APPARATUS, SYSTEM AND METHOD FOR CONTROLLING MOTORIZED FURNITURE

FIELD OF INVENTION

[0001] The present invention relates broadly, but not exclusively, apparatuses, systems and methods for controlling motorized furniture.

BACKGROUND

[0002] Currently, most motorized furniture is built in-house by manufacturers such that they integrate their full circuitry into their own furniture. Hence, in the current market, integration between furniture made by different manufacturers and smart home systems is generally not possible. This incompatibility issue poses a problem for users who own furniture made by different manufacturers when attempting to implement a complete smart home system. Furthermore, this limits the availability of the designs of the furniture in the market that are compatible with smart home systems since such manufacturers make up a small share of the market only.

[0003] For example, the Southeast Asian furniture market is still at the early stage of adopting smart home technologies that allow furniture to be controlled by mobile applications. Although there are factories in other countries such as China which are able to create a complete smart home solution, the cost of shipping such products to Southeast Asia is comparatively high. This will affect the competitiveness of the retailers in the market.

[0004] A need therefore exists to provide a solution that can address at least some of the above problems.

SUMMARY

[0005] The present disclosure provides an adaptor that can be plugged in between the control buttons and motors of most conventional furniture. With such configuration, signals that control the mechanical movement of the furniture can be sent not only from the control

buttons but also from a remote controller or a mobile device so that users can control the mechanical movement e.g. via a mobile application. The adaptor also allows the motorized furniture to be added to smart device hubs like Google Home and Amazon Alexa so that the mechanical movement of the furniture can be voice controlled as well.

[0006] An aspect of the present disclosure provides an apparatus comprising:

a signal module comprising a plurality of input ports and a plurality of output ports; and

an antenna connected to the signal module,

wherein the signal module is operable based on an input control signal from either the antenna or a control device to control operation of a motor.

[0007] The apparatus may further comprise:

a plurality of first relays, wherein each first relay is operable by a signal from an associated output port of the control device,

a plurality of second relays, wherein each second relay is operable by a signal from an associated output port of the signal module.

[0008] The signal module may be configured to generate a module output signal from a selected output port of the signal module based on the input control signal received from the antenna, the module output signal operating an associated second relay to provide a motor input signal to a selected input port of the motor.

[0009] The control device may be configured to generate an output signal from a selected output port of the control device based on the input control signal, the output signal operating an associated first relay to provide a module input signal to a selected input port of the signal module, and the signal module may be configured to generate a module output signal from a selected output port of the signal module based on the module input signal, the module output signal operating an associated second relay to provide a motor input signal to a selected input port of the motor.

[0010] The first relays may comprise normally-open switches, and the second relays may comprise normally-open switches.

[0011] Another aspect of the present disclosure provides a control system for a motorized furniture article, the control system comprising:

a first control device;

a signal module comprising a plurality of input ports and a plurality of output ports;

an antenna connected to the signal module;

a plurality of first relays, wherein each first relay is operable by a signal from an associated output port of the first control device; and

a plurality of second relays, wherein each second relay is operable by a signal from an associated output port of the signal module.

[0012] The signal module may be configured to generate a module output signal from a selected output port of the signal module based on an input control signal received from the antenna, the module output signal operating an associated second relay to provide a motor input signal to a selected input port of a motor of the motorized furniture item.

[0013] The first control device may be configured to generate an output signal from a selected output port of the first control device based on an input control signal, the output signal operating an associated first relay to provide a module input signal to a selected input port of the signal module, and the signal module may be configured to generate a module output signal from a selected output port of the signal module based on the module input signal, the module output signal operating an associated second relay to provide a motor input signal to a selected input port of a motor of the motorized furniture article.

[0014] The signal module and each of the first relays may be connected to a first voltage source having a first voltage, the first control device, motor and each of the second relays may be connected to a second voltage source having a second voltage, and the second voltage may be different from the first voltage.

[0015] The control system may further comprise a second control device configured to provide a wireless input control signal to the antenna.

[0016] The second control device may comprise a mobile device, and the mobile device may be configured to communicate with the antenna over at least one network.

[0017] The second control device may comprise a wireless remote controller.

[0018] Another aspect of the present disclosure provides a method for controlling a motor, comprising:

providing a module input signal from either an antenna or a first control device to a signal module;

generating a module output signal from a selected output port of the signal module based on the received module input signal; and

operating a relay associated with the selected output port of the signal module using the module output signal to provide a motor input signal to a selected input port of the motor.

[0019] Providing the module input signal may comprise connecting the antenna to the signal module and providing an input control signal directly to the antenna.

[0020] Providing the module input signal may comprise:

generating an output signal from a selected output port of the first control device based on an input control signal; and

operating a relay associated with the selected output port of the first control device using the output signal to provide the module input signal to a selected input port of the signal module.

[0021] Providing the input control signal directly to the antenna may comprise operating a second control device to provide a wireless input control signal to the antenna.

[0022] The second control device may comprise a mobile device, the mobile device communicating with the antenna over at least one network.

[0023] The second control device may comprise a wireless remote controller.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] Embodiments of the invention are provided by way of example only, and will be better understood and readily apparent to one of ordinary skills in the art from the following written description and the drawings, in which:

[0025] Fig. 1 shows a schematic circuit diagram of a conventional motorized furniture.

[0026] Fig. 2 shows a connector used in the conventional motorized furniture of Fig. 1.

[0027] Fig. 3 shows a schematic circuit diagram incorporating an adaptor according to an example embodiment.

[0028] Fig. 4 shows a detailed circuit diagram of an implementation of the adaptor of Fig. 3.

[0029] Fig. 5 shows an example user interface of a mobile application used to transmit a signal to control the motorized furniture.

[0030] Fig. 6 shows an example remote controller used to transmit a signal to control the motorized furniture.

DETAILED DESCRIPTION

[0031] The present disclosure provides a smart device conversion adaptor for converting conventional motorized furniture, e.g. electrical recliner sofas, electrical tables with adjustable height, coffee tables with adjustable height, etc., into smart devices that enable the remote controlling of the motorized furniture e.g. using mobile devices. This has the effect of achieving integration for different pieces of motorized furniture originally manufactured with incompatible smart home solutions. Additionally, the adaptor enables the motorized furniture to integrate into smart device hubs such as Google Home, Amazon Alexa, etc. which can provide the controlling of the motorized furniture using voice commands.

[0032] Fig. 1 shows a schematic circuit diagram of a conventional motorized furniture. Typically, a household power supply 102, for example, one with a rating of 90 to 250 VAC, is stepped down by an AC/DC adapter 104 to a lower voltage to power side control buttons 106 on the furniture as well as a motor 108 that moves the designated part of the furniture. In such a setup, only the side control buttons 106 (e.g. OPEN & CLOSE) can be used to move the motor 108 in either direction.

[0033] In practice, the portion depicted in broken line between the side control buttons 106 and the motor 108 in Fig. 1 is implemented as a connector, such as a 5-pin DIN connector 200 shown in Fig. 2.

[0034] In example embodiments, an adaptor can be incorporated into the circuit to realise remote control of the motorized furniture. Fig. 3 shows a schematic circuit diagram incorporating an adaptor 310 in place of the 5-pin DIN connector 200 of Fig. 2 according to an example embodiment. Here, the power supply 302 (e.g. an external AC power source), AC/DC adapter 304 (e.g. a step-down adapter), side control buttons 306

and motor 308 (e.g. a DC motor) generally correspond to equivalent circuit elements of Fig. 1 and function in a similar manner. The adaptor 310 is powered by the power supply 302 and sends signals to the motor 308 to move it in the intended direction.

[0035] The adaptor 310 is connected to the side control buttons 306 to receive an input control signal from the side control buttons 306. In addition, the adaptor 310 includes an antenna 312 for receiving a wireless input control signal. Examples of the wireless signal include, but are not limited to, a Wi-Fi signal, a Bluetooth signal, a radio-frequency (RF) signal, an infrared signal, a 3G/4G/5G mobile telephone signal. In use, the input control signal provided to the adaptor 310 can come from the side control buttons 306 or from the antenna 312, for example, in the form of a 2.4 GHz Wi-Fi signal or a 433 MHz RF signal.

[0036] Fig. 4 shows a detailed circuit diagram of an implementation of the adaptor 310 of Fig. 3. In this embodiment, the adaptor 310 includes a signal module 400 which is powered by the power supply 302, the antenna 312 communicatively connected to the signal module 400, and a plurality of relay modules in the form of relay S1, relay S2, relay M1 and relay M2 each communicatively connected to the signal module 400. While four relay modules are used in this embodiment, it will be appreciated that the number of relay modules may vary in alternate embodiments.

[0037] While the motorized furniture is usually powered by a lower power voltage, the signal module 400 draws its power directly from the common power supply 302 of 90 to 250 VAC. Due to the mismatch in power supply requirements between the signal module 400 and the motorized furniture, in example embodiments, four or more relay switches are used as buffers in between.

[0038] As shown in Fig. 4, a connection 402 is formed between the power supply 302 and the signal module 400, a connection 404 is formed between the power supply 302 and the relay S1, and a connection 406 is formed between the power supply 302 and the relay S2. In other words, the signal module 400 and relays S1 and S2 are directly connected to the power supply 302. Typically, the relay S1 and S2 comprise normally-open (NO) switches.

[0039] A connection 408 is formed between the AC/DC adaptor 304 and the relay M1 and a connection 410 is formed between the AC/DC adapter 304 and the relay M2. In addition, a connection 412 is formed between the AC/DC adapter 304 and the side control buttons 306 and a connection 414 is formed between the AC/DC adapter 304

and the motor 308. In other words, the relays M1 and M2, side control buttons 306 and motor 308 are connected to the stepped down voltage. Typically, the relay M1 and M2 comprise normally-open (NO) switches.

[0040] With reference to Fig. 4, the relay modules are connected so that the right signals are sent to the motor 308 when input control signal from the side control buttons 306, or a mobile device or a remote controller is provided. For example, a connection 416 is formed between the relay S1 and a first output port SOUT1 of the side control buttons 306 and a connection 418 is formed between the relay S2 and a second output port SOUT2 of the side control buttons 306. In addition, a connection 420 is formed between a first output port MOUT1 of the signal module 400 and the relay M1, while a connection 422 is formed between a second output port MOUT2 of the signal module and the relay M2.

[0041] In use, when a button (e.g. CLOSE) on the mobile device (not shown) is triggered and the input control signal is received by the antenna 312, the first output port MOUT1 of the signal module 400 can transmit a high voltage signal to energize the relay M1, causing the first input port MIN1 of the motor 308 to receive a low voltage signal and the second input port MIN2 of the motor 308 to receive a high voltage signal. Accordingly, the motor 308 will move upon receiving the corresponding signals from input ports MIN1 and MIN2.

[0042] On the other hand, an input control signal from the side control buttons 306 can cause the relays S1 and S2 to send the appropriate voltage signal to input ports SIN1 and SIN2 of the signal module 400, respectively. Output ports MOUT1 and MOUT2 of the signal module 400 can then toggle the input ports MIN1 and MIN2 of the motor 308 to move according to the corresponding signal received. For example, a high voltage signal from the first output port SOUT1 of the side control buttons 306 can energise the relay S1, causing the first input port SIN1 of the signal module 400 to receive a high voltage signal via connection 404 and causing the second input port SIN2 of the signal module 400 to receive a low input signal. The first output port MOUT1 of the signal module 400 can then transmit a high voltage signal to energise the relay M1 and provide corresponding signals to input ports MIN1 and MIN2 of the motor 308 in the same manner as described above.

[0043] As mentioned above, the signal module 400 can receive a wireless input signal via the antenna 312 (e.g. a 2.4 GHz Wi-Fi signal) to enable the controlling of the motorized furniture using a mobile device. An example of the user interface of the

mobile application is shown in Fig. 5. The mobile device allows the motorized furniture to be connected mainstream smart device hubs like Google Home, Amazon Alexa etc., thereby realising remote/smart control of the furniture, e.g. over the Internet. For example, a caretaker of an elderly person can remotely adjust the inclination of the motorised bed or armchair that the elderly person is in by using a mobile application. In another example, the height of a motorized desk can be automatically adjusted based on the profile of the user using the desk, or based on a voice command.

[0044] In another embodiment, the antenna 312 of the signal module 400 can receive a 433 RF MHz signal to enable the controlling of the motorized furniture using a remote controller. An example of the remote controller is illustrated in Fig. 6.

[0045] By incorporating the adaptor according example embodiments, most conventional furniture can be converted to a smart device that can be controlled via a mobile application. The manufacturing of the furniture therefore does not need to be changed, while the cost of producing and fitting the adaptor to the manufactured furniture articles can be kept low so that the retailer remains competitive in terms of costs as well as design variety.

[0046] The adaptor according to example embodiments can be used on a variety of motorized furniture normally found in the home or office, including but not limited to, electrical recliner sofas, electrical comfort sofas with neck and lumbar support, electrical tables with adjustable height, storage bed frames that can be opened with motors, coffee tables with adjustable height, dining tables with extendable width and adjustable height, etc. Non-limiting examples of movements performed by the motor 108 include closing/opening, raising/lowering, tilting, bending, etc.

[0047] In alternate embodiments, for motorized furniture with more than 1 mechanical movement (e.g. 1 motor for opening and closing of leg support, 1 motor for neck support, 1 motor for lumbar support), the signal module may be modified accordingly to accommodate multiple input signals from the side control buttons or mobile device as well as sending multiple output signals to the various motors. The mobile application interface may be modified to accommodate more control buttons as well.

[0048] Further, instead of just an open (100%) and close (0%) mechanical movement, the signal module may register a semi-open state that is in between (e.g. 50% open). In other words, control of movement may be effected in discrete steps or a continuous manner. In such embodiments, extra calibration may be performed to make sure the

signal module registers the full length of the mechanical movement in the motorized furniture. The motorized furniture can be set to action in a large variation of mechanical movement settings.

[0049] It will be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

CLAIMS

1. An apparatus comprising:

a signal module comprising a plurality of input ports and a plurality of output ports; and

an antenna connected to the signal module,

wherein the signal module is operable based on an input control signal from either the antenna or a control device to control operation of a motor.

2. The apparatus as claimed in claim 1, further comprising:

a plurality of first relays, wherein each first relay is operable by a signal from an associated output port of the control device,

a plurality of second relays, wherein each second relay is operable by a signal from an associated output port of the signal module.

3. The apparatus as claimed in claim 2, wherein the signal module is configured to generate a module output signal from a selected output port of the signal module based on the input control signal received from the antenna, the module output signal operating an associated second relay to provide a motor input signal to a selected input port of the motor.

4. The apparatus as claimed in claim 2, wherein the control device is configured to generate an output signal from a selected output port of the control device based on the input control signal, the output signal operating an associated first relay to provide a module input signal to a selected input port of the signal module; and

wherein the signal module is configured to generate a module output signal from a selected output port of the signal module based on the module input signal, the module output signal operating an associated second relay to provide a motor input signal to a selected input port of the motor.

5. The apparatus as claimed in claim 2, wherein the first relays comprise normally-open switches, and wherein the second relays comprise normally-open switches.

6. A control system for a motorized furniture article, the control system comprising:

a first control device;

a signal module comprising a plurality of input ports and a plurality of output ports;

an antenna connected to the signal module;

a plurality of first relays, wherein each first relay is operable by a signal from an associated output port of the first control device; and

a plurality of second relays, wherein each second relay is operable by a signal from an associated output port of the signal module.

7. The control system as claimed in claim 6, wherein the signal module is configured to generate a module output signal from a selected output port of the signal module based on an input control signal received from the antenna, the module output signal operating an associated second relay to provide a motor input signal to a selected input port of a motor of the motorized furniture item.

8. The control system as claimed in claim 6, wherein the first control device is configured to generate an output signal from a selected output port of the first control device based on an input control signal, the output signal operating an associated first relay to provide a module input signal to a selected input port of the signal module; and

wherein the signal module is configured to generate a module output signal from a selected output port of the signal module based on the module input signal, the module output signal operating an associated second relay to provide a motor input signal to a selected input port of a motor of the motorized furniture article.

9. The control system as claimed in claim 7 or 8, wherein the signal module and each of the first relays are connected to a first voltage source having a first voltage, wherein the first control device, motor and each of the second relays are connected to a second voltage source having a second voltage, and wherein the second voltage is different from the first voltage.

10. The control system as claimed in claim 7, further comprising a second control device configured to provide a wireless input control signal to the antenna.

11. The control system as claimed in claim 10, wherein the second control device comprises a mobile device, and wherein the mobile device is configured to communicate with the antenna over at least one network.

12. The control system as claimed in claim 10, wherein the second control device comprises a wireless remote controller.

13. A method for controlling a motor, comprising:

providing a module input signal from either an antenna or a first control device to a signal module;

generating a module output signal from a selected output port of the signal module based on the received module input signal; and

operating a relay associated with the selected output port of the signal module using the module output signal to provide a motor input signal to a selected input port of the motor.

14. The method as claimed in claim 13, wherein providing the module input signal comprises connecting the antenna to the signal module and providing an input control signal directly to the antenna.

15. The method as claimed in claim 13, wherein providing the module input signal comprises:

generating an output signal from a selected output port of the first control device based on an input control signal; and

operating a relay associated with the selected output port of the first control device using the output signal to provide the module input signal to a selected input port of the signal module.

16. The method as claimed in claim 14, wherein providing the input control signal directly to the antenna comprises operating a second control device to provide a wireless input control signal to the antenna.

17. The method as claimed in claim 16, wherein the second control device comprises a mobile device, the mobile device communicating with the antenna over at least one network.

18. The method as claimed in claim 16, wherein the second control device comprises a wireless remote controller.