



## (12) Utility Model Patent

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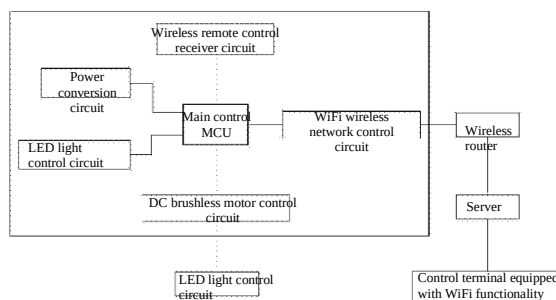
(54) Name of Utility Model

A Brushless Ceiling Fan Light Based on WiFi Smart

Remote Control

(57) Abstract

The present utility model discloses a brushless ceiling fan light based on WiFi smart remote control, including a DC brushless motor and a circuit module, which comprises a main control MCU, a power conversion circuit, an LED light control circuit, a DC brushless motor control circuit, and a WiFi wireless network control circuit. 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. The 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, which establishes a wireless communication connection with a control terminal equipped with WiFi functionality, thereby enabling remote control of the brushless ceiling fan light.



1. A brushless ceiling fan light based on WiFi smart remote control, wherein includes a DC brushless motor and a circuit module, which comprises a main control MCU, a power conversion circuit, an LED light control circuit, a DC brushless motor control circuit, and a WiFi wireless network control circuit. 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. The 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, which establishes a wireless communication connection with a control terminal equipped with WiFi functionality.
2. A brushless ceiling fan light based on WiFi smart remote control according to Claim 1, characterized in 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 control circuit.
3. A brushless ceiling fan light based on WiFi smart remote control according to Claim 1 or 2, characterized in that it further comprises a wireless remote control receiver circuit connected to the main control MCU.
4. A brushless ceiling fan light based on WiFi smart remote control according to Claim 1 or 2, characterized in that it further comprises an LED cold light source connected to the LED light control circuit.
5. A brushless ceiling fan light based on WiFi smart remote control according to Claim 1 or 2, characterized in that the power conversion circuit adopts a BUCK circuit.

## A Brushless Ceiling Fan Light Based on WiFi Smart Remote Control

### Technical Field

[0001] The present utility model relates to a ceiling fan light, particularly a brushless ceiling fan light based on WiFi smart remote control.

### Background Art

[0002] The ceiling fan light is a perfect combination of light and ceiling fan, possessing both the decorative function of a light and the practicality of a fan, and perfectly embodies the fusion of classical and modern styles, making it the preferred choice for indoor decoration.

[0003] In the prior art, brushless ceiling fan lights are controlled by means of wall switches, remote controls, or pull chains, but lack the capability for remote control.

### Summary of the Utility Model

[0004] The objective of the present utility model is to provide a brushless ceiling fan light based on WiFi smart remote control, which allows for remote control of the brushless ceiling fan light.

[0005] In order to achieve the aforementioned objective, these technical solutions are adopted in the present utility model: a brushless ceiling fan light based on WiFi smart remote control, including a DC brushless motor and a circuit module, which comprises a main control MCU, a power conversion circuit, an LED light control circuit, a DC brushless motor control circuit, and a WiFi wireless network control circuit. 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. The 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, which establishes a wireless communication connection with a control terminal equipped with WiFi functionality and a mobile phone APP.

[0006] 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.

[0007] 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.

[0008] In one or more examples of the present utility model, an LED cold light source connected to the LED light control circuit is further included.

[0009] In one or more examples of the present utility model, the power conversion circuit adopts a BUCK circuit.

[0010] Compared to the background art, the present utility model produces the following beneficial effects:

[0011] The present utility model realizes remote control of a brushless ceiling fan light and possesses

practical functions such as remote timing switch, stepless speed regulation, light control adjustment, and fault alarm.

### **Description of Drawings**

[0012] FIG. 1 is a schematic diagram illustrating the principle of a brushless ceiling fan light in an example.

### **Specific Embodiments**

[0013] Examples of the present utility model are described in detail below, examples of exemplary examples which are shown in the attached drawings, wherein the same or similar numerals throughout represent the same or similar elements or elements having the same or similar functions.

[0014] In the description of the present utility model, it should be noted that the orientational and positional relationships indicated by orientational terms such as “center”, “longitudinal”, “transverse”, “length”, “width”, “thickness”, “upper”, “lower”, “front”, “back”, “left”, “right”, “vertical”, “horizontal”, “top”, “bottom”, “inside”, “outside”, “clockwise”, “counterclockwise”, and the like, disclosed in the present utility model are based on the orientational and positional relationships indicated by the drawings. They are only for the convenience of describing the present utility model and simplifying the description, and are not for indicating or implying that the device or element referred to must have a specific orientation or must be constructed and operated in a specific orientation, nor shall they be construed as limiting the specific scope of protection of the present utility model.

[0015] Furthermore, the terms “first”, “second”, and the like are for descriptive purposes only and shall not be construed as indicating or implying relative importance or implicitly indicating the number of technical features indicated. Therefore, features defined as “first” and “second” may explicitly or implicitly include at least one of such features. In the description of the present utility model, the term “at least” means one or more, unless specifically defined otherwise.

[0016] In the present utility model, unless expressly specified and defined otherwise, the terms “assembly”, “linkage”, “connection”, and the like should be broadly interpreted. For example, they may be fixed connections, may be detachable connections, or may be integrally connected; they may be mechanically connected, may be directly connected, may also be indirectly connected through intermediate media, and may be communication within two elements. The specific meaning of the above terms in the present utility model may be understood by those with ordinary skill in the art based on the specific situation.

[0017] In a utility model, unless specified and defined otherwise, the first feature “on” or “under” the second feature, may include direct contact between the first and second features, or further include indirect contact between the first and second features but through additional features therebetween. In addition, the first feature “on”, and “upper”, the second feature, includes the first feature directly above and obliquely above the second feature, or simply indicates that the level of the first feature is higher than that of the second feature. The first feature “under”, and “below”, the second feature, includes the

first feature directly below and obliquely below the second feature, or simply indicates that the level of the first feature is lower than that of the second feature.

[0018] The technical solution of the present utility model and its beneficial effects will be made clearer and more explicit by the further description of the specific embodiments of the present utility model in conjunction with the attached drawings of the Specification below. The examples described below with reference to the attached drawings are exemplary, are for the purpose of interpreting the present utility model, and should not be construed as limiting the present utility model.

[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 and a circuit module, which comprises a main control MCU, a power conversion circuit, an LED light control circuit, a DC brushless motor control circuit, and a WiFi wireless network control circuit. 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. The 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, which establishes a wireless communication connection with a control terminal equipped with WiFi functionality.

[0020] The present embodiment realizes remote control of a brushless ceiling fan light and possesses practical functions such as remote timing switch, stepless speed regulation, light control adjustment, and fault alarm. This product 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.

[0021] The present example is the first to adopt a comprehensive smart solution using a brushless motor and WiFi control, inventing the first smart ceiling fan light and addressing the core requirements of stepless speed regulation and remote control over the Internet.

[0022] The present example addresses the limitations in the [existing] application of brushless ceiling fan light, such that brushless ceiling fan lights are no longer restricted to remote control, wall control, and chain control methods, thereby enhancing the usability thereof:

[0023] 1) 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.

[0024] 2) The WiFi module of the ceiling fan light is connected to a motor driver through the UART serial port, thereby enabling data communication.

[0025] 3) The user may perform stepless speed regulation, on and off switching, and mode adjustments for the ceiling fan light remotely over the Internet. The status is then uploaded to the server through the WiFi module and synchronized for push notifications to the WiFi control terminal.

[0026] The present example represents an improvement in the application scope of brushless ceiling fan light.

[0027] Preferably, the power conversion circuit primarily functions to rectify and filter AC220V mains electricity, converting it to high-voltage DC required for the motor driver system and stepping the voltage down to provide low-voltage DC required for the main control MCU. This circuit utilizes a DC/DC switch-mode power supply design in BUCK mode. Compared to the traditional method of voltage reduction using a mains frequency transformer, it has significant advantages in terms of high efficiency and a wide input voltage range. The power conversion circuit adopts a BUCK circuit.

[0028] The WiFi wireless network control circuit primarily functions to enable remote monitoring and control of the fan and lighting through a mobile APP. The key characteristic is that 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.

[0029] That is, 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.

[0030] 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.

[0031] Furthermore, an LED cold light source connected to the LED light control circuit is also included. The LED cold light source features heat generation, high efficiency, and uniform brightness.

[0032] 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. [The main control MCU] features up to 32 KB of embedded flash memory and 8 KB of SRAM, a 10-bit  $\mu$ 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.

[0033] The DC brushless motor control circuit adopts an FOC sensorless sine wave drive hardware and its algorithm, enabling sensorless FOC operation of the motor. Field oriented control is a purely mathematical transformation method adopted in the field of DC brushless motor and AC induction motor control, with key characteristics of improving control performance and reducing energy consumption. It also 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.

[0034] Throughout the description of the present Specification, reference to the terms “an example”, “preferably”, “exemplary examples”, “specific exemplary examples”, or “some exemplary examples”, and the like, means that specific features, structures, materials, or characteristics described in connection with the example or exemplary examples are included in at least one example or exemplary examples of the present utility model. In the present Specification, the illustrative expressions of the above terms may not necessarily refer to the same example or exemplary examples. Moreover, the specific features, structures, materials, or characteristics described may be combined in a suitable manner in any one or a plurality of example or exemplary examples.

[0035] Through the description of the above structures and principles, those skilled in the art should understand that the present utility model is not limited to the specific embodiments mentioned above, and improvements and substitutions using known techniques in the art based on the present utility model fall within the scope of protection of the present utility model and should be defined by the claims.

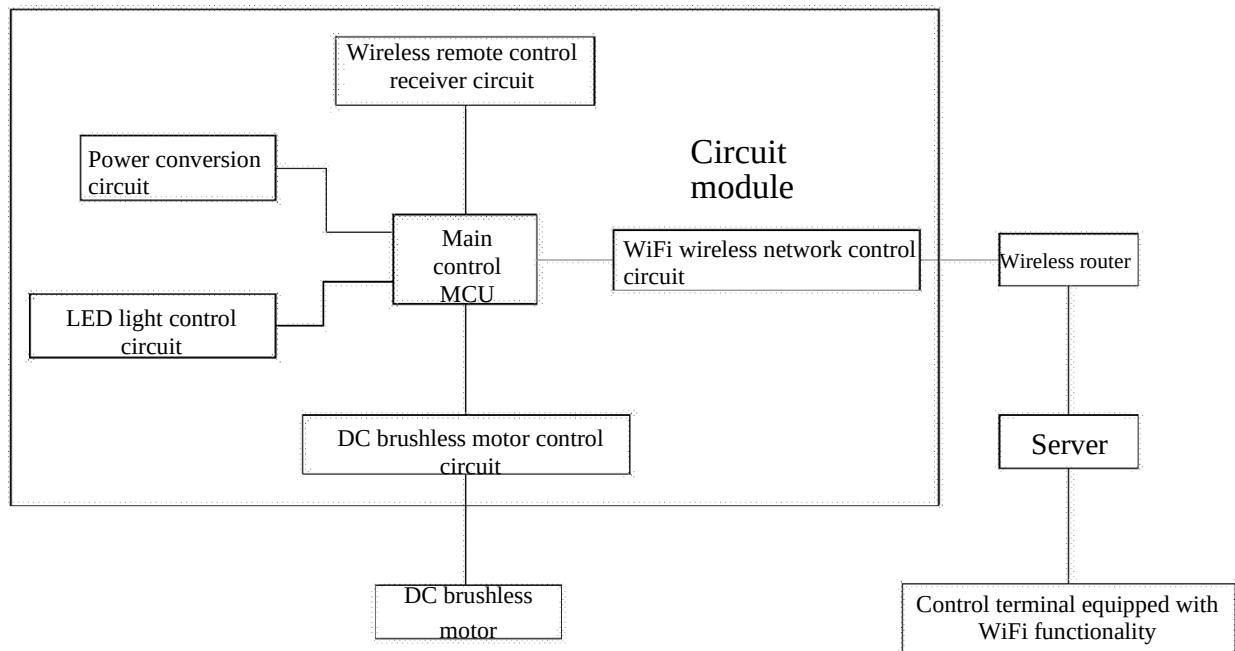


FIG. 1

1250 Broadway, New York, NY 10001

I, [VIVIAN KHAW RUI FANG], am fluent in the [ENGLISH] and [CHINESE] languages, I have been translating documents for over [SIX] years and am competent to translate from [SIMPLIFIED CHINESE] to [ENGLISH].

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I hereby certify under penalty of perjury under the laws of the United States that the following is, to the best of my knowledge and belief, a true and accurate translation of the attached [CN204716567U and CN206738206U] from

[SIMPLIFIED CHINESE] into [ENGLISH].

Signature:

  
[VIVIAN KHAW RUI FANG]

[12 APRIL 2024]



## (12)实用新型专利

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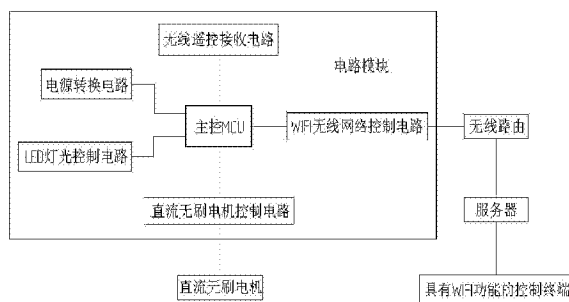
权利要求书1页 说明书4页 附图1页

### (54)实用新型名称

一种基于WIFI智能远程控制的无刷吊扇灯

### (57)摘要

本实用新型公开了一种基于WIFI智能远程控制的无刷吊扇灯,包括直流无刷电机和电路模块,所述电路模块具有主控MCU、电源转换电路、LED灯光控制电路、直流无刷电机控制电路以及WIFI无线网络控制电路,所述主控MCU分别与所述电源转换电路、LED灯光控制电路、直流无刷电机控制电路以及WIFI无线网络控制电路相连,其中所述电源转换电路将市电转换成直流高压以及直流低压以为各部分电路供电,所述主控MCU通过所述直流无刷电机控制电路与所述直流无刷电机相连,所述WIFI无线网络控制电路与路由器相连,所述路由器与服务器相连,所述服务器与具有WIFI功能的控制终端建立无线通信连接,其可对无刷吊扇灯进行远程控制。



1. 一种基于WIFI智能远程控制的无刷吊扇灯,其特征在于,包括直流无刷电机和电路模块,所述电路模块具有主控MCU、电源转换电路、LED灯光控制电路、直流无刷电机控制电路以及WIFI无线网络控制电路,所述主控MCU分别与所述电源转换电路、LED灯光控制电路、直流无刷电机控制电路以及WIFI无线网络控制电路相连,其中所述电源转换电路将市电转换成直流高压以及直流低压以为各部分电路供电,所述主控MCU通过所述直流无刷电机控制电路与所述直流无刷电机相连,所述WIFI无线网络控制电路与路由器相连,所述路由器与服务器相连,所述服务器与具有WIFI功能的控制终端建立无线通信连接。

2. 根据权利要求1所述的一种基于WIFI智能远程控制的无刷吊扇灯,其特征在于,所述具有WIFI功能的控制终端是指手机,在所述手机内装有用于控制所述LED灯光控制电路以及所述直流无刷电机控制电路的APP软件。

3. 根据权利要求1或2所述的一种基于WIFI智能远程控制的无刷吊扇灯,其特征在于,还包括有与所述主控MCU相连的无线遥控接收电路。

4. 根据权利要求1或2所述的一种基于WIFI智能远程控制的无刷吊扇灯,其特征在于,还包括有与所述LED灯光控制电路相连的LED冷光源。

5. 根据权利要求1或2所述的一种基于WIFI智能远程控制的无刷吊扇灯,其特征在于,所述电源转换电路采用BUCK电路。

## 一种基于WIFI智能远程控制的无刷吊扇灯

### 技术领域

[0001] 本实用新型涉及吊扇灯,尤其涉及一种基于WIFI智能远程控制的无刷吊扇灯。

### 背景技术

[0002] 吊扇灯,它是灯和吊扇的完美结合,既具灯的装饰性,又具风扇的实用性,古典和现代完美体现,实为室内装修首选。

[0003] 现有技术中,通过使用墙控、摇控器或者拉链控制无刷吊扇灯,但是其无法对无刷吊扇灯进行远程控制。

### 实用新型内容

[0004] 本实用新型的目的在于提供一种基于WIFI智能远程控制的无刷吊扇灯,其可对无刷吊扇灯进行远程控制。

[0005] 为了实现上述目的,本实用新型采用的技术方案:一种基于WIFI智能远程控制的无刷吊扇灯,包括直流无刷电机和电路模块,所述电路模块具有主控MCU、电源转换电路、LED灯光控制电路、直流无刷电机控制电路以及WIFI无线网络控制电路,所述主控MCU分别与所述电源转换电路、LED灯光控制电路、直流无刷电机控制电路以及WIFI无线网络控制电路相连,其中所述电源转换电路将市电转换成直流高压以及直流低压以为各部分电路供电,所述主控MCU通过所述直流无刷电机控制电路与所述直流无刷电机相连,所述WIFI无线网络控制电路与路由器相连,所述路由器与服务器相连,所述服务器与具有WIFI功能的控制终端以及手机APP建立无线通信连接。

[0006] 于本实用新型的一个或多个实施例当中,所述具有WIFI功能的控制终端是指手机,在所述手机内装有用于控制所述LED灯光控制电路以及所述直流无刷电机控制电路的APP软件。

[0007] 于本实用新型的一个或多个实施例当中,还包括有与所述主控MCU相连的无线遥控接收电路。

[0008] 于本实用新型的一个或多个实施例当中,还包括有与所述LED灯光控制电路相连的LED冷光源。

[0009] 于本实用新型的一个或多个实施例当中,所述电源转换电路采用BUCK电路。

[0010] 本实用新型同背景技术相比所产生的有益效果:

[0011] 本实用新型实现对无刷吊扇灯的远程控制化,并且具备了远程定时开关、无极调速、灯控调节、故障报警等实用功能。

### 附图说明

[0012] 图1为实施例中无刷吊扇灯的原理示意图。

### 具体实施方式

[0013] 下面详细描述本实用新型的实施例,所述的实施例示例在附图中示出,其中自始至终相同或类似的标号表示相同或类似的元件或具有相同或类似功能的元件。

[0014] 在本实用新型的描述中,需要说明的是,对于方位词,如有术语“中心”、“横向”、“纵向”、“长度”、“宽度”、“厚度”、“上”、“下”、“前”、“后”、“左”、“右”、“竖直”、“水平”、“顶”、“底”、“内”、“外”、“顺时针”、“逆时针”等指示方位和位置关系为基于附图所示的方位或位置关系,仅是为了便于叙述本实用新型和简化描述,而不是指示或暗示所指的装置或元件必须具有特定的方位、以特定方位构造和操作,不能理解为限制本实用新型的具体保护范围。

[0015] 此外,如有术语“第一”、“第二”仅用于描述目的,而不能理解为指示或暗示相对重要性或隐含指明技术特征的数量。由此,限定有“第一”、“第二”特征可以明示或者隐含包括一个或者多个该特征,在本实用新型描述中,“至少”的含义是一个或一个以上,除非另有明确具体的限定。

[0016] 在本实用新型中,除另有明确规定和限定,如有术语“组装”、“相连”、“连接”术语应作广义去理解,例如,可以是固定连接,也可以是可拆卸连接,或一体地连接;也可以是机械连接;可以是直接相连,也可以是通过中间媒介相连,可以是两个元件内部相连通。对于本领域普通技术人员而言,可以根据具体情况理解上述的术语在本实用新型中的具体含义。

[0017] 在实用新型中,除非另有规定和限定,第一特征在第二特征之“上”或之“下”可以包括第一和第二特征直接接触,也可以包括第一特征和第二特征不是直接接触而是通过它们之间的另外特征接触。而且,第一特征在第二特征“之上”和“上面”包括第一特征在第二特征正上方和斜上方,或仅仅是表示第一特征水平高度高于第二特征的高度。第一特征在第二特征“之下”和“下面”包括第一特征在第二特征正下方或斜下方,或仅仅表示第一特征水平高度低于第二特征。

[0018] 下面结合说明书的附图,通过对本实用新型的具体实施方式作进一步的描述,使本实用新型的技术方案及其有益效果更加清楚、明确。下面通过参考附图描述实施例是示例性的,旨在解释本实用新型,而不能理解为对本实用新型的限制。

[0019] 请参看图1所示的,本实施例提供一种基于WIFI智能远程控制的无刷吊扇灯,包括直流无刷电机和电路模块,所述电路模块具有主控MCU、电源转换电路、LED灯光控制电路、直流无刷电机控制电路以及WIFI无线网络控制电路,所述主控MCU分别与所述电源转换电路、LED灯光控制电路、直流无刷电机控制电路以及WIFI无线网络控制电路相连,其中所述电源转换电路将市电转换成直流高压以及直流低压以为各部分电路供电,所述主控MCU通过所述直流无刷电机控制电路与所述直流无刷电机相连,所述WIFI无线网络控制电路与路由器相连,所述路由器与服务器相连,所述服务器与具有WIFI功能的控制终端建立无线通信连接。

[0020] 本实施实现对无刷吊扇灯的远程控制化,并且具备了远程定时开关、无极调速、灯控调节、故障报警等实用功能。本产品为吊扇灯领域为首创产品,率先引入物联网技术实现无刷吊扇灯的远程控制。

[0021] 本实施例首次采用无刷电机+WIFI控制的整体智能化方案,发明了首款智能吊扇灯,解决了无极调速以及跨互联网控制的核心需求。

[0022] 本实施例解决无刷吊扇灯应用的局限性质,使得无刷吊扇灯不再局限于遥控、墙控、链控方式,提高了无刷吊扇灯的易用性:

[0023] 1) 吊扇灯的WIFI模组作为STA模式通过TCP/IP协议与无线路由设备进行连接。无线路由为已连接互联网,通过路由器连接至服务器。

[0024] 2) 吊扇灯的WIFI模组通过UART串口与电机驱动进行连接,进而进行数据通信。

[0025] 3) 用户可对吊扇灯进行跨互联网无极调速,开关,档位控制,并且状态通过WIFI模块上传数据至服务器,同步推送到WIFI的控制终端。

[0026] 本实施例为无刷吊扇灯的应用范围改进。

[0027] 优选地,电源转换电路:主要功能是把市电的AC220V整流滤波,转换成电机驱动系统需要的直流高压,以及降压转换成主控MCU部分需要的直流低压。此部分电路运用DC/DC开关电源BUCK方式设计,比传统的用工频变压器方式降压,有着明显的高效率、宽输入电压范围的特点。所述电源转换电路采用BUCK电路。

[0028] WIFI无线网络控制电路:主要功能是实现手机APP远程查看、控制风扇和灯光。其主要特点是手机安装软件APP,而风扇控制系统处于可用WIFI信号范围内,即可实现通过网络远程查看、控制的功能。

[0029] 即,所述具有WIFI功能的控制终端是指手机,在所述手机内装有用于控制所述LED灯光控制电路以及所述直流无刷电机控制电路的APP软件。

[0030] 优选地,还包括有与所述主控MCU相连的无线遥控接收电路。无线遥控接收电路使用433MHZ频率的无线通讯方式。相比传统的电视机遥控器具有方向任意性,不受物件遮挡,不容易受干扰,更稳定的特点。

[0031] 进一步地,还包括有与所述LED灯光控制电路相连的LED冷光源,LED冷光源具有发热量,效率高,光线亮度均匀等特点。

[0032] 主控MCU部分:采用美国设计的进口芯片。该芯片针对新一代的智能家电,智能设备的电源和控制需求进行高度优化,集成了一个50MHz 运行速度的 ARM Cortex-M0 32 位微控制器核心与多模式电源管理模块、可配置的模拟前端以及特殊应用功率驱动,组成基于微控制器的高度集成的一体化通用控制器,非常适用于电机控制。其具有高达32KB的嵌入式闪存和 8KB的SRAM存储器,一个10位1 $\mu$ s 的高速模数转换器(ADC),并且带有两条自动采样序列,5V/3.3V可配置I/Os,灵活的时钟源,定时器,多功能14通道的PWM引擎和多个串行接口。

[0033] 直流无刷电机控制电路:采用FOC无感正弦波驱动硬件及其算法。实现电机的无感FOC运转。磁场定向技术(Field Oriented Control)是直流无刷电机和交流感应电机控制领域所采用的一种纯粹的数学变换方法,其具有改善控制性能,降低能源消耗的主要特点。并且能使电机的三相运行电流接近正弦波,从而降低电机转矩脉动,降低转动噪声,提高电机效率。

[0034] 在说明书的描述中,参考术语“合一个实施例”、“优选地”、“示例”、“具体示例”或“一些示例”等的描述意指结合该实施例或示例描述的具体特征、结构、材料或者特点,包含于本实用新型的至少一个实施例或示例中,在本说明书中对于上述术语的示意性表述不一定指的是相同的实施例或示例。而且,描述的具体特征、结构、材料或者特点可以在任何一个或多个实施例或者示例中以合适方式结合。

[0035] 通过上述的结构和原理的描述,所属技术领域的技术人员应当理解,本实用新型不局限于上述的具体实施方式,在本实用新型基础上采用本领域公知技术的改进和替代均落在本实用新型的保护范围,应由各权利要求限定之。

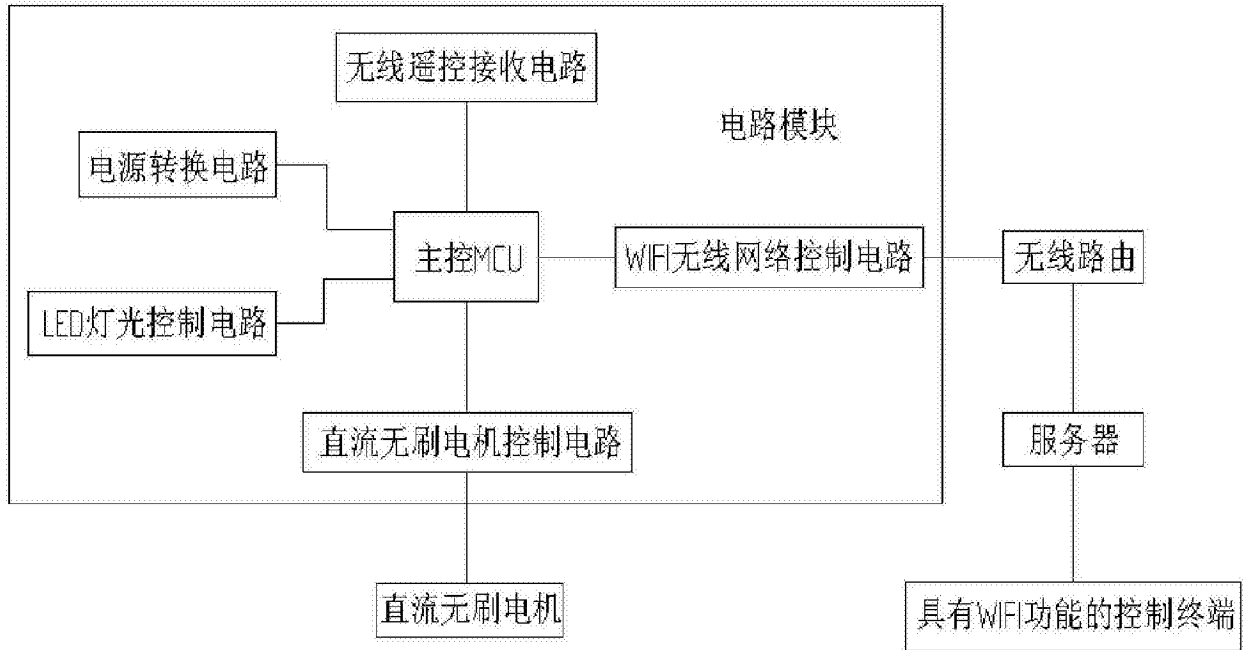


图1