Abstract:


(54) Title: USING HDMI-CEC TO IDENTIFY A CODESET

(57) Abstract: A system for control of electronic consumer device (ECD) functions includes a device having a signal output adapted to communicate with an ECD function information database to obtain function information for the ECD and to create a signal, transmittable via the signal output, using the function information for the ECD obtained from the function information database and a High-Definition Multimedia Interface (HDMI) cable that communicates the signal transmitted via the signal output to the ECD.


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USING HDMI-CEC TO IDENTIFY A CODESET

RELATED APPLICATION

[0001] This application claims the benefit of and is a divisional of US Application No. 12/148,444, filed on April 18, 2008, the disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] This application relates to systems including control devices for performing methods for control of electronic consumer devices.

BACKGROUND INFORMATION

[0003] Consumers purchase many electronic devices for their homes. One device might be a television. The television comes with a remote control, which has various functions, such as on off; channel up and down; volume up and down; and so on. The remote control communicates with the television via an infrared signal. Another electronic consumer device is a DVD player. The DVD player likewise comes with its own remote control with its own shape, button layout, button functions, and text and other characters on the remote. The same can be said for an audiovisual receiver, a cable box, and a game console. Some of these devices may be connected together. For example, the game console can output a video signal that is connected to the audiovisual receiver via S-video. The same can be said for the DVD player. Other methods of same can be said for the DVD player. Other methods of connecting devices can also be used. For example, a cable box may be connected to the audiovisual receiver using a High Definition Multimedia Interface (HDMI) cable. The net result of all of this is that the consumer must have anywhere from two to five or more remote controls, each one being needed to control its respective associated electronic consumer device (ECD). Not only does this make for a lot of clutter in the consumer’s home, but it also is confusing to remember which remote goes with which device, and which of the many multitudes of possible choices on each remote the consumer is most interested in.

[0004] A more detailed example 20 is shown in Figure 1. One remote 31, with its own unique button layout, is used to control a television 21. Another remote 32 is used to control an audiovisual receiver 22. Another remote 34 is used to control a game console 24, and another remote 36 is used to control a cable box 26. Lastly, another remote 38 is used to
control a DVD player 28. Each remote has its own unique button layout, as illustrated schematically in Figure 1.

**SUMMARY**

[0005] The system of the preferred embodiment eliminates the need to use multiple remote control devices on a regular basis. Instead of needing a multitude of different remote controls, a single browser device (for example, a cellular telephone having a display) can be used. The browser device can illustrate all of the various remotes currently used by the consumer, only one at a time. The illustrated remotes each function in the same manner as the original remotes. By using the browser device, the clutter and the need to keep and locate a number of different remotes is eliminated.

[0006] In one embodiment, the browser device communicates via Wi-Fi with a central function device. The function device has information regarding all the various remote controls needed by the consumer. The function device communicates wirelessly with the browser device and in turn then operates all of the consumer’s electronic devices.

[0007] In a first novel aspect, the single-line HDMI-CEC (High Definition Multimedia Interface-Consumer Electronic Control) bus or protocol is used to identify an IR codeset for an electronic consumer device (ECD) from a database of IR codesets. When the ECD is coupled to an AV system via an HDMI cable, the system automatically queries the new ECD using the single-wire HDMI-CEC bus to identify itself. The ECD automatically responds by sending back information across the HDMI-CEC bus. This information is usable to identify the ECD. In one example, the returned information includes a brand name in ASCII format of the ECD, a device type in ASCII format of the ECD, and a model number in ASCII format of the ECD. The system uses the returned information to identify particular IR codeset in the database that is usable to control the ECD. The system then enables an IR remote control device to use the identified codeset to send IR remote control operational signals to the ECD device so that the IR remote control device can control the ECD. The use of HDMI-CEC to identify a codeset is not, however, limited to IR applications but rather also applies to codesets used to generate and detect other wireless remote control operational signals such as, for example, RR remote control operational signals for remote control devices that transmit RF signals.

[0008] In a second novel aspect, illustrations (for example, digital pictures) of a plurality of remote control devices are displayed to a user on a portable display device. The user then uses the portable display device to select one of the illustrations that looks like a remote
control device that the user is trying to imitate. When the user selects the illustration, the
system uses the user selection to identify an IR codeset for the associated ECD from many IR
codesets in a database of IR codesets. In one example, a portable display device such as a
PDA, or cellular telephone, or Apple iPhone having a browser communicates with an AV
system. The AV system serves the illustrations of the remote control devices, and the portable
display device and associated browser displays the illustrations to the user. The user, then
uses the portable display device and browser to select the illustration of the remote control
device that the user wishes to emulate. Alternatively, the portable display device displays
illustrations or pictures of ECDs and the user might want to control. The user uses the
portable display device to select the picture of the ECD that the user wishes to control. In
either case, the portable display device communicates the user selection information back to
the system. The system uses the information to identify the IR codeset in the database that
controls the ECD (the ECD controlled by the remote control device). In one example, the
system then enables the portable display device to use the identified codeset to send IR
remote control operational signals to the ECD device so that the portable display device can
operate as (imitate) the original remote control device picture selected by the user. By
showing the user pictures of ECDs that the user might want to control, the system is usable to
emulate a remote control device that the user has lost.

[0009] In a third novel aspect, pictures of a plurality of remote control devices are
displayed to a user on a portable display device. The user can use the portable display device
to select icons or buttons on the pictures, and to cause functionality of the selected icons or
buttons to be associated with another rendering of a remote control device. For example, the
user can copy (for example, by "dragging, and dropping") a selected icon or key or button
from the pictured remote control device to a template of a remote control device illustrated
elsewhere on the portable display device. Both the pictured remote control device and the
template remote control device are displayed on the portable display device. As the user
"drags and drops" icons or keys or buttons, the icons or keys or buttons are added to and
appear on the template. In this way, icons or keys or buttons from multiple different pictured
remote control devices can be dragged and dropped onto the same template, and the
functionalities associated with the original icons, key and buttons in the pictured remote
control devices are automatically assumed by the associated new icons or keys or buttons on
the template. Using this feature, the user builds a new custom hybrid remote control device, a
rendering of which can be displayed on the portable display device. When the user later
selects an icon or key or button on the hybrid remote control device, the portable display
device performs the function that the original pictured remote control device that had the same key would have performed.

[0010] In a fourth novel aspect, the user takes a digital picture of a remote control device to be imitated, and this picture is communicated to a system. The system performs optical recognition on the digital picture. In one example, a user has a portable display device such as a PDA, or cellular telephone, or Apple iPhone that has a camera functionality. The user uses the portable display device to take a digital picture of an IR remote control device. The display device then communicates the digital picture (for example, in the form of a JPEG file) to the system. The system performs optical object recognition on the digital picture and identifies which one of a plurality of codesets in a database of codeset is the codeset for the remote control device in the digital picture. The database may, for example, contain information on what the various remote control device look like so that the optical recognition results will be usable to identify the pictured remote control device. This information may include information on the shape of the contour of the remote control device, the number of keys and placement of keys on the remote control device, and text that is printed on the remote control device. Once the system has identified the codeset associated with the pictured remote control device, the system communicates back to the portable display device such that the portable display device is enabled to use the identified codeset to send IR remote control operational signals in accordance with the codeset. In this Way, a user may use the portable display device to take a picture of a remote control device that operates a particular ECD. The system then responds by enabling the portable display device to emulate the remote control device. A picture or rendering of the emulated remote control device may thereafter be displayed on the portable display device. When || selects an icon or key or button on this picture or rendering, the portable display device performs the same function that the original remote control device would have performed.

[0011] In another example, the internet-accessible computer system receives from a user a digital image of an electrical device via the internet. The electrical device may, for example, be a remote control device or an electronic consumer device (ECD) that is controlled by a remote control device. The internet-accessible computer system then automatically performs optical object recognition on the digital image, and charges the user a fee to return information obtained from the optical recognition. The returned information may, for example, be codeset information.
Further details and embodiments are described in the detailed description below. This summary does not purport to define the invention. The invention is defined by the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, where like numerals indicate like components, illustrate various embodiments.

Figure 1 (Prior Art) is a diagram of a collection of various electronic consumer devices, including various means of communication.

Figure 2 is a schematic illustration of a system for communicating with electronic consumer devices.

Figure 2A is a schematic illustration of a system for communicating with electronic consumer devices, where a device includes among other parts: the functionality of the function device of Figure 2, the records database of Figure 2, a speaker, a display output, and a signal output 125.

Figure 3 is a schematic illustration of a database including a plurality of records regarding various remote controls, including a schematic illustration of some of the detail included in each of the records.

Figure 4 is an illustration of various control devices used for controlling electronic consumer devices.

Figure 5 is an illustration of other control devices for controlling electronic consumer devices including a device for controlling lights that may be turned on or off or dimmed or brightened.

Figure 6 is a schematic illustration of a display device illustrating a picture of a remote control with a user's finger on one of the illustrated buttons.

Figure 7 is an illustration of a display device including buttons that cause a collection of changes in the function of electronic consumer devices, based on the different interests or moods of the user.

Figure 8 is a diagram of a display with an illustration of a possible main menu that permits a user to select various functions.

Figure 9 is an illustration of a method of how a consumer can set up the system to control electronic consumer devices.

Figure 10 is a schematic illustration of how possible choices available to a user can be limited.
Figure 11 is an illustration of a method of using a digital image to narrow down the possible choices of which particular device for consumers interested in.

Figure 12 is a flowchart showing how a consumer can obtain a digital image of a particular device, and then use that image to identify a specific database record referencing that particular control device.

Figure 13 illustrates how a custom device screen can be created.

Figure 14 illustrates a resulting smaller custom device screen.

Figure 15 illustrates a possible device button layout that can be programmed for a particular control device of interest.

Figure 16 an illustration of a template custom control device with existing buttons, where the user then assigns a button function to each of the buttons on the template.

Figure 17 is a schematic illustration of a function device.

Figures 17A through 17M illustrate the details of the components that make up the function device shown in Figure 17.

**DETAILED DESCRIPTION**

The drawings illustrate a system for controlling electronic consumer devices (ECDs). Household ECDs, as used in this description, can be anything that can be controlled by a remote control device or a keypad or some other control device, such as a DVD, a television, an audiovisual receiver, a sprinkler system, a light switch, an alarm panel, a game console, a computer, and so on.

**OVERVIEW**

Figure 2 is one embodiment of a system 100 for controlling electronic consumer devices (ECDs). System 100 includes a function device 101, a display 102, a plurality of ECDs 103-111, a database 112 and a memory 113. Database 112 and memory 113 are accessible via a network connection 131 to a network such as the internet 115. The ECDs 103-111 include, in this example, a light switch 103, a heating ventilation and air conditioning (HVAC) controller 104, sprinkler system controller 105, an alarm system controller 106, a DVD player 107, a set-top box 108, an audio-visual receiver 104 (sometimes also referred to as an "audio-video receiver" or "AV receiver"), a game console 110, and a television 111. In other embodiments, more or fewer ECDs may be present.

Function device 101 communicates with the database 112. In one example, the database 112 is a database of codesets. For details on an example of a codeset and what a
codeset entails and how a codeset is used, see: U.S. Patent No. 7,259,696, the subject matter of which is incorporated herein by reference. Database 112 includes information on the identities of many different types of ECDs, and information on the functions of each ECD. These functions may, for example, be volume up or down, channel up or down, turn on sprinkler, etc., which can be controlled by a remote control device. The ECD manufacturer usually supplies such a remote control device at the time the ECD is originally sold to consumers. How to generate the various signals needed to be received by the ECD in order to make the ECD perform a desired function is set forth in database 112.

[0036] In a further example, database 112 is or includes a pictorial record database of illustrations of remotes or control devices with buttons that are used to control the ECD functions. The term "illustration" as it is used here includes both digital photographs and schematic renderings. The term "control device" as it is used here encompasses, but is not limited to, a remote control device.

[0037] In a further example, in addition to an illustration of the control device, database 112 includes extracted graphical information on each control device. Such extracted graphical information may, for example, include information on the shape of the control device, the buttons (keys) on the control device, the number of buttons and the locations of the buttons, and characters or other printing that appears on the control device. The database also includes the ECD function information (keycodes and other codeset information) associated with each button.

[0038] Central function device 101 communicates with the database 112 to obtain the control device's information, such as the device's shape, devices button labels, button shapes, and the button locations i.e., the button layout. Function device 101 also includes a display output 116 that outputs a signal to a display device 102. Display device 102 displays an input screen that illustrates the control device's information, such as the device's shape, button labels, button shapes and button locations or layout.

[0039] Although function device 101, database 112, memory 113 and display device 102 are illustrated in Figure 2 as separate devices or functionalities, in another embodiment (see Fig. 2A) some or all of these system elements can be combined into a single device. In one example (not shown), the function device 101 is functionality that is physically incorporated (not shown) into one of the ECDs, such as the cable set-top box 108. More particularly, a processor can provide some or all of the function device's functionality. The term "processor" as the term is used herein is a digital processing unit such as a microcontroller or microprocessor, along with its associated functional hardware and software. The term
includes a microprocessor such as is normally found in a personal computer, and its functional software.

[0040] In one example of operation of system 100, a consumer (not shown) purchases a new ECD. The consumer takes the new ECD home, and plugs it into an existing home entertainment/ECD system. For example, if the ECD were a set-top box, such as a cable box, a consumer can connect a cable wire to the box, and then connect the box to an audio-visual system. If the system includes an AV receiver, the consumer might use a high-definition media interface (HDMI) cable to connect the cable box to the AV receiver, as, further explained below. Once connected into system 100, the following would occur. In this example, the cable box includes a novel function device. The function device within the cable box begins to recognize the various ECDs in the consumer's home system. For example, the function device can determine the manufacturer, type, and particular model of the AV receiver using the CEC protocol over the HDMI cable. Once the identity of the AV receiver is determined, the function device then communicates with the database 112 that includes information about the various control devices. By communicating to database 112 the particular identity of the AV receiver, the database can use the identity information to identify information associated with the particular control device normally supplied to the consumer when the AV receiver is sold. Using the ECD identity information, database 112 returns to the function device in the cable box that particular ECD function information. In some embodiments, it also returns an illustration of the control device supplied by the ECD device manufacturer at the time the ECD is sold to consumers.

[0041] Not all ECDs have an ability to communicate via HDMI with the function device. In the case of these other ECDs, the consumer may identify the ECD for the function device. Using a setup procedure, as further explained below, the consumer identifies the other ECDs in the consumer's home entertainment/ECD system.

[0042] Once all of the ECDs in the system have been identified, the consumer can then use a single display device (for example, display 102) with two-way communication to the function device to control all of the ECDs, as further explained below.

**DISPLAY DEVICE**

[0043] More particularly, as illustrated in Figure 2, display 102 is a mobile communication device that has a touch screen 114. Display 102 can respond to a user interacting with the input screen 114. For example, when the screen 114 displays a button 130, and the user can interact with the button 130. If the display 102 is a multi-touch screen;
the display 102 can react to a user touching the button 130 on the screen 114. In other less preferred embodiments, a user may use a keyboard (not shown) to tab between buttons and touch a key in order to interact with the button, or the user can use a mouse (not shown) to mouse over each button and click to interact with the button. There are many different ways for users to interact with an input screen on a display, all of which are considered possible embodiments.

[0044] As a result of the user interaction with the input screen, the user input is communicated to function device 101, and function device 101 takes the information from the button function information database 112 and uses it to create a signal with the control devices button function information. This signal is then output through a signal output to the ECD to be controlled. In one case, the signal output is an IR transmitter, and the signal is an infrared transmission. In other case, the signal output is an HDMI port, and the signal is an HDMI communication that is communicated to the ECD to be controlled by an HDMI cable.

COMMUNICATION BETWEEN DISPLAY DEVICE AND FUNCTION DEVICE

[0045] The function device 101 can communicate with the display 102 in many ways. For example, if display 102 is physically located (not shown) in the same device housing as functional device 101, then a data bus can communicate between the display and the function device 101. If the display is physically located in a separate device in a separate housing, as shown in Figure 2, other means for communicating between the display and the function device 101 are required. In one example (not shown), the display is hard wired to the function device 101. In another example, as, shown in Figure 2, the display communicates wirelessly with the function device 101. While all methods of wireless communication can be used, a preferred method of communication is to use Wi-Fi. In other embodiments (not shown) a cellular network can be used for communication between the function device 101 and the display 102. Other methods of communication can include using coaxial cable, like an RF signal, and an HDMI cable, including using consumer electronic communication (CEC). The communication between the display device 102 and the function device 101 can be one-way or two-way communication. For example, for two-way communication, the function device 101 can output the input screen information to the display device, and the display device can return to the function device 101 information about user interaction.

[0046] The display device can take many forms. It could be a television, a personal computer, or a smart phone or smart device such as an Apple Inc. iPhone or iPod Touch, both
of which have Wi-Fi communication capabilities. With Wi-Fi communication capabilities; the display device can interact using Wi-Fi with the function device 101.

COMMUNICATION BETWEEN FUNCTION DEVICE AND DATABASES

[0047] Function device 101 communicates with the button function information database and the database with pictorial records of other devices. These databases can be stored in a database server within the function device 101, or the database can be located remote from function device 101. For example, if the database is on the Internet, then communication with the Internet can permit the function device 101 to communicate with the database. Such communication could be over each Ethernet cable through a modem to a remotely located database server.

MEMORY

[0048] In some instances, user input needs to be recorded. For example if the user of display device 102 selects, as explained below, a particular control device, then the function device 101 will want to retain this information. As a result, the function device 101 will need to communicate with memory to retain this information. So the function device 101 will include some form of memory. The memory may be physically within the same device housing as the function device 101, or it may be located remotely from the function device 101. If located remotely, then some form of communication will need to occur between the function device 101 and the remote memory in order to retrieve the user interaction information. The communication between the memory and the function device 101 can be over a data bus, if located in the same physical housing, or can be over network communication, if located remote from the function device 101. If located remotely, then any of the previously described methods of communication can be used.

PAGE SERVER

[0049] In order to display the input screen on display device 102, function device 101 creates an input screen output. In the preferred embodiment, the input screen is a page in a plurality of linked pages. The function device serves the pages using HTML. In other embodiments, other methods, such as by using a stand-alone application to create the input screen can be used. In the preferred embodiment, a browser executing in display device 102 is used to render the input screen on the display of display device 102. Since the user will interact repeatedly with the input screen, it is beneficial if the web browser on the display device supports HTML and user interaction with the HTML. More particularly, in the
preferred embodiment, the web browser should support JavaScript to permit user interaction with a button without having to refresh the entire user input screen, or some other form of AJAX (Asynchronous JavaScript and XML) process. Still more particularly, in a preferred embodiment, the display device should support enlargement of any illustration on the display, as shown in Figure 6.

[0050] The page server can be either software processed by the same function device 101 referred to above, or the web server can be located remotely from the function device 101. For example, the web server can be on a network web server, and the function device 101 can communicate with the networked web server. The term "web server" as it is used here is not limited to use on the World Wide Web, but rather is a page server of linked pages, regardless of whether the pages are part of the World Wide Web or whether the pages are only locally accessible.

FUNCTION DEVICE AND ECD COMMUNICATION

[0051] As mentioned earlier, function device 101 communicates with various ECDs. The communication can use any of the above-described methods of communicating a signal, such as using infrared Wi-Fi, HDMI, CEC and/or RE. Another form of communication between the function device 101 in the ECDs may be a zWave, or Zigbee, which is a known method of communication between household ECDs such as light switches and devices for its controlling the light switch. In many cases, the communication will be one way. For example, the function device 101 can cause a television to turn on. Or function device 101 can tell the television volume to increase. In other circumstances, two-way communication can occur between function device 101 and the ECD. For example, if communicating over HDMI or zWave, a signal to turn on can be communicated to a light switch, and some sort of response indicating the light did in fact turn On can be returned to function device 101, so that the user can confirm that the light was turned on. In still other examples, as described below, the existence of a particular ECD may be communicated to function device 101 through such two-way communication. Other methods of communication can also include X10 and RS-485, as illustrated in Figure 17.

MOOD BUTTONS

[0052] In addition to merely responding to user input regarding button interaction, the system can also handle more complicated actions. For example, a combination of many button functions can occur in response to the user interaction with one particular button. For
example, a user can in the morning turn on various ECDs. Lights can be turned on, and a coffee pot started. For example, one button labeled MORNING, as illustrated in Figure 7, can be used on the display device to cause these various different ECD function commands to be output by the function device 101, in response to the user interacting with the MORNING button on the display device.

PICTORIAL DATABASE

[0053] Referring again to the database that contains the pictorial records, an example database 120 is illustrated in Figure 3. Database 120 includes records 124 for different control devices, and each record 124 includes information on the control device's shape, the button layout of the control device, and the button labels and other text that can appear on the control device. Each record 124 also includes the code 126 or signals associated with each button 128 on the control device 124. These codes may, for example, be referred to as keycodes.

[0054] Figure 4 illustrates a sample selection of device shapes and button layouts. Various pieces of text (such as the ECD manufacturer, as best seen in Figure 14) also appear in various locations on each device. In addition to such text, various symbols also appear on each device, either on the buttons or otherwise. The pictorial database includes this information regarding the symbols, the buttons, the shapes of the buttons, the button locations, and the shape of the overall control device. In other less preferred embodiments, a subset of this information can be used.

TYPES OF CONTROL DEVICES

[0055] The pictorial database includes information on many different kinds of other devices. For example, reference can be made to Figures 5A and 5B illustrating various sample control devices used for control of ECDs, such as a DVD, cable box, a DVD player, and a television. Other ECDs include, for example, referring to the Figure illustrating other control devices, an alarm system, and HVAC control, as well as a light switch wall plate.

TYPES OF ECD INTERACTION AND DISPLAY RESPONSE

[0056] In regard to lights, lights can be turned on or off or dimmed or brightened. In addition to having the buttons merely respond to user input, the buttons can also change color or otherwise respond to user interaction. For example, if a light is turned on, a button on display device 102 can change color to indicate that the light is on.
MAIN INPUT SCREEN

[0057] The main input screen shown on the display device can permit a user to select generally the category of user desired ECD interaction. An example of a main input screen is shown in Figure 8. The user can select which type of ECD to use. In addition, the user can select various custom control devices, created as explained below. In addition, the user can choose to build a new custom control device, to teach the device to learn how to behave like an existing control device, or to set up the function device 101, as explained below.

IR LEARNING

[0058] In addition to the function device 101 communicating with a database of pictorial records and other button information, the system can also learn a particular control device's button function information. This can be done using an IR learning process, as commonly known in the art.

SYSTEM SETUP

[0059] An important aspect of the system of Figure 2 is the ability of the system to permit easy setup of the system. Setup as used herein means the selection of the choice of control devices to be imitated. An example of a setup procedure, as illustrated in Figure 10, is as follows. Function device 101 outputs a user input screen to display device 102. The input screen, as rendered on the display of display device 102, presents the user with a choice of a one of the following criteria: a control device's shape, a control device manufacturer, a control device type of ECD to be controlled, and a selection of other device button layouts. The user interacts with the input screen to select one of the criteria. Display device 102 then communicates with function device 101, and the function device 101 communicates with the device pictorial database to reduce the number of other devices, of interest to the user. For example, if the user selects the manufacturer "Sony" from a list of ECD manufacturers presented to the user, then only Sony devices would be available to the user for further selection. More particularly, as illustrated in Figure 11, the second criterion will depend on the first criterion selected by the user. For example, if ECD type, such as DVD or television or receiver, was selected as the first criterion, than a second choice presented to the user may be a list of ECD manufacturers. Another option would be to show a selection of button layouts for other devices, or to show the shapes of other devices. When the second criterion is then selected, the display device 102 will communicate again with function device 101, which in turn will communicate with the device database. As a result of the narrower
criterion, the set of possible choices presented to the user will be further narrowed. The set of possible choices is then returned to the function device 101, and the function device 101 creates an input display screen with a more limited selection choices. The user interacts with the user input screen to select a particular device of interest to the user. If, in the first instance, the user selected device manufacturer, then the second criterion may be to show the types of ECDs made by that manufacturer. In the alternative, after selecting a device manufacturer, the second criteria may be button layouts of devices made by that manufacturer, or the shapes of such devices. Likewise, if device shape is the first criterion, then the second criterion can be either a button layout or the device manufacturer or the type ofECD:

**PROCESSING THE SELECTED DEVICE**

[0060] Once a particular control device is selected, then display device 101 communicates the device selection to the function device 101. Function device 101 in turn communicates with the device pictorial record database to return to the function device 101 a pictorial record for the selected device. The pictorial record shows the control device shape, the button layout on the control device, and any text that appears on the control device. Function device 101 also obtains all of the button function information from the button information database. The button function database referred to here is sometimes referred to as a codeset database. The button information database can be the same database as the pictorial database, or it may be another database.

[0061] Once function device 101 has obtained all necessary the information about the control device to imitate the control device, an illustration of the control device is output, via the page server, to the display device along with codeset information and/or other information usable to imitate the original control device. The illustration appears on the user input screen that is displayed on the display device. The user then can interact with the buttons on the user input screen to select various device functions of the control device.

**USING COMMUNICATION WITH AN ECD TO IDENTIFY A CONTROL DEVICE**

[0062] Another method of obtaining information about what ECDs the user wants to control involves having function device 101 output a communication query signal across the HDMI-CEC bus to any newly connected ECDs, as shown in Figure 9. The newly connected ECD automatically responds by communicating back ECD identification information across the CEC bus. This ECD identification information may include a brand name in ASCII
characters, a device type in ASCII characters, and a model number in ASCII characters. Function device 101 parses and interprets this returning ECD identification information, and then forwards some or all of it, or a determination based on it, to the control device pictorial database. The pictorial database returns an illustration of the associated control device, which is forwarded to display device 102 so an image of the control device is displayed to the user on display device 102.

**USING AN IMAGE OF A CONTROL DEVICE TO IDENTIFY A CONTROL DEVICE**

[0063] Another method of obtaining information from a user regarding a particular control device to be imitated by the system, is to begin with a digital photograph of the control device to be imitated, as illustrated in Figures 11 and 12. The user can obtain this digital photograph (image) using a digital camera. For example, the Apple iPhone has a digital camera built into the smartphone. Once the digital camera captures an image of the control device to be imitated (for example, as a JPEG file), the image is communicated to the function device 101 using any suitable method of communication. With an Apple iPhone, the image could be transferred via Wi-Fi to the function device 101. In one particular embodiment, display device 102 is a cellular telephone having a camera functionality, and the cellular telephone is used to capture a digital image and to transmit the digital photograph to function device 101.

[0064] Function device 101 then analyzes the digital photograph (image) or communicates with another function device 101 that analyzes the digital photograph or image. The analyzing function device typically uses optical recognition techniques to analyze one of more of the following characteristics of the image: the shape of the outer contour of the pictured control device, the location and number of buttons on the pictured control device, the characters or text appearing on the buttons, and any characters or text of other printing that appears on the control device. Any one or all of the above pieces of extracted graphical information can be extracted from the raw digital photograph. This information can be obtained from the digital image using known optical recognition approaches, or by using techniques used with facial recognition, for example. Once the graphical information has been extracted using optical recognition, the extracted information is communicated to a database that includes similar types of previously extracted graphical information about other control devices. Based on such extracted graphical information, a particular control device in the database is selected as the best match. After the particular control device has been
selected, information particular to the particular control device is communicated back to the function device 101. Function device 101 may forward the information to display device 102.

MORE PARTICULARS REGARDING WHAT IS ANALYZED IN THE DIGITAL IMAGE

[0065] By referring to Figure 4 illustrating a sample selection of control device shapes and button layouts, it can be observed that often control devices have unique shapes. For example, in Figure 4B, one remote has a tear drop type of shape. The control device in Figure 4D has a relatively straight sided shape with parallel sides, but with rounded ends. The device in Figure 4A has straight parallel sides and relatively straight parallel ends, while the device in Figure 4C has a rounded contour in the middle of the device, which makes it readily distinguishable from the control devices. This device shape information can be used by the optical recognition software executing in function device 101 to identify a particular control device in addition, by referring to this same figure, one can observe various characters on the devices. In some instances, the characters identify the device manufacturer. This information can be used to select or narrow down the particular devices of interest. In addition, the button layout, and the symbols on the buttons, as illustrated in this figure, can also be used.

DEVICE OPERATION

[0066] Once the narrowing down process has concluded and a particular control device has been identified, an illustration of the identified control device is made to be displayed on display device 102 and the user can interact with the control device illustration to select a control device button to create a signal to control an ECD function. Once the user has identified multiple such control devices (for example, that might be usable to operate various different ECDs in the user's home), the user can then interact with the illustrations of the control devices to imitate the operation of the control devices. When the user selects a particular button on an illustration, for example, the display device communicates with the function device 101, telling the function device 101 what button was selected. The function device 101 then outputs a signal to a signal output, which, for example, can be an IR emitter, that then emits the appropriate IR code for that function for that particular ECD, so that the particular ECD can respond to that command. Alternatively the signal output is a hardwired bus port such as, for example, an HDMI port into which an HDMI cable is plugged.
CUSTOM CONTROL DEVICE CREATION

[0067] In addition to permitting the user to interact with ECDs by using illustrations of the control devices typically used to control such ECDs, the system of Figure 2 offers the creation of a custom control device. A custom control device is one that realized a selection of button functions from multiple different control devices. To create such a custom control device, the function device 101 outputs at least one collection of button information from one of the control devices of interest to the user. In the preferred embodiment, the original button layout, including the shape of the control device, is displayed on the user input screen, as illustrated in Figure 14. The user then interacts with the buttons on the user input screen, by either selecting a button, choosing a menu option or other control that says use such button, or, in the preferred embodiment, by dragging and dropping the illustrated button to another location on the input screen. In this manner, the user makes that particular button part of the custom control device illustration 140. By then continuing to choose various buttons, these various buttons and button functions are added to the custom control device. In the end, the custom control device includes a collection of buttons and button functions from the depicted other control devices of interest to the user. After completing the building or creating of the custom control device, a done or finish button 142 is selected by the user, and this user input is communicated to the function device 101. The function device 101 then creates the custom control device illustration. The custom control device illustration is then output to the display device.

[0068] In one embodiment, as illustrated in Figure 14, the custom control device buttons used to control a television, for example, can be the buttons used to control the television in a custom control device area labeled TV. Likewise, the buttons used to control a cable set-top box could be gathered in a custom control device location entitled Cable. To build the custom control device, the user drags and drops selected buttons from the illustrations appearing to the right in Figure 14. These selected buttons are dropped in the area illustrated to the left in Figure 14.

[0069] By including only particular buttons of interest to the user on the custom control device, the custom control device offers a simpler device for control of ECDs. In the preferred embodiment, the custom control device ends up with an illustration of buttons, as shown in Figure 15, which is much more compact in size than the original shape of the various other devices of interest to the user. This permits the button sizes to be larger, making
it easier for user interaction. This also simplifies the amount of information the user has to deal with in order to interact with the various ECDs.

ASSIGNING FUNCTIONS TO CUSTOM CONTROL DEVICE BUTTONS

[0070] In Figure 16, another approach to custom control device creation is illustrated. In this procedure, the user input screen begins with a template custom control device with existing buttons. The user then assigns various button functions to each of the buttons on the template custom control device. This is done in a fashion similar to the description of selection of buttons referred to earlier. The control device of interest to the user is illustrated, and the user drags and drops buttons of interest from the illustrated control device to the template custom control device, thereby assigning functions of the selected buttons to the buttons on the custom control device. As shown in Figures 15 and 16, the resulting custom control device input screens are much simpler than the original, relatively busy, control devices.

FUNCTION DEVICE CONSTRUCTION

[0071] The function device 101 can include various components. These components may be housed in one housing, or in separate housings with communication between the various housings. In the embodiment in Figure 17, the function device 101 includes a power source, a fan control, a RS-232 port, and a general-purpose processor board. The function device 101 also includes flash memory, z-Wave, X10 and RS-485 wireless communication, and IR learning. The function device 101 also includes IR outputs, HDMI ports, and a level shifter. The function device 101 also includes Wi-Fi inputs and outputs, SRAM, RS485, an Ethernet router, and an X10 TW523. The particulars regarding these various components are illustrated in Figures 17A through 17M.

[0072] Although certain specific exemplary embodiments are described above in order to illustrate the invention, the invention is not limited to the specific embodiments. The use of an HDMI-CEC communication to identify a remote control device usable to control an ECD, or to identify a codeset usable to control an ECD, has general applicability. The use of a digital photograph of a remote control device (and/or of an ECD controllable by the remote control device) to identify information about the remote control device (and/or about the ECD) has general applicability. For example, a web-based service can receive a digital photograph via the internet, can perform optical recognition on the digital photograph and use the results of the optical recognition to identify information in a database about the remote
control device and/or an ECD controllable by the remote control device. The identified information can be returned to the user via the Internet and the user can be billed for the service. Accordingly, the lookup function performed by function device 101 and database 112 need not be localized to a user's home. The storage of digital images of remote control devices in a codeset database has general applicability, and does the storage of extracted graphical information about remote control devices in the codeset database. Accordingly, various modifications, adaptations, and combinations of various features of the described embodiments can be practiced without departing from the scope of the invention as set forth in-the claims.
What is claimed is:

1. A system for control of electronic consumer device (ECD) functions, the system comprising:
   a device having a signal output adapted to communicate with an ECD function information database to obtain function information for the ECD and to create a signal, transmittable via the signal output, using the function information for the ECD obtained from the function information database; and
   a High-Definition Multimedia Interface (HDMI) cable that communicates the signal transmitted via the signal output to the ECD.

2. The system as recited in claim 1, wherein the device uses ECD identity data obtained from the ECD via the HDMI cable to obtain the function information for the ECD from the function information database.

3. The system as recited in claim 2, wherein the ECD identity data comprises a brand name and a model number for the ECD.

4. The system as recited in claim 2, wherein the ECD identity data comprises device type information.

5. The system as recited in claim 1, wherein the function information database is resident on the device.

6. The system as recited in claim 1, wherein the function information database is remote from the device.

7. The system as recited in claim 1, wherein the device uses a High-Definition Multimedia Interface-Consumer Electronic Control (HDMI-CEC) communication to identify an infrared codeset (IR codeset) for the ECD in a database of IR codesets.

8. The system as recited in claim 7, wherein the device communicates across the Internet to a remote server that is associated with the database of IR codesets and wherein the device receives from the remote server an identification of the IR codeset for the ECD.
9. The system as recited in claim 7, wherein the database of IR codesets is maintained on the device.

10. The system as recited in claim 7, comprising a remote control wherein the IR codeset for the ECD is used to enable the remote control to transmit operational signals to the ECD.
(PRIOR ART)

FIG. 1
FIG. 2
FIG. 3
FIG. 8
CONSUMER CONNECTS A ECD TO THE FUNCTION DEVICE VIA AN HDMI CABLE.

FUNCTION DEVICE COMMUNICATES WITH ECD VIA CEC OVER THE HDMI CABLE TO DETERMINE THE ECD'S IDENTITY INFORMATION.

FUNCTION DEVICE USES THE IDENTITY INFORMATION TO OBTAIN FROM A DATABASE CONTROL INFORMATION ABOUT HOW TO CONTROL THE ECD'S FUNCTIONS.

FUNCTION DEVICE COMMUNICATES A PICTURE OF THE ECD'S REMOTE CONTROL DEVICE TO THE DISPLAY.

USER INTERACTS WITH THE DISPLAY TO SELECT A ECD FUNCTION.

DISPLAY COMMUNICATES THE USER'S SELECTION TO THE FUNCTION DEVICE.

FUNCTION DEVICE OUTPUTS A CONTROL SIGNAL TO THE ECD CAUSING THE ECD TO PERFORM THE SELECTED FUNCTION.

FIG. 9
OFFERING A USER A CHOICE OF ONE OF THE FOLLOWING CRITERIA: DEVICE SHAPE, DEVICE MANUFACTURER, TYPE OF APPLIANCE TO BE CONTROLLED, GRAPHIC OF DEVICE BUTTON LAYOUT.

COMMUNICATING THE CHOICE TO A DATABASE OF INFORMATION ABOUT OTHER DEVICES. THE DATABASE INCLUDES INFORMATION (FOR EXAMPLE, CODESETS) ON BUTTONS THAT ARE USED TO CONTROL APPLIANCE FUNCTIONS.

RETURNING FROM THE DATABASE A SET OF OTHER DEVICES (AS WELL AS ASSOCIATED CODESETS) THAT MEET THE CHOSEN CRITERIA.

OFFERING TO THE USER A DIFFERENT ONE OF THE ABOVE CRITERIA FOR FURTHER NARROWING DOWN THE NUMBER OF OTHER DEVICES.

REPEATING THE PROCESS UNTIL THE USER HAS SELECTED ONE CONTROL DEVICE AND ITS ASSOCIATED CODESET.

DISPLAYING ON A DISPLAY DEVICE THE SELECTED CONTROL DEVICE, WITH ITS ORIGINAL BUTTON LAYOUT. A USER SELECTION OF A BUTTON ON THE DISPLAY DEVICE CAUSES THE CODESET OF THE SELECTED CONTROL DEVICE TO BE USED TO GENERATE AN OPERATIONAL SIGNAL.

FIG. 10
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HAVE USER CHOSE INITIAL DEVICE CRITERIA

BASED ON SELECTION, OFFER FURTHER CRITERIA TO NARROW DOWN DEVICES

DEVICE SHAPE OR MANUFACTURER OR OBTAIN PICTURE OF DEVICE OF TYPE OF APPLIANCE

IF APPLIANCE TYPE, THEN SHOW LIST OF MANUFACTURES AND HAVE USER NARROW DOWN DEVICE BASED ON MANUFACTURER

IF APPLIANCE TYPE, THEN SHOW BUTTON LAYOUT OF DEVICES FOR SUCH APPLIANCE AND HAVE USER NARROW DOWN DEVICE BASED ON BUTTON LOCATIONS

IF APPLIANCE TYPE, THEN SHOW SHAPES OF DEVICES FOR SUCH APPLIANCE AND HAVE USER NARROW DOWN DEVICE BASED ON DEVICE SHAPE

SHOW PICTURES OF DEVICES BY MANUFACTURER FOR SELECT APPLIANCE TYPE AND HAVE USER NARROW DOWN DEVICE BASED ON BUTTON LOCATIONS

IF DEVICE MANUFACTURER, THEN SHOW TYPES OF APPLIANCES AND HAVE USER NARROW DOWN DEVICE BASED ON APPLIANCE TYPE

IF DEVICE MANUFACTURER, THEN SHOW BUTTON LAYOUTS OF DEVICES MADE BY MANUFACTURER AND HAVE USER NARROW DOWN DEVICE BASED ON BUTTON LOCATIONS

IF DEVICE MANUFACTURER, THEN SHOW SHAPES OF DEVICES MADE BY MANUFACTURER AND HAVE USER NARROW DOWN DEVICE BASED ON DEVICE SHAPE

SHOW PICTURES OF DEVICES BY MANUFACTURER FOR SELECT APPLIANCE TYPE AND HAVE USER NARROW DOWN DEVICE BASED ON BUTTON LOCATIONS

IF DEVICE SHAPE, THEN SHOW BUTTON LAYOUTS OF DEVICES OF SIMILAR SHAPE AND HAVE USER NARROW DOWN DEVICE BASED ON BUTTON LOCATIONS

IF DEVICE SHAPE, THEN LIST MANUFACTURES OF SUCH DEVICE SHAPES AND HAVE USER NARROW DOWN DEVICE BASED ON MANUFACTURE OR TYPE OF APPLIANCE

FIG. 11
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OBTAINING A DIGITAL IMAGE OF A PARTICULAR CONTROL DEVICE.

PERFORMING OPTICAL RECOGNITION ON THE DIGITAL IMAGE.

BASED ON THE OPTICAL RECOGNITION RESULTS, NARROWING DOWN THE POSSIBILITIES OF WHICH CONTROL DEVICE THE PARTICULAR CONTROL DEVICE CAN BE.

FIG. 12
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- OBTAIN IMAGE OF DEVICE
  - PROCESS TO DETERMINE SHAPE OF DEVICE
    - USE SHAPE OF DEVICE TO NARROW DOWN DEVICE
  - PROCESS TO DETERMINE TEXT ON DEVICE
    - USE TEXT ON DEVICE TO NARROW DOWN DEVICE
  - PROCESS TO DETERMINE LOCATIONS OF BUTTON OUTLINES ON DEVICE
    - USE LOCATIONS OF BUTTON OUTLINES ON DEVICE TO NARROW DOWN DEVICE

- DISPLAY NARROWED DOWN DEVICES
  - HAVE USER CONFIRM OR FURTHER NARROW DOWN DEVICE

FIG. 13
DRAG AND DROP KEYS TO CREATE A NEW CUSTOM REMOTE CONTROL DEVICE

FIG. 14
NEW CUSTOM REMOTE CONTROL DEVICE

FIG. 15
FIG. 17H