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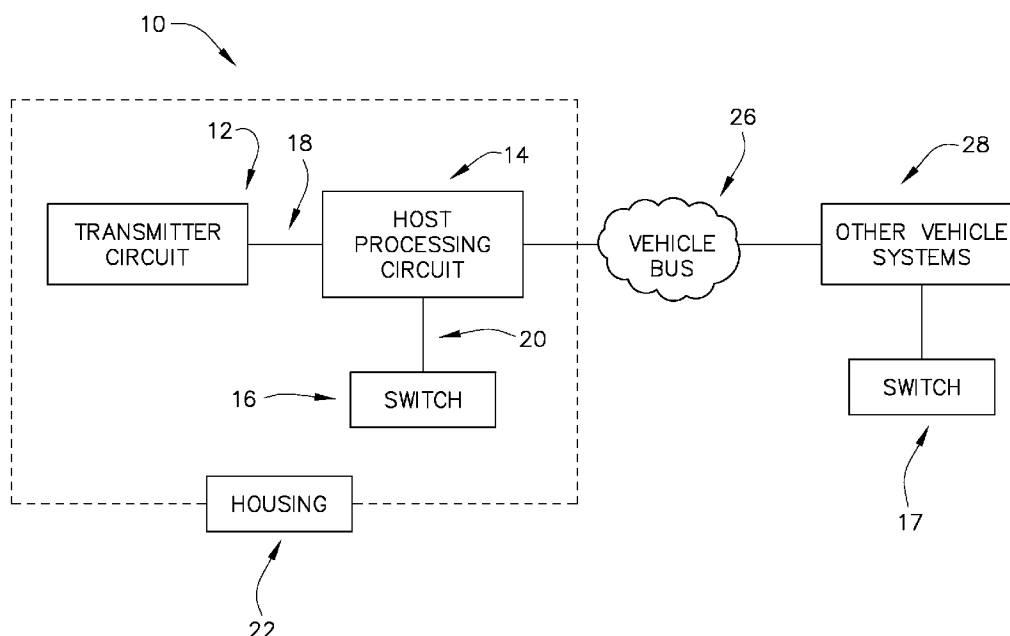
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[Continued on next page]

(54) Title: WIRELESS CONTROL DEVICE WITH EXTENDED TRANSMISSION



(57) Abstract: A wireless control system (e.g. garage door opener) is configured to transmit signals even when a user is not continuing to indicate that a transmission should occur. The wireless control system may include multiple microprocessors, may not start transmission until after a user releases a switch, may treat different controlled devices differently, and/or may receive power based on closure of a switch.

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WIRELESS CONTROL DEVICE WITH EXTENDED TRANSMISSION

RELATED APPLICATIONS

[0001] This application claims priority under the Patent Cooperation Treaty to U.S. Prov. Pat. App. No. 60/849,998, filed October 6, 2006.

BACKGROUND

[0002] A number of transmitters exist for controlling devices using radio frequency signals. Examples of devices that are controlled by such transmitters include garage door opener systems, home appliances such as lights, security systems, automatic gate systems, etc.

[0003] Universal transmitters have been developed to control differing types and/or brands of remotely controlled devices using radio frequencies. These universal transmitters are often designed to be capable of being trained to control the various devices. Examples patents covering such universal transmitters include US Pat. No. 5,442,340; U.S. Pat. No. 5,479,155; and US Pat. Pub. 2005/0024229.

[0004] Since users sometimes initially hit a button to control a system when the transmitter is out of range of the receiver of the controlled system, a user may need to hold down the button of the transmitter until the transmitter is within range if the transmitter stopped transmitting when the button was released. To avoid this inconvenience, some companies have developed transmitters which continue to transmit after a button has been released. The FCC has set a limit on the amount of time that a remote such as a garage door opener may continue to transmit after a button of the transmitter has been released.

SUMMARY

[0005] One embodiment is directed to a trainable wireless control system and/or a universal wireless control system having an extended transmission time.

[0006] Another embodiment is directed to a garage door opener mounted in a vehicle that includes an extended transmission time.

[0007] Another embodiment is directed to a transmitter system that includes a transmitter circuit having a first microprocessor. The first microprocessor is connected to a second microprocessor. The second microprocessor may be configured to control the first

microprocessor. The second microprocessor may be closely connected to a switch that is usable to control the first microprocessor. The first and second microprocessors may be closely connected.

[0008] One embodiment is directed to a wireless control system mounted in a vehicle. The wireless control system includes a transmitter circuit having a first microprocessor configured to control transmission of signals that are configured to control a wirelessly controlled system. The transmitter circuit is configured to transmit signals in response to data representative of a user input. The wireless control system also includes a second microprocessor connected to the first microprocessor. The first and second microprocessors are mounted in the vehicle. The transmitter circuit continues to transmit a signal configured to control a wirelessly controlled system after the user input has finished.

[0009] Another embodiment is directed to a wireless control system mounted in a vehicle. The system includes a housing mounted in the vehicle and a transmitter circuit in the housing. The transmitter circuit includes a first microprocessor configured to control transmission of signals that control a wirelessly controlled system. The transmitter circuit is configured to transmit signals in response to data representative of a user input. The transmitter also includes a second microprocessor located in the vehicle. The second microprocessor is coupled to the first microprocessor. The transmitter circuit continues to transmit a signal configured to control a wirelessly controlled system after the user input has finished.

[0010] Another embodiment is directed to a wireless control system mounted in a vehicle. The system includes a switch and a transmitter circuit configured to transmit signals in response to actuation of the switch. The transmitter circuit is also configured to transmit signals that are configured to control a wirelessly controlled system. The transmitter also includes a power supply circuit configured to provide power from the vehicle to the transmitter circuit. The power supply circuit is configured to provide power to the transmitter circuit when the switch is actuated. The transmitter circuit continues to transmit a signal configured to control a wirelessly controlled system after the switch is released.

[0011] Another embodiment is directed to a wireless control system mounted in a vehicle. The system includes a switch and a transmitter circuit configured to transmit signals in response to actuation of the switch. The signals are configured to control a wirelessly controlled system. The transmitter circuit is configured such that it may start transmitting a

signal configured to control a wirelessly controlled system after the switch has been released.

[0012] Another embodiment is directed to a method of operating a wireless control system mounted in a vehicle. The method includes receiving a user input indicative of a command to operate a transmitter circuit of the vehicle that is configured to transmit signals that are configured to control a wirelessly controlled system. The user input includes actuation of a switch. The method further includes transmitting a signal configured to control a wirelessly controlled system from the transmitter circuit in response to the user input. Transmitting the signal includes starting transmission of the signal at time that is after the switch has been released.

[0013] Another embodiment is directed to a method of operating a wireless control system mounted in a vehicle. The method includes receiving a user input indicative of a command to operate a transmitter circuit of the vehicle. The transmitter circuit is configured to transmit signals that control a wirelessly controlled system. The method further includes transmitting a signal configured to control a wirelessly controlled system from the transmitter circuit in response to the user input. Transmitting the signal includes starting transmission of the signal after the user input has finished.

[0014] Another embodiment is directed to a wireless control system mounted in a vehicle. The system includes a transmitter circuit configured to transmit signals that control a wirelessly controlled system. The transmitter circuit is configured to transmit these signals based on a user input. The transmitter circuit is configurable to control more than one type of wirelessly controlled system. The transmitter circuit continues to transmit a signal that controls a wirelessly controlled system after the user input has finished for at least one wirelessly controlled system it is configurable to control, and does not continue to transmit such a signal for at least one other wirelessly controlled system it is configurable to control.

[0015] Another embodiment is directed to a wireless control system mounted in a vehicle. The system includes a transmitter circuit configured to transmit signals that control a wirelessly controlled system. The transmitter circuit is configured to transmit signals based on a user input, and is configurable to control more than one type of wirelessly controlled system. The transmitter circuit is configured to continue to transmit a signal for controlling a first type of wirelessly controlled system for a different amount of time than for controlling a second type of wirelessly controlled system.

[0016] Other embodiments are directed to combinations of the above discussed embodiments with each other and with other various features described below.

[0017] Other embodiments are directed to combinations of the other various features described below which are not described above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Fig. 1 is a diagram of a control system that includes a universal wireless control system according to one embodiment.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0019] Referring to Fig. 1, a transmitter system 10 includes a transmitter circuit 12. Transmitter circuit 12 may be configured to receive a user input (e.g. from a switch 16,17) and transmit signals in response to that input.

[0020] Transmitter circuit 12 may be configured to continue to transmit signals (e.g. control signals capable of controlling a remotely controlled device) even though a user is no longer issuing a command to transmit a signal. As one example, a host processing circuit 14 may receive a signal from a switch 16 and, in response, send data to transmitter circuit 12 to indicate that switch 16 is pressed. Host processing circuit 14 may continue to transmit data to transmitter circuit 12 indicating that switch 16 is pressed even after switch 16 has been released by a user.

[0021] In addition to receiving a signal from switch 16, host processing circuit 14 may receive data from other vehicle systems 28. Host processing circuit 14 may be configured to send data to transmitter circuit 12 based on the data received from the other vehicle system 28. For example, host processing circuit 14 may be configured to send data to transmitter circuit 12 that causes transmitter circuit 12 to initiate transmission of a signal. As in the example of a directly connected switch 16, host processing circuit 14 may be configured to continue to transmit data to transmitter circuit 12 that causes transmitter circuit 12 to initiate transmission of a signal even though a user is no longer issuing a command (e.g. using switch 17) to transmit a signal.

[0022] The commands received may include commands issued by a user through a switch (e.g. button, touch screen “switch,” etc.), may be commands issued by a user using voice commands received by a voice command circuit (e.g. a voice command circuit of a hands-

free phone system), may be location based commands from a GPS system, or may be received through other means.

[0023] In any of these embodiments, transmitter system 10 may be configured to continue to transmit signals even though a user is no longer issuing commands to transmit signals. In any of these embodiments, transmitter system 10 may also (or alternatively) be configured such that, at least some of the time, transmitter circuit 12 does not transmit signals until after a user is done issuing the command. For example, transmitter system 10 may be configured such that a user may tap switch 16, 17 to initiate sending of signals by transmitter circuit 12, but where transmitter circuit 12 does not initiate transmission until a time that occurs after switch 16 has been released. In some embodiments, system 10 may be configured to only send signals from transmitter circuit 12 after a switch has been pressed for at least a predetermined amount of time. The predetermined amount of time may be more than about one or more of 0.1 seconds, 0.2 seconds, 0.3 seconds, 0.4 seconds, 0.5 seconds, 0.7 seconds, and/or 1 second.

[0024] Many remotely controlled devices are controlled by a signal of a given length (in time, of data, etc.). System 10 may be configured to transmit that signal a number of times after a switch has been released. In some embodiments, system 10 is configured to send the full signal (message) at least two or three times after a switch has been released. In some of these embodiments, system 10 is configured to send the full message four or more times after a switch has been released.

[0025] In some embodiments, system 10 is configured to send a message for up to about five seconds after a switch has been released. In some of these embodiments, system 10 may be configured to send a message for no more than about 4 seconds or no more than about 3 seconds after a switch has been released.

[0026] System 10 may continue to transmit signals for different lengths of time for different types of remotely controlled devices which it controls. For example, system 10 may transmit longer for remotely controlled systems of different manufacturers, for devices having different functions (e.g. garage door openers, lighting modules, security systems, etc.), for systems using different coding schemes (e.g. fixed code, rolling code, ternary code, etc.), and/or other types of differences.

[0027] In some embodiments, host processing circuit 14 and transmitter circuit 12 may include separate, distinct processing circuits such as separate microprocessors. The microprocessor of host processing circuit 14 may send data to the microprocessor of

transmitter circuit 12 over a data line 18 connecting the two circuits 12,14. Data line 18 can be a serial bus. In other embodiments, host processing circuit 14 and transmitter circuit 12 may be part of a common circuit, and may include a single microprocessor.

[0028] Transmitter circuit 12 may be a trainable transmitter circuit that can be trained to operate various devices. Training may involve learning a frequency and/or code by analyzing a signal generated by a user's original hand-held transmitter. Training may involve learning a frequency and code generated by a user's original hand-held transmitter by means other than directly analyzing a signal generated by a user's original hand-held transmitter. Training may involve selection from menus. The menus could list various parameters such as controllable device types, manufacturers, brands, models, etc. Training could involve any number of other techniques, or combination of techniques.

[0029] Transmitter circuit 12 may be a universal transmitter capable of being trained to any number of different types of devices, brands of devices, etc. Transmitter circuit 12 may be a universal garage door opener (UGDO) configured to be capable of controlling various different types of garage door openers. The types of garage door openers controllable by transmitter circuit 12 may be pre-programmed in transmitter circuit 12 or may be added as needed. Transmitter circuit 12 may be pre-programmed to control various brands of garage door openers, or may be trainable as discussed previously. If transmitter circuit 12 is configured as a UGDO, transmitter circuit 12 may also be configured to control other types of devices such as security gates, home lighting and other home appliance systems, security systems, etc.

[0030] Transmitter circuit 12 may include a transmitter (e.g. a transceiver), a receiver, an antenna, a processing circuit (which may include a microprocessor), a memory configured to store data (including data that is used to determine a configuration of a signal transmitted by transmitter circuit 12), a circuit configured to analyze a signal transmitted by another transmitter, a circuit configured to vary a frequency transmitted by transmitter circuit 12, a circuit configured to modulate a code on a signal transmitted by transmitter circuit 12, and/or other circuitry.

[0031] Transmitter circuit 12 may be configured to power down when a switch 16 is not pressed. In this embodiment, host processing circuit 14 may continue to transmit data to transmitter circuit 12 that is indicative of a switch being pressed even though no switch is being pressed.

[0032] Transmitting circuit 12 may be configured to transmit a radio frequency signal. In embodiments where transmitting circuit 12 is configured to control a garage door opener, transmitting circuit 12 may be configured to be capable of transmitting at least one frequency in the ultra-high frequency (UHF) range. In embodiments where transmitting circuit 12 is configured to control a garage door opener, transmitting circuit 12 may be configured to be capable of transmitting at least one frequency in the range of 280 MHz to 440 MHz. In many of these embodiments, transmitting circuit 12 would be configured to transmit multiple distinct frequencies in this range. In some of these embodiments, transmitting circuit 12 may be configured to only transmit signals with frequencies in the UHF range. Transmitting circuit 12 may be configured to transmit at least one frequency in the range of 280 MHz to about 310 MHz, at least one frequency in the range of about 300 MHz to about 320 MHz, at least one frequency in the range of about 360 MHz to about 400 MHz, and/or at least one frequency in the range of about 380 MHz to 440 MHz. Transmitting circuit 12 may be configured to transmit at least one frequency in the range of 280 MHz to about 290 MHz, at least one frequency in the range of about 300 MHz to about 310 MHz, at least one frequency in the range of about 300 MHz to about 310 MHz, at least one frequency in the range of about 370 MHz to about 380 MHz, and/or at least one frequency in the range of about 380 MHz to 400 MHz.

[0033] Transmitter circuit 12 may have any number of structures such as those disclosed in one or more of U.S. Pat. Nos. 5,442,340; 5,479,155; 5,583,485; 5,614,885; 5,614,885; 5,614,891; 5,646,701; 5,661,804; 5,699,054; 5,708,415; 5,854,593; 5,903,226; 6,137,421; 6,703,941; and/or 7,057,494. The disclosures of these U.S. patents is hereby incorporated by reference to the extent they are consistent with the reminder of the disclosure of this application. In addition to (or as an alternative to) the structures of the above listed patents, transmitter circuit may have a structure such as that disclosed in one or more of U.S. Pat. Pub. Nos. 2006/0217850; 2006/0214813; 2006/0198523; 2006/0181428; 2006/0158344; 2005/0024229; 2004/0110472; 2003/0216139; and/or 2003/0197594. The disclosures of these U.S. patent publications is hereby incorporated by reference to the extent they are consistent with the reminder of the disclosure of this application.

[0034] Host processing circuit 14 may be directly connected to switch 16, or may contain intermediate circuitry such as a switch interface circuit. Switch 16 may include a mechanical switch and a transistor in some embodiments.

[0035] Processing circuit 14 can include various types of processing circuitry, digital and/or analog, and may include a microprocessor, microcontroller, application-specific integrated circuit (ASIC), field programmable gate array (FPGA), or other circuitry configured to perform various input/output, control, analysis, and other functions to be described herein. Processing circuit 14 may be configured to digitize data, to filter data, to analyze data, to combine data, to output command signals, and/or to process data in some other manner. Processing circuit 14 may also include a memory that stores data.

Processing circuit 14 could be composed of a plurality of separate circuits and discrete circuit elements. In some embodiments, processing circuit 14 will essentially comprise solid state electronic components such as a microprocessor (e.g. microcontroller).

Processing circuit 14 may be mounted on a single board in a single location or may be spread throughout multiple locations which cooperate to act as processing circuit 14, including components connected across a vehicle bus 26. In some embodiments, processing circuit 14 may be located in a single location and/or all the components of processing circuit 14 will be closely connected.

[0036] Host processing circuit 14 may be part of a compass circuit, a trip computer circuit, a rearview mirror circuit (e.g. an electrochromic mirror circuit), a vehicle communication circuit, a hands-free phone circuit, and/or some other circuit.

[0037] Transmitter circuit 12, host processing circuit 14, and/or switch 16 may be contained in a common housing 22. Housing 22 may be mounted to a vehicle interior such as in a headliner module, a rearview mirror assembly, an instrument cluster system, a lighting system such as an LED (or other solid state) lighting system, or some other vehicle interior system. Housing 22 could also be mounted to a vehicle exterior in some embodiments.

[0038] The other vehicle system 28 may include a GPS system, an HVAC system, an entertainment system, a trip computer, a display input system, an audio system, a camera system, a phone system, a wireless system such as a Bluetooth-based system, a sunroof system, a variable mirror dimming system, a compass system, an e-mail system, a vehicle lighting system, and/or some other vehicle system.

[0039] Other vehicle system 28 may be a display input system that displays commands to a user on a screen and inputs a user selection of a command that is displayed. Display input system 28 may include a rear-projection system that projects information onto a screen from

behind the screen. The command selected by a user may be used to initiate sending of a signal by transmitter circuit 12.

[0040] Other vehicle system 28 may include a voice command system that receives voice data from a user and determines a command from a user. Voice command system 28 may require a user to actuate a switch to let voice command system 28 know that a command is being issued. This may help voice command system 28 sort between regular conversation of a user and commands issued by a user. The commands identified by voice command circuit 28 may be used to initiate sending of a signal by transmitter circuit 12.

[0041] Reference to a “universal transmitter” is not meant to imply that the transmitter can control every conceivable type of device. A “universal transmitter” may be able to control a number of different types of devices, but not be able to control every type of device. A “universal garage door opener” would be configured such that it can control a number of different types of garage door opening systems. A “universal garage door opener” may also be capable of controlling non-garage door opening systems as well (such as gates, security systems, home appliances, etc.).

WHAT IS CLAIMED IS:

- 1 1. A wireless control system mounted in a vehicle that is configured to
2 wirelessly control a wirelessly controlled device external to the vehicle, comprising:
3 a transmitter circuit comprising a first microprocessor configured to control
4 transmission of signals that are configured to control a garage door opener, the
5 transmitter circuit configured to transmit signals in response to data representative of
6 a user input;
7 a second microprocessor connected to the first microprocessor;
8 wherein the first and second microprocessors are mounted in the vehicle; and
9 wherein the transmitter circuit continues to transmit a signal configured to
10 control a wirelessly controlled device after the user input has finished.
- 11 2. A wireless control system mounted in a vehicle that is configured to
12 wirelessly control a wirelessly controlled device external to the vehicle, comprising:
13 a housing mounted in the vehicle;
14 a transmitter circuit in the housing, the transmitter circuit comprising a first
15 microprocessor configured to control transmission of signals that are configured to
16 control a wirelessly controlled device, the transmitter circuit configured to transmit
17 signals in response to data representative of a user input;;
18 a second microprocessor located in the vehicle, the second microprocessor
19 coupled to the first microprocessor;
20 wherein the transmitter circuit continues to transmit a signal configured to
21 control a wirelessly controlled device after the user input has finished.
- 22 3. The wireless control system of any of the preceding claims, wherein
23 the second microprocessor receives data representative of the user input, and
24 provides data representative of the user input to the first microprocessor; and
25 the second microprocessor is configured to continue to provide data
26 representative of the user input after the user input has finished.
- 27 4. The wireless control system of any of the preceding claims, wherein the user
28 input is actuation of a switch.

29 5. The wireless control system of any of the preceding claims, wherein the first
30 microprocessor is configured to power down when it is not receiving data representative of
31 a user input.

32 6. The wireless control system of any of the preceding claims, wherein the user
33 input is a voice command.

34 7. The wireless control system of any of the preceding claims, wherein the first
35 microprocessor is connected to the second microprocessor by a serial bus.

36 8. A wireless control system mounted in a vehicle that is configured to
37 wirelessly control a wirelessly controlled device external to the vehicle, comprising:
38 a switch;
39 a transmitter circuit mounted in the vehicle, the transmitter circuit configured
40 to transmit signals that are configured to control a wirelessly controlled device, the
41 transmitter circuit configured to transmit signals in response to actuation of the
42 switch;
43 a power supply circuit configured to provide power from the vehicle to the
44 transmitter circuit, the power supply circuit providing power to the transmitter
45 circuit when the switch is actuated;
46 wherein the transmitter circuit continues to transmit a signal configured to
47 control a wirelessly controlled device after the switch is released.

48 9. A wireless control system mounted in a vehicle that is configured to
49 wirelessly control a wirelessly controlled device external to the vehicle, comprising:
50 a switch;
51 a transmitter circuit mounted in the vehicle, the transmitter circuit configured
52 to transmit signals that are configured to control a wirelessly controlled device, the
53 transmitter circuit configured to transmit signals in response to actuation of the
54 switch;
55 wherein the transmitter circuit is configured such that it may start
56 transmitting a signal configured to control a wirelessly controlled device after the
57 switch has been released.

- 58 10. A method of operating a wireless control system mounted in a vehicle,
59 comprising:
60 receiving a user input indicative of a command to operate a transmitter
61 circuit of the vehicle that is configured to transmit signals that are configured to
62 control a wirelessly controlled device, the user input including actuation of a switch;
63 transmitting a signal configured to control a wirelessly controlled device
64 from the transmitter circuit in response to the user input,
65 wherein transmitting the signal comprises starting transmission of the signal
66 after the switch has been released.
- 67 11. The method of claim 9, wherein the user input further includes a voice
68 command.
- 69 12. A method of operating a wireless control system mounted in a vehicle,
70 comprising:
71 receiving a user input indicative of a command to operate a transmitter
72 circuit of the vehicle that is configured to transmit signals that are configured to
73 control a wirelessly controlled device;
74 transmitting a signal configured to control a wirelessly controlled device
75 from the transmitter circuit in response to the user input,
76 wherein transmitting the signal comprises starting transmission of the signal
77 after the user input has finished.
- 78 13. A wireless control system mounted in a vehicle that is configured to
79 wirelessly control a wirelessly controlled device external to the vehicle, comprising:
80 a transmitter circuit mounted in the vehicle, the transmitter circuit configured
81 to transmit signals that are configured to control a wirelessly controlled device, the
82 transmitter circuit configured to transmit signals based on a user input, the
83 transmitter circuit configurable to control more than one type of wirelessly
84 controlled device;
85 wherein the transmitter circuit continues to transmit a signal configured to
86 control a wirelessly controlled device after the user input has finished for at least one
87 wirelessly controlled device it is configurable to control; and

88 wherein the transmitter circuit does not continue to transmit a signal
89 configured to control a wirelessly controlled device after the user input has finished
90 for at least one wirelessly controlled device it is configurable to control.

91 14. A wireless control system mounted in a vehicle that is configured to
92 wirelessly control a wirelessly controlled device external to the vehicle, comprising:
93 a transmitter circuit mounted in the vehicle, the transmitter circuit configured
94 to transmit signals that are configured to control a garage door opener, the
95 transmitter circuit configured to transmit signals based on a user input, the
96 transmitter circuit configurable to control more than one type of wirelessly
97 controlled device;

98 wherein the transmitter circuit is configured to continue to transmit a signal
99 configured to control a first wirelessly controlled device for a first duration after the
100 user input has finished;

101 wherein the transmitter circuit is configured to continue to transmit a signal
102 configured to control a second wirelessly controlled device for a second duration
103 after the user input has finished; and

104 wherein the second duration is different than the first duration.

105 15. Any of claims 12-14, wherein the user input is finished when the user
106 releases a switch.

107 16. The wireless control system of any preceding claim, further comprising a
108 housing configured to contain at least a portion of the transmitter circuit, the housing
109 mounted in the interior of the vehicle.

110 17. The wireless control system of any preceding claim, wherein the wireless
111 control system is configured to continue to transmit a signal an amount of time that is not
112 greater than about 4 seconds after a user input has finished for at least one wirelessly
113 controlled device which it is configured to control.

114 18. The wireless control system of any preceding claim wherein the user input is
115 received on a user input device mounted in the vehicle.

116 19. The wireless control system of any preceding claim wherein the transmitting
117 circuit is configured to re-transmit a same message during a time period when it continues
118 to transmit a signal.

119 20. The wireless control system of any preceding claim wherein the transmitting
120 circuit is configured to transmit at least one radio frequency in the range of 280 MHz to 440
121 MHz.

122 21. The wireless control system of any preceding claim wherein the transmitting
123 circuit is configured to only transmit signals having an ultra high frequency (UHF).

124 22. The wireless control system of any preceding claim wherein the transmitting
125 circuit is configured to transmit multiple distinct radio frequencies in the range of 280 MHz
126 to 440 MHz.

127 23. The wireless control system of any preceding claim, wherein the transmitter
128 circuit is a trainable transmitter.

129 24. The wireless control system of any preceding claim, wherein the transmitter
130 circuit comprises a garage door opener.

131 25. The wireless control system of any preceding claim, wherein the transmitter
132 circuit comprises a universal garage door opener.

FIG. 1

