{th} wireless access point on the i^{th} channel at the control device, and C is the number of wireless access points on the i^{th} channel.

[0059] Step S102, determining the target channel from each channel based on the channel quality of each channel, where the target channel may be the channel with the best channel quality among the channels.

[0060] More specifically, determining the target channel from each channel based on the channel quality of each channel, where the target channel may be the channel with the best channel quality among the channels may include: determining the target channel from each channel based on the channel quality indicator value of each channel, where the target channel may be the channel with the best channel quality among the channels.

[0061] In particular, the lower the channel quality indicator value Q, the better the channel quality, that is, the lowest channel quality indicator value Q may be selected from the obtained channel quality indicator values, and the channel corresponding to the lowest channel quality indicator value Q may be the channel with the best channel quality, that is, the target channel.

[0062] Step S103, sending the channel switching instruction from the control device to the target wireless router if the working channel of the target wireless router is different from the target channel, where the channel switching instruction may include the identifier of the target channel and the channel switching instruction may be used to instruct the target wireless router to switch the working channel to the target channel.

[0063] More specifically, the control device may determine whether the working channel of the target wireless router is the same as the target channel. If they are different, the channel switching instruction may be sent to the target wireless router, where the channel switching instruction may include the identifier of the target channel, and the channel switching

instructor may be used to instruct the target wireless router to switch the working channel to the target channel.

[0064] In some embodiments, the channel switching instruction may be in the form of a wireless channel switching list, where the identifier of the target channel may be included in the wireless channel switching list.

[0065] Further, in the process of networking the control device with the target wireless router, that is, in the process of connecting the control device to the wireless network provided by the target wireless router, the control device may synchronize the working channel with the target wireless router to determine the working channel of the target wireless router.

[0066] Furthermore, the specific process of synchronizing the channels may refer to the procedure specified in the IEEE 802.11 b/g/n wireless protocol, which will not be described herein.

[0067] Step S104, switching the current working channel to the target channel based on the identifier of the target channel.

[0068] More specifically, after receiving the channel switching instruction, the target wireless router may switch the current working channel to the target channel based on the identifier of the target channel in the channel switching instruction.

[0069] Furthermore, the specific process of switching the channels may refer to the procedure specified in the IEEE 802.11 b/g/n wireless protocol, which will not be described herein.

[0070] The embodiments of the present disclosure provide a method that allows the wireless router to select the channel with the best quality out of all available channels. If the wireless router's current working channel is not the channel with the best quality, a channel switching instruction may be sent to the wireless router to switch the working channel of the wireless router to the channel with best quality, thereby improving the communication quality of the wireless router.

[0071] Those skilled in the art will appreciate that the steps mentioned above may be performed in a cycle, for example, periodically at a predetermined time interval. More specifically, the process may be: at a predetermined time interval periodically detecting the wireless signal corresponding to each channel, and obtaining the number of wireless access

points on each channel and the signal strength of the wireless signals transmitted by each wireless access point on each channel at the control device during the detection period (e.g., corresponding to the predetermined time interval); obtaining the channel quality indicator value for each channel based on the number of wireless access points on each channel in the corresponding detection period and the signal strength of the wireless signal transmitted by each wireless access point on each channel at the control device; and determining the target channel from each channel based on the channel quality indication value of each channel, where the target channel may be the channel with the best channel quality among the channels.

[0072] During each detection period, a target channel may be obtained, and after obtaining the target channel in the corresponding period, the process of determining whether the working channel of the target wireless router is the same as the target channel may be performed. If the channels are the same, determine whether the time lapse between the current time and the last time the wireless signal corresponding to each channel was detected equals to the predetermined time interval or not; if so, the steps in the next cycle may be performed; if not, the channel switching instruction may be sent to the target wireless router, so that the target wireless router may switch the working channel to the target channel. Further, after the channel switching instruction has been sent to the target wireless router, determine whether the time lapse between the current time and the last time the wireless signal corresponding to each channel was detected equals to the predetermined time interval or not; if so, the steps in the next cycle may be performed.

[0073] The wireless router control method provided in the present embodiment may include: for each channel that the wireless router may connect to, the control device may obtain the channel quality of the corresponding channel based on the number of wireless access points on the corresponding channel and the wireless signal strength of each wireless access point, where the wireless signal strength may be the signal strength of the wireless signal transmitted by the wireless access point at the control device; the control device may determine the target channel from each channel based on the channel quality of each channel, where the target channel may be the channel with the best channel quality among the channels; if the working channel of the target wireless router is different from the target channel, the control device may send a channel switching instruction to the target wireless router, where

the channel switching instruction may include an identifier of the target channel, and the channel switching instruction may be used to instruct the target wireless router to switch the working channel to the target channel; and the target wireless router may switch the current working channel to the target channel based on the identifier of the target channel. The wireless router control method provided in the present embodiment allows the wireless router to work on the channel with the best channel quality, thereby improving the communication quality of the wireless router.

[0074] FIG. 3 is a schematic of a control device according to an embodiment of the present disclosure. Referring to FIG. 3, the control device may include: a channel quality acquisition module 31; a target channel determination module 32; and a transmission module 33. In particular, for each channel that the wireless router may connect to, the channel quality acquisition module 31 may be used to obtain the channel quality of the corresponding channel based on the number of wireless access points on the corresponding channel and the wireless signal strength of each wireless access point, where the wireless signal strength may be the signal strength of the wireless signal transmitted by the wireless access point at the control device. Further, the target channel determination module 32 may be used to determine the target channel from each channel based on the channel quality of each channel, where the target channel may be a channel with the best channel quality among the channels. Furthermore, if the working channel of the wireless router is different from the target channel, the transmission module 33 may be used to send a channel switching instruction to the wireless router, where the channel switching instruction may include an identifier of the target channel, and the channel switching instruction may be used to instruct the wireless router to switch the working channel to the target channel.

[0075] More specifically, the channel quality acquisition module 31 may be used to obtain a channel quality indicator value of the corresponding channel based on the sum of the wireless signal strengths of all the wireless access points on the corresponding channel and the number of the wireless access points, where the channel quality indicator value may be used to indicate the channel quality of the channel. In addition, the target channel determination module 32 may be used to determine the target channel from each channel based on the channel quality indicator value corresponding to each channel.

[0076] The control device of the present embodiment may be used to implement the

technical solution of the foregoing method. Since the implementation principle and the technical effect are similar, details will not be described herein again.

[0077] FIG. 4 is a schematic of the control device according to another embodiment of the present disclosure. Referring to FIG. 4, further to the control device shown in FIG. 3, the control device may further include a detecting module 34.

[0078] The detecting module 34 may be used to detect the wireless signal corresponding to each channel to obtain the number of wireless access points on each channel and the respective wireless signal strengths of the wireless access points on each channel.

[0079] More specifically, the detecting module 34 may be used to periodically detect the wireless signal corresponding to each channel at a predetermined time interval to obtain the number of wireless access points on each channel in the corresponding detection period and the wireless signal strength of each wireless access point on each channel.

[0080] The control device of the present embodiment may be used to implement the technical solution of the foregoing method. Since the implementation principle and the technical effect are similar, details will not be described herein again.

[0081] FIG. 5 is a schematic of an LED lighting device according to an embodiment of the present disclosure. The LED lighting device may include: an LED lighting unit 51; an LED driving power source 52; and a control device 53 corresponding to the control device shown in FIG. 3 and FIG. 4, where the LED lighting unit 51 and the control device 53 are both connected to the LED driving power source 52.

[0082] More specifically, the LED lighting device may be an LED lamp. The structure of the LED lamp is not limited in this embodiment as long as the LED lamp includes the LED lighting unit 51, the control device 53 and the space to house the LED driving power source 52.

[0083] More specifically, the LED driving power source 52 may be used to supply power to the LED lighting unit 51 and the control device 53. The control device 53 may be further configured to send a current lighting status of the LED lighting unit 51 to a remote control terminal through the target wireless router, and/or receive an instruction from the remote control terminal through the target wireless router. The LED lighting unit 51 may be configured to adjust emitted light (e.g., on/off switch, brightness or color adjustment) based on the instruction received by the control device 53 from the target wireless router (e.g.,

through the working channel or the target channel).

[0084] Further, the structure and principle of the LED lighting unit and the LED driving power source are well known to those skilled in the art and will not be described herein.

[0085] The present embodiment integrates the control device of the wireless router into the LED lighting device, so a separate power source module is not required to supply power to the control device, and a separate space is not required to house the control device, thereby combining the functions of controlling the communication quality of the wireless router and lighting into one device.

[0086] The present embodiment may further provide a computer readable storage medium with computer program instructions. When the computer program instructions are being executed on a computer, the computer may instruct the control device to perform the method shown in FIG. 2.

[0087] FIG. 6 is a schematic of an electronic device according to an embodiment of the present disclosure. Referring to FIG. 6, the electronic device 600 of the present disclosure includes: a processor 61; a storage 62; and a communication bus, where the communication bus may be used to connect different components, the storage may be used to store computer program instructions, and the processor may be used to read the computer program instructions stored in the storage 62 and execute the computer program instructions stored in the storage 62 to perform the control method shown in FIG. 2.

[0088] Those skilled in the art may clearly understand that, for ease and concision of the descriptions, the aforementioned processing method may be applied to the related electronic devices, and the related details may refer to corresponding descriptions in the disclosed embodiments, which are not repeated herein.

[0089] The embodiments in this specification are described in a progressive manner, each embodiment emphasizes a difference from the other embodiments, and the identical or similar parts between the embodiments may be made reference to each other. Since the apparatuses disclosed in the embodiments are corresponding to the methods disclosed in the embodiments, the description of the apparatuses is simple and relevant parts may be made reference to the description of the methods.

[0090] Persons skilled in the art may further realize that, units and steps of algorithms according to the description of the embodiments disclosed by the present disclosure can be

implemented by electronic hardware, computer software, or a combination of the two. In order to describe interchangeability of hardware and software clearly, compositions and steps of the embodiments are generally described according to functions in the forgoing description. Whether these functions are executed by hardware or software depends upon specific applications and design constraints of the technical solutions. Persons skilled in the art may use different methods for each specific application to implement the described functions, and such implementation should not be construed as a departure from the scope of the present disclosure.

[0091] The steps of the methods or algorithms described in the embodiments of the present disclosure may be directly implemented by hardware, software modules executed by the processor, or a combination of both. The software module can be placed in a random access memory (RAM), memory, read only memory (ROM), electrically programmable ROM, electrically erasable and programmable ROM, register, hard disk, mobile disk, CD-ROM, or any other form of storage medium known to the technical domain.

[0092] It will be understood by those skilled in the art that the features described in the respective embodiments and/or claims of the present disclosure can be combined in various ways, even if such combinations are not explicitly described in the present disclosure. In particular, without departing from the spirit and teaching of the present disclosure, the features described in the respective embodiments and/or claims can be combined in various ways. All of these combinations fall within the scope of the present disclosure.

[0093] While the present disclosure has been shown and described with reference to various embodiments thereof, it will be understood by those skilled in the art that various modifications in form and details may be made therein without departing from the spirit and scope of the present disclosure as defined by the appended claims and their equivalents. Therefore, the scope of the present disclosure should not be limited to the above-described embodiments but should be determined by not only the appended claims but also the equivalents thereof.

[0094] It should be noted that the description of the foregoing embodiments of the electronic device may be similar to that of the foregoing method embodiments, and the device embodiments have the same beneficial effects as those of the method embodiments. Therefore, details may not be described herein again. For technical details not disclosed in the

embodiments of the electronic device of the present disclosure, those skilled in the art may understand according to the method embodiments of the present disclosure.

[0095] In the several embodiments provided in the present disclosure, it should be understood that the disclosed device and method may be realized in other manners. The device embodiments described above are merely exemplary. All functional modules or units in the embodiments of the present disclosure may all be integrated in one processing unit, or each unit may be used as a single unit. Two or more units may be integrated in one. The above integrated unit can either be implemented in the form of hardware, or in the form of hardware combined with software functional units.

[0096] Persons of ordinary skill in the art should understand that, all or a part of steps of implementing the foregoing method embodiments may be implemented by related hardware of a computer instruction program. The instruction program may be stored in a computer-readable storage medium, and when executed, a processor executes the steps of the above method embodiments as stated above. The foregoing storage medium may include various types of storage media, such as a removable storage device, a read only memory (ROM), a random-access memory (RAM), a magnetic disk, or any media that stores program code.

[0097] Alternatively, when the above-mentioned integrated units of the present disclosure are implemented in the form of a software functional module being sold or used as an independent product, the integrated unit may also be stored in a computer-readable storage medium. Based on this understanding, the technical solutions provided by the embodiments of the present disclosure essentially or partially may be embodied in the form of a software product stored in a storage medium. The storage medium stores instructions which are executed by a computer device (which may be a personal computer, a server, a network device, or the like) to realize all or a part of the embodiments of the present disclosure. The above-mentioned storage medium may include various media capable of storing program codes, such as a removable storage device, a read only memory (ROM), a random-access memory (RAM), a magnetic disk, or an optical disk.

[0098] Logic when implemented in software, can be written in an appropriate language such as but not limited to C# or C++, and can be stored on or transmitted through a computer-readable storage medium (e.g., that is not a transitory signal) such as a random

access memory (RAM), read-only memory (ROM), electrically erasable programmable read-only memory (EEPROM), compact disk read-only memory (CD-ROM) or other optical disk storage such as digital versatile disc (DVD), magnetic disk storage or other magnetic storage devices including removable thumb drives, etc.

[0099] The foregoing descriptions are merely embodiments of the present disclosure, and the protection scope of the present disclosure is not limited thereto. The scope that anyone skilled in the art may easily conceive changes and substitutions within the technical scope disclosed in the present disclosure that should be covered by the present disclosure. Therefore, the protection scope of the present disclosure should be subject to the scope of the claims as listed in the following.

[0100] Other embodiments of the disclosure will be apparent to those skilled in the art from consideration of the specification and practice of the disclosure provided herein. It is intended that the specification and examples be considered as exemplary only, with a true scope and spirit of the disclosure being indicated by the claims.

CLAIMS

What is claimed is:

1. A wireless router control method applied in a control device, comprising:

obtaining a channel quality of each channel of multiple channels that the wireless router can connect to based on a number of wireless access points on each channel and wireless signal strengths of the wireless access points, wherein a wireless signal strength is a signal strength of a wireless signal transmitted by a wireless access point at the control device;

determining a target channel from the multiple channels based on the channel quality of each channel, wherein the target channel is a channel with the best channel quality among the multiple channels; and

sending a channel switching instruction from the control device to a target wireless router if a working channel of the target wireless router is different from the target channel, wherein the channel switching instruction includes an identifier of the target channel and the channel switching instruction is used to instruct the target wireless router to switch the working channel to the target channel.

2. The method according to claim 1, further comprising:

obtaining a channel quality indicator value of each channel based on a sum of the wireless signal strengths of all the wireless access points on the corresponding channel and the number of the wireless access points, wherein the channel quality indicator value is used to indicate the channel quality of the corresponding channel; and

determining the target channel from the multiple channels based on the channel quality indicator value corresponding to each channel.

3. The method according to claim 1, prior to obtaining the channel quality of each channel, further comprising:

detecting the wireless signal corresponding to each channel to obtain the number of the wireless access points on each channel and the respective wireless signal strengths of the wireless access points on each channel.

4. The method according to claim 3, further comprising:

periodically detecting the wireless signal corresponding to each channel at a predetermined time interval; and

obtaining, in each detection period corresponding to the predetermined time interval, the number of the wireless access points on each channel and the wireless signal strengths of the wireless access points on each channel.

5. A control device, comprising:

a channel quality acquisition module configured to obtain a channel quality of each channel of multiple channels that the wireless router can connect to based on a number of wireless access points on each channel and wireless signal strengths of the wireless access points, wherein a wireless signal strength is a signal strength of a wireless signal transmitted by a wireless access point at the control device;

a target channel determination module configured to determine the target channel from multiple channels based on the channel quality of each channel, wherein the target channel is a channel with the best channel quality among the multiple channels; and

a transmission module configured to send a channel switching instruction to the wireless router if a working channel of the wireless router is different from the target channel, wherein the channel switching instruction includes an identifier of the target channel, and the channel switching instruction is used to instruct the wireless router to switch the working channel to the target channel.

6. The control device according to claim 5, wherein:

the channel quality acquisition module is further configured to obtain the channel quality indicator value of each channel based on the sum of the wireless signal strengths of all the wireless access points on the corresponding channel and the number of the wireless access points, wherein the channel quality indicator value is used to indicate the channel quality of the channel; and

the target channel determination module is further configured to determine the target channel from the multiple channels based on the channel quality indicator value corresponding to each channel.

7. The control device according to claim 5, further comprising a detection module configured to detect the wireless signal corresponding to each channel to obtain the number of the wireless access points on each channel and the respective wireless signal strengths of the wireless access points on each channel.

8. The control device according to claim 7, wherein the detection module is configured

to periodically detect the wireless signal corresponding to each channel at the predetermined time interval; and obtain, in each detection period corresponding to the predetermined time interval, the number of the wireless access points on each channel and the wireless signal strengths of the wireless access points on each channel.

9. A light emitting diode (LED) lighting device, comprising: an LED lighting unit; an LED driving power source; and a control device, wherein:

the LED lighting unit and the control device are connected to the LED driving power source;

the control device is configured to:

obtain a channel quality of each channel of multiple channels that the wireless router can connect to, based on a number of wireless access points on each channel and wireless signal strengths of the wireless access points, wherein a wireless signal strength is a signal strength of a wireless signal transmitted by a wireless access point at the control device;

determine a target channel from the multiple channels based on the channel quality of each channel, wherein the target channel is a channel with the best channel quality among the multiple channels; and

send a channel switching instruction from the control device to a target wireless router if a working channel of the target wireless router is different from the target channel, wherein the channel switching instruction includes an identifier of the target channel and the channel switching instruction is used to instruct the target wireless router to switch the working channel to the target channel.

10. The LED lighting device according to claim 9, wherein:

the LED lighting unit is configured to adjust emitted light based on an instruction received by the control device from the target wireless router through the target channel.

11. The LED lighting device according to claim 9, wherein the control device is further configured to:

obtain the channel quality indicator value of each channel based on the sum of the wireless signal strengths of all the wireless access points on the corresponding channel and the number of the wireless access points, wherein the channel quality indicator value is used to indicate the channel quality of the channel; and

determine the target channel from the multiple channels based on the channel quality indicator value corresponding to each channel.

12. The LED lighting device according to claim 9, the control device is further configured to detect the wireless signal corresponding to each channel to obtain the number of the wireless access points on each channel and the respective wireless signal strengths of the wireless access points on each channel.

13. The LED lighting device according to claim 12, wherein the control device is further configured to: periodically detect the wireless signal corresponding to each channel at the predetermined time interval; and obtain, in each detection period corresponding to the predetermined time interval, the number of the wireless access points on each channel and the wireless signal strengths of the wireless access points on each channel.

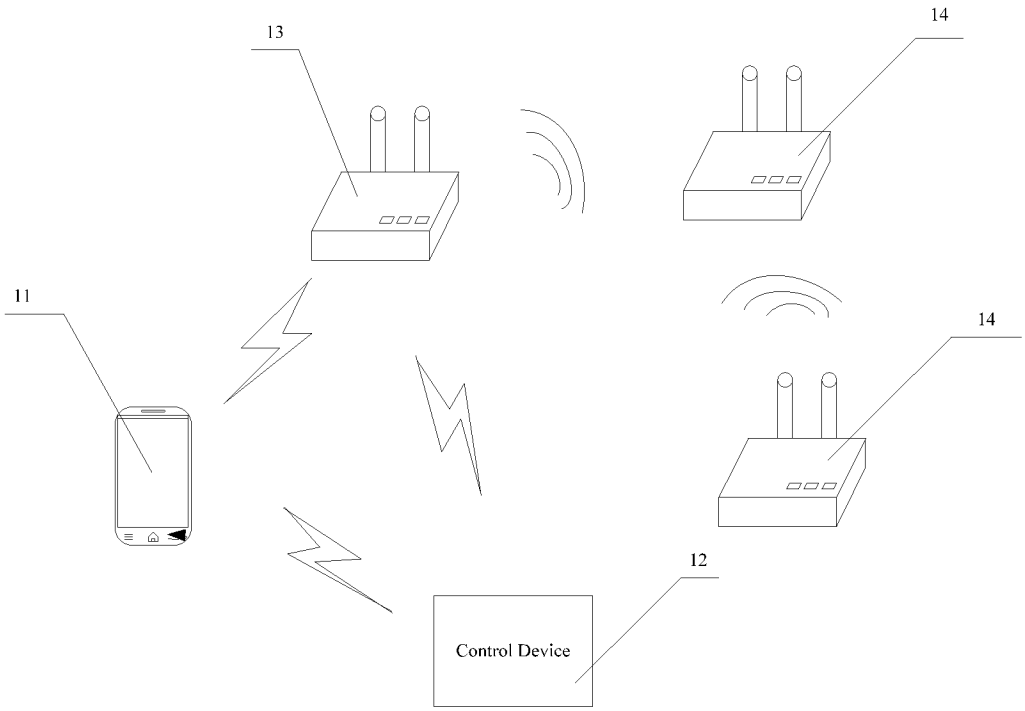

FIG. 1

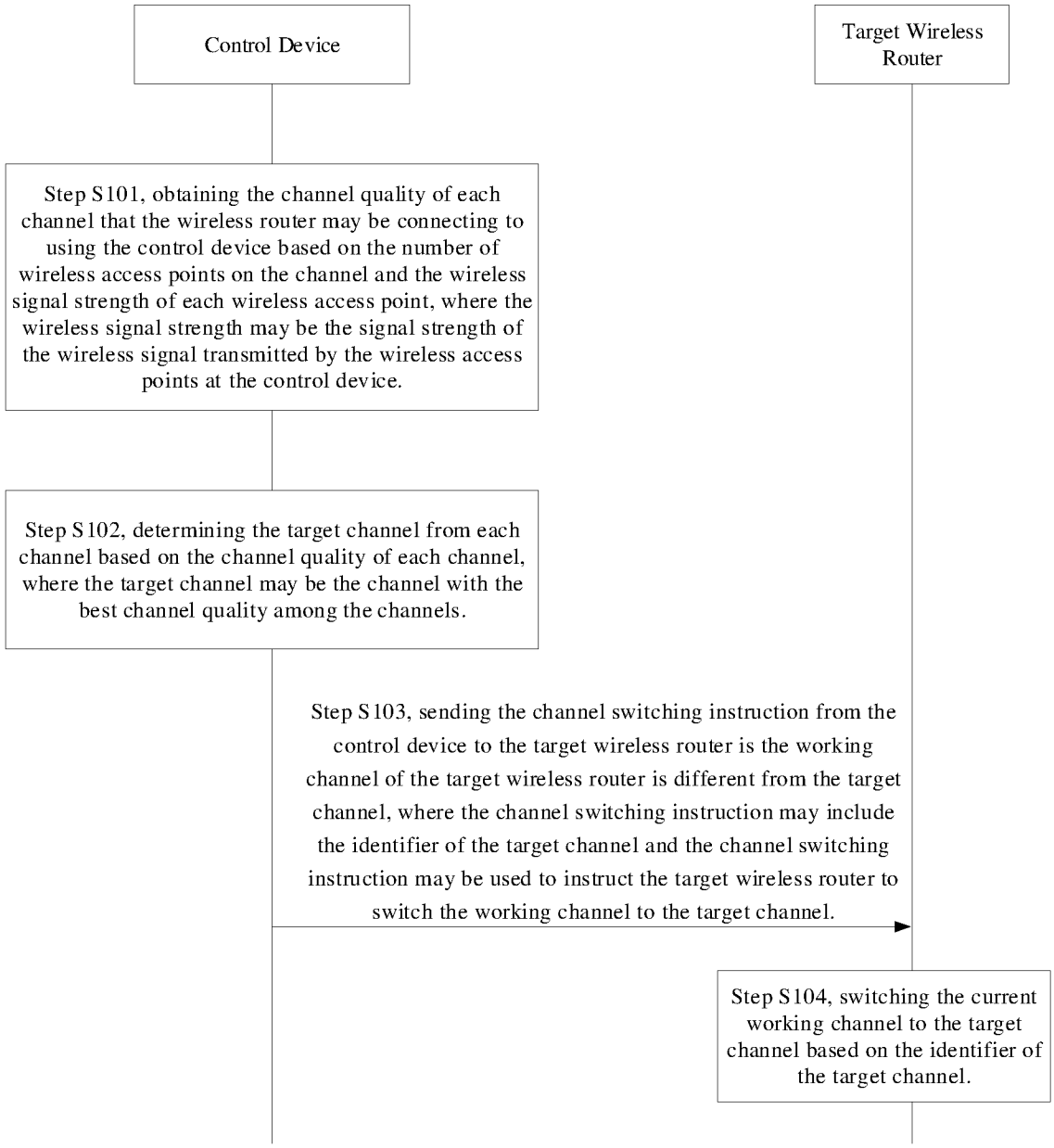
Control Device
Target Wireless Router
Step S101, obtaining the channel quality of each channel that the wireless router may be connecting to using the control device based on the number of wireless access points on the channel and the wireless signal strength of each wireless access point, where the wireless signal strength may be the signal strength of the wireless signal transmitted by the wireless access points at the control device.
Step S102, determining the target channel from each channel based on the channel quality of each channel, where the target channel may be the channel with the best channel quality among the channels.
Step S103, sending the channel switching instruction from the control device to the target wireless router is the working channel of the target wireless router is different from the target channel, where the channel switching instruction may include the identifier of the target channel and the channel switching instruction may be used to instruct the target wireless router to switch the working channel to the target channel.
Step S104, switching the current working channel to the target channel based on the identifier of the target channel.

FIG. 2

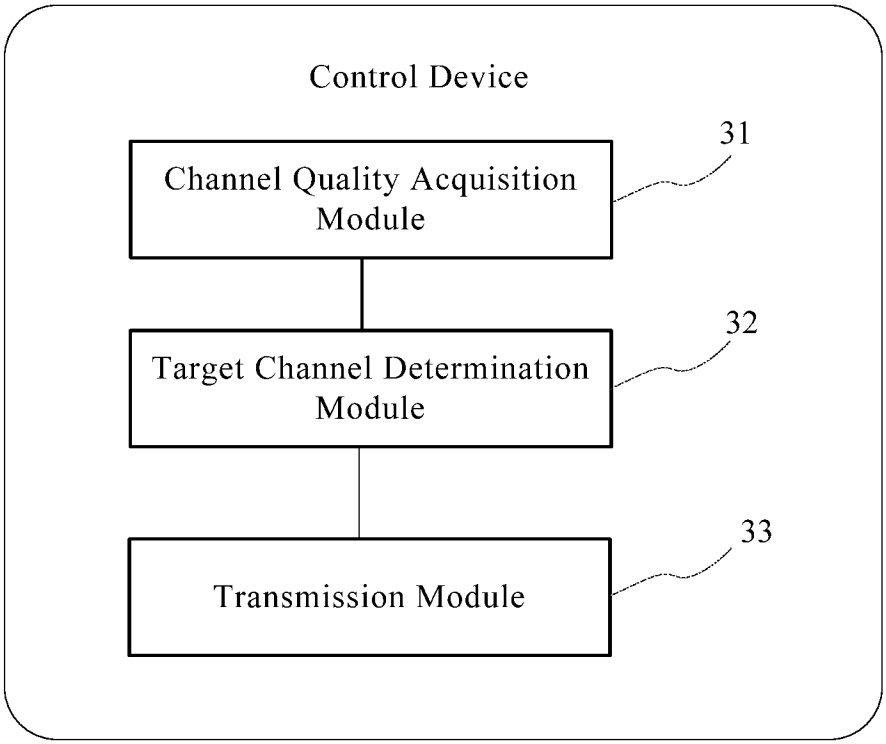
Control Device
Channel Quality Acquisition Module
31
Target Channel Determination Module
32
Transmission Module
33

FIG. 3

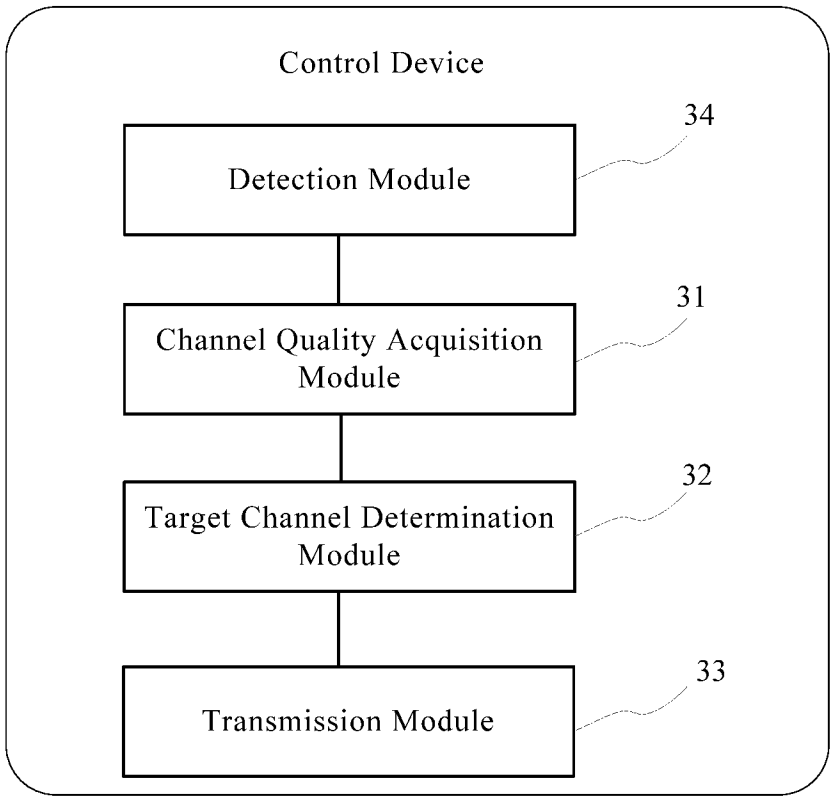
Control Device
34
Detection Module
31
Channel Quality Acquisition Module
32
Target Channel Determination Module
33
Transmission Module

FIG. 4

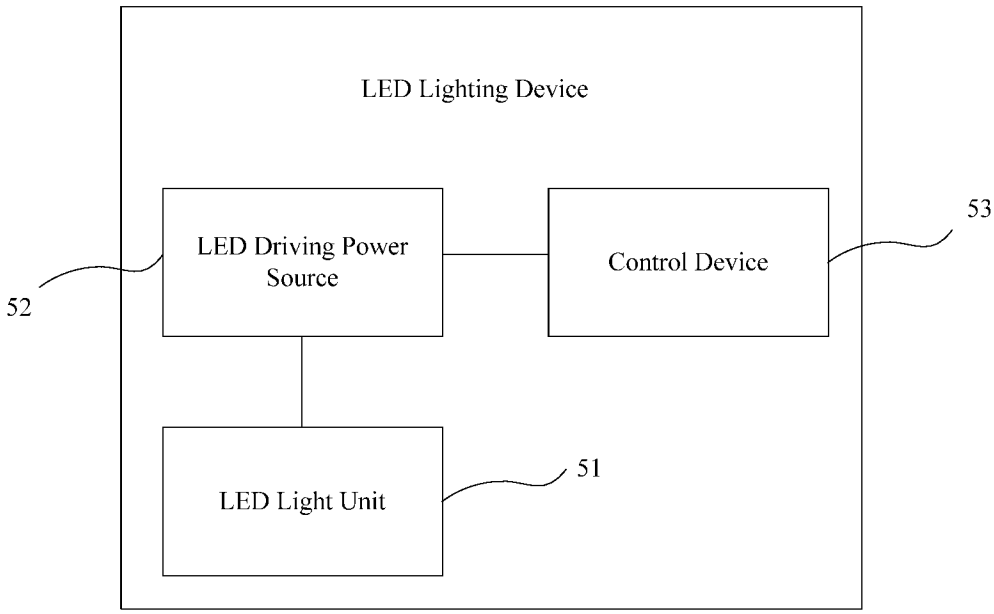
LED Lighting Device
LED Driving Power Source
Control Device
LED Light Unit
52
53
51

FIG. 5

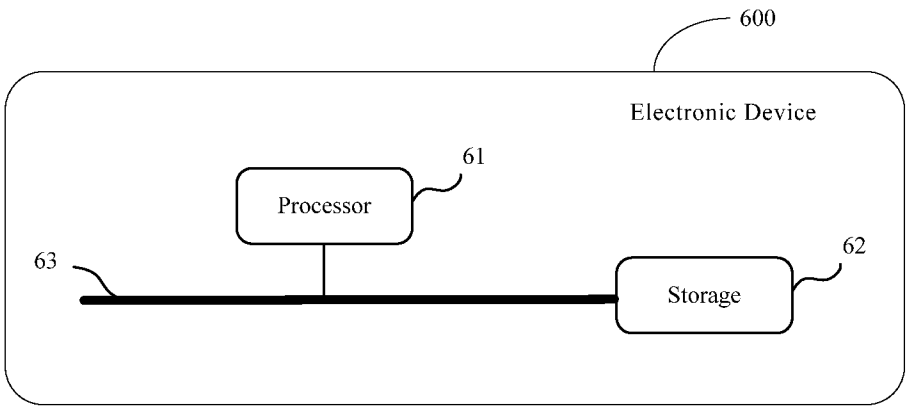
600
Electronic Device
Processor
61
63
62
Storage

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2018/124918

A. CLASSIFICATION OF SUBJECT MATTER

H04W 36/30(2009.01)i; H04W 84/12(2009.01)i; H04W 24/00(2009.01)i; F21V 33/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04L; H04W; F21V

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS; CNTXT; CNKI; DWPI; SIPOABS: wifi, wireless, fidelity, wlan, AP, access point, hot point, channel, quality, number, switch, best, indicate

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 108200615 A (SENGLED WISDOM TECHNOLOGY CO LTD) 22 June 2018 (2018-06-22) claims 1 to 11	1-13
X	CN 107172673 A (SHENZHEN MELINKR INFORMATION TECHNOLOGY CO LTD) 15 September 2017 (2017-09-15) the description, paragraphs 0045 to 0088, and claims 1 to 10	1-13
X	CN 104507113 A (BEIJING HIWIFI TECHNOLOGY CO LTD) 08 April 2015 (2015-04-08) the description, paragraphs 0019 to 0049, and claims 1 to 3	1-13
A	CN 104602137 A (SICHUAN CHANGHONG ELECTRIC CO LTD) 06 May 2015 (2015-05-06) the whole document	1-13
A	CN 104144455 A (HUAWEI DEVICE CO LTD) 12 November 2014 (2014-11-12) the whole document	1-13
A	WO 2015199680 A1 (INTEL CORP) 30 December 2015 (2015-12-30) the whole document	1-13

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:

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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 February 2019	**11 March 2019**

Name and mailing address of the ISA/CN	Authorized officer
National Intellectual Property Administration, PRC **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing** **100088** **China**	**XUE,Yu**
Facsimile No. **(86-10)62019451**	Telephone No. **86-(010)-62412008**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2018/124918

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	108200615	A	22 June 2018	None			
CN	107172673	A	15 September 2017	None			
CN	104507113	A	08 April 2015	None			
CN	104602137	A	06 May 2015	CN	104602137	B	22 December 2017
CN	104144455	A	12 November 2014	CN	104144455	B	20 April 2018
WO	2015199680	A1	30 December 2015	US	2018234978	A1	16 August 2018
				CN	107432000	A	01 December 2017