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Remote Interface for Audio Devices (RIAD)

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ABSTRACT

Although many audio devices have the capabilities to be remotely controlled (e.g. MIDI, RS-232 and proprietary systems), usually this control is oriented to automation or computer control, and is by many specific parameters, which usually don't support all the needed control features and normally have user interface problems, forcing a directed manual intervention in the equipment. To resolve these problems we propose RIAD (Remote Interface for Audio Devices). RIAD allows remote access to the devices interface (e.g. buttons, displays, LEDs and knobs) allowing users to have remotely full control of audio equipment.

1. INTRODUCTION

With the increasing in the number of audio equipment that every professional have to work with (usually several racks of audio devices); when the computer is already a tool in the audio professional world and audio networking solutions arising, the need for a standard remote management interface for audio systems increases every day.

Part of the audio equipment can be remotely controlled using MIDI, RS-232, or proprietary systems, but that control are not conceived to act as a human interface, and usually don't support every management situation.

One way to solve this problem is to allow a remote access to the components of the user equipment interface (e.g. buttons, knobs, LEDs and displays).

In this paper we propose a Remote Interface for Audio Devices (RIAD). RIAD is a protocol to support the remote management of audio devices, by remotely access the equipment interface, independently of the communication protocol used to access the equipment.

The rest of the paper has the following structure. In Section 2 we analyze user interfaces in current audio systems. In Section 3 we describe RIAD system and it's components with some detail. In Section we analyze de applicability of the proposed system. Finally, in Section 5, we conclude our work with some conclusion and with the presentation of directions for future work.

2. INTERFACES WITH AUDIO DEVICES

Normally, five different interface components are considered in audio systems; Displays, LEDs, LED arrays (typically for VU meters), Buttons and Knobs.

2.1. Displays

There are three types of displays in audio equipment: Graphical displays (that receive raster information, pixel by pixel), alphanumeric and numeric displays.
The first type is used with graphical elements (usually large LCD displays). The second type can be used with alphanumeric displays, which receive the information in a character format (but with the possibility to receive custom chars). The numeric format is usually available with LED numeric displays. Figure 1 shows a combination of these types of displays.

Figure 1 – Several display types in audio equipment

2.2. Buttons

There are three types of button: on/off, press, press&hold.
These three types of buttons are used in diverse combinations very distinct situations, to control audio device functionality.

2.3. Knobs

Essentially two types of knobs exist in audio equipment: absolute and relative. The first type has absolute values (typically the normal potentiometers that have a beginning and an end like faders and most of rotating controls). The relative ones change the value considering the last value (like job dials or the knobs that can rotate for ever without having an end). Knobs normally work as an input devices, but can also be used as output devices (as in the case of motorized faders).

2.4. LEDs and LED Arrays

LEDs can work individually or as a led array elements. If alone, they can have a standard behavior (on / off, blinking / quick blinking, red / green / amber / blue) or custom. If in a led array, the group behavior could be based in a value (like VU meters) or custom (every led is represented by a bit)

2.5. Other Devices

The other types of interface could be modeled based on the messages of the previous five types. For example, a joystick may be modeled, at the communication level, as a double knobs, with the 1st knob representing the x axis, and the 2nd one representing the y axis, but continuing to be appear (at the client) as a joystick. A touch panel can be represented as a display and an array of buttons that are located on the same location of the display. Custom light indicators can be represented as simple led interface, but in the client you say that that light have a custom form (you can use two bitmap images, on to represent the off and other to represent the on state).

3. RIAD SYSTEM

Our proposal, the Remote Interface for Audio Devices (RIAD) is a protocol to support the remote management of audio devices, by remotely access the equipment interface, independently of the communication protocol used to access the equipment (e.g. MIDI, RS-232, Ethernet and IEEE 1394).

A RIAD system consists of two components: the device, i.e. the element that the user wants to access and/or manage (example: digital mixer); and one or more clients – the elements that are available at user side to access the device (e.g. software client). There could be other elements, namely controllers, that help clients to access devices with a better user interface (e.g. a hardware controller with motorized faders), but we consider this as part of the client. So RIAD communication occurs only between the device and the clients, as shown in Figure 2.

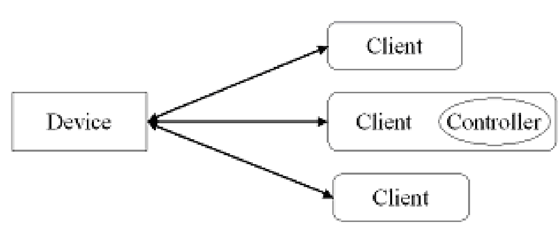

Figure 1 – RIAD system

3.1. RIAD Messages

Although RIAD don't specify the physical layer of communication between users and audio devices (RIAD it's independent of the type of communication used), RIAD specifies the format of the messages exchanged to achieve remote control of the equipment.

RIAD messages are encapsulated on the communication messages (for example encapsulated on MIDI SysEx messages), and extracted at the receptor.

3.2. RIAD Graphical Interface

Besides the interface control and information, RIAD can also support additional information regarding the disposition and aspect of the several components and the device himself. This way, the remote management of the device will have a very similar graphical interface with the physical interface. RIAD can support three modes of graphical interface:

- Basic – only control data. There is no information regarding the disposition or graphical appearance of the interface components;
- Position – where is specified the location and size of each component;
- Graphical – all graphical information of each interface component is defined.

In position mode there is information about the device (such as width, height, text labels), and information regarding the location and size of the components and their text captions.

The graphical information is defined in raster format, about the device (like background image) and every component (button on image, button off image, led image, etc).

3.3. Multi-session

Situations exist where the need for more than one user interface at the same time. In that case, the device could (or not) support the feature of existing several sessions: multi-sessions

To clarify better this situation, let's imagine the following situation: one digital mixer with two users (one local, operating at the physical interface; and one remote user using a virtual interface).

In the "unique session" situation, if one of the users enters the configuration menu of surround, the other user will see on his display, every step what his partner is doing. In "multisession", that situation doesn't occur. Both users can be using different menus of the same mixer: for example, the first one using the surround menu, and the second one, using the dynamics menu, but with both actions been applied at the mixer.

3.4. Legacy Devices and RIAD Gateways

To solve the problem of interface with legacy devices, we define the concept of RIAD gateway: a virtual device that translates RIAD messages on messages that the physical device understand (e.g. MIDI, RS232, proprietary). Of course, that solution may not be fully supported; after all, the device could not support every feature of the interface, even in proprietary protocols, and usually this works well regarding device input (parameter changes), but not output (leds, etc). Even supporting most of the features, the task of translating RIAD information (like pressed buttons, displays messages, etc) to parameters changes, will be a complex task. Figure 3 illustrates the use of RIAD Gateway.

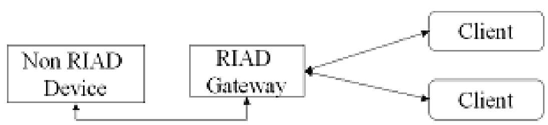

Figure 2 – RIAD Gateway

4. EVALUATION

The RIAD system brings a new world of possibilities in audio systems management and offers several advantages over traditional systems.

One main advantage is Remote Access to audio equipment. With remote access the equipment can be a locked dark room and managed form everywhere. Since the user has access to the entire interface, he don't need to have physical access to the equipment.

Other important advantage is the possibility of definition of Virtual interfaces. With that possibility we can have black boxes without physical interfaces (simple black boxes with connectors) or even additional interfaces besides the physical one. RIAD can work with the physical interface, but also with virtual one. For example:

- One sound module without any type of interface (no displays, no knobs, no nothing), only audio and midi connectors, and controlled by a remote virtual interface (with a virtual color graphical display, several virtual knobs and buttons) that don't physically exist.
- One effects processor, with the minimum interface (numeric display, two or three knobs,

and little more) in a way to reduce production costs, but with a much richer virtual interface.

Other advantage of RIAD is the possibility of defining Custom interfaces adapted to the user or custom skins. The user could increase the display size, change the graphical representation of the knobs (from rotary to fader, etc).

Inter-device Interfaces definition is also an prospective advantage of the system. The user can build custom interfaces with interface components from different devices

Although RIAD seems to work as a software client to control a physical device, there isn't any limitation to the fact of having a hardware client or a software controlled device, i.e., RIAD can work with any combination (software/physical controller - software/physical device).

5. CONCLUSIONS

The RIAD system presented in this paper is a solution to remote access and management of audio devices, from the human interaction point of view. This should not be mistaken as an automation system.

Manufactures begin to see the importance of virtual clients (especially as a way to increase the human interface), and there are several audio devices with computer utilities that control almost every aspect of the device, but continue to exist the problem of proprietary protocols.

At the moment, the message format is defined, and a prototype built (client prototype and device prototype). The future work includes a more cooperative work with some manufactures (as a way to make better adjustments), and the definition of full specifications regarding every aspect of RIAD.

More information about RIAD can be found in www.estg.iplei.pt/~nfonseca.

ACKNOWLEDGMENT

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6. REFERENCES

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